

# Advances in sport science: latest findings and new scientific proposals, volume II

**Edited by**

Rubén Maneiro, Iyán Iván-Baragaño, José Luis Losada,  
Antonio Ardá Suárez, Mario Amatria and Gudberg K. Jonsson

**Published in**

Frontiers in Psychology



## FRONTIERS EBOOK COPYRIGHT STATEMENT

The copyright in the text of individual articles in this ebook is the property of their respective authors or their respective institutions or funders. The copyright in graphics and images within each article may be subject to copyright of other parties. In both cases this is subject to a license granted to Frontiers.

The compilation of articles constituting this ebook is the property of Frontiers.

Each article within this ebook, and the ebook itself, are published under the most recent version of the Creative Commons CC-BY licence. The version current at the date of publication of this ebook is CC-BY 4.0. If the CC-BY licence is updated, the licence granted by Frontiers is automatically updated to the new version.

When exercising any right under the CC-BY licence, Frontiers must be attributed as the original publisher of the article or ebook, as applicable.

Authors have the responsibility of ensuring that any graphics or other materials which are the property of others may be included in the CC-BY licence, but this should be checked before relying on the CC-BY licence to reproduce those materials. Any copyright notices relating to those materials must be complied with.

Copyright and source acknowledgement notices may not be removed and must be displayed in any copy, derivative work or partial copy which includes the elements in question.

All copyright, and all rights therein, are protected by national and international copyright laws. The above represents a summary only. For further information please read Frontiers' Conditions for Website Use and Copyright Statement, and the applicable CC-BY licence.

ISSN 1664-8714  
ISBN 978-2-8325-5962-8  
DOI 10.3389/978-2-8325-5962-8

## About Frontiers

Frontiers is more than just an open access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

## Frontiers journal series

The Frontiers journal series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the *Frontiers journal series* operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

## Dedication to quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews. Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

## What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the *Frontiers journals series*: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area.

Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers editorial office: [frontiersin.org/about/contact](https://frontiersin.org/about/contact)

# Advances in sport science: latest findings and new scientific proposals, volume II

## Topic editors

Rubén Maneiro — University of Vigo, Spain

Iván Iván-Baragaño — European University of Madrid, Spain

José Luis Losada — University of Barcelona, Spain

Antonio Ardá Suárez — University of A Coruña, Spain

Mario Amatria — Pontifical University of Salamanca, Spain

Gudberg K. Jonsson — University of Iceland, Iceland

## Citation

Maneiro, R., Iván-Baragaño, I., Losada, J. L., Suárez, A. A., Amatria, M., Jonsson, G. K., eds. (2025). *Advances in sport science: latest findings and new scientific proposals, volume II*. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-8325-5962-8

# Table of contents

- 04 **Editorial: Advances in sport science: latest findings and new scientific proposals, volume II**  
Rubén Maneiro, Iyán Iván-Baragaño, José L. Losada, Antonio Ardá, Mario Amatria and Gudberg K. Jonsson
- 07 **Social representation of masculine and feminine sports among Saudi adolescents**  
Munirah Alsamih
- 14 **British elite swimmers' experiences and perspectives on life skill development**  
Ross Murdoch and Hee Jung Hong
- 24 **Emotional regulation and self-perceived quality of life in high-performance mountain sports athletes**  
Pablo Rojo-Ramos, Carmen Galán-Arroyo, Santiago Gómez-Paniagua, Antonio Castillo-Paredes and Jorge Rojo-Ramos
- 33 **How did you perform? Investigating football players' perception of self-regulated passing performances under auditory noise environments**  
Stefanie Klatt, Fabian Werner Otte, Adam Beavan, Tom Schumacher and Sarah Kate Millar
- 42 **Costs over benefits: mind wandering in sporting performance**  
Jieling Li, Yafang Liu, Shuangpeng Xue and Bao Tian
- 52 **Searching for the perfect goalkeeping personality. Myth or reality?**  
Jan Spielmann, Fabian Otte, Tom Schumacher, Jan Mayer and Stefanie Klatt
- 64 **Effectiveness of school-based physical activity programs in enhancing attention, academic performance, and social relationships among children with intellectual disabilities: evidence from Pakistani schools**  
Saima Sabri, Mei-Yue Zhang, Lu Guo, Junhua Dang and Zhi-Xiong Mao
- 72 **Gender differences in skilled performance under failure competitive environments: evidence from elite archers**  
Chunhua Li and Yangqing Zhao
- 81 **Self-regulation and performance among elite youth soccer players: the role of approach-avoidance motivation**  
Mounir Hamoud, Stig Arve Sæther and Gunnar Bjørnebekk



## OPEN ACCESS

EDITED AND REVIEWED BY  
Miguel-Angel Gomez-Ruano,  
Universidad Politécnica de Madrid, Spain

## \*CORRESPONDENCE

Iván Iván-Baragaño  
✉ iyanivanbaragano@gmail.com

RECEIVED 23 December 2024

ACCEPTED 06 January 2025

PUBLISHED 21 January 2025

## CITATION

Maneiro R, Iván-Baragaño I, Losada JL, Ardá A, Amatria M and Jonsson GK (2025) Editorial: Advances in sport science: latest findings and new scientific proposals, volume II. *Front. Psychol.* 16:1550371. doi: 10.3389/fpsyg.2025.1550371

## COPYRIGHT

© 2025 Maneiro, Iván-Baragaño, Losada, Ardá, Amatria and Jonsson. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Editorial: Advances in sport science: latest findings and new scientific proposals, volume II

Rubén Maneiro<sup>1</sup>, Iván Iván-Baragaño<sup>2\*</sup>, José L. Losada<sup>3</sup>, Antonio Ardá<sup>4</sup>, Mario Amatria<sup>5</sup> and Gudberg K. Jonsson<sup>6</sup>

<sup>1</sup>Faculty of Education and Sport, University of Vigo, Vigo, Spain, <sup>2</sup>Department of Sport Sciences, Faculty of Medicine, Health and Sports, Universidad Europea de Madrid, Villaviciosa de Odón, Spain, <sup>3</sup>Department of Social Psychology and Quantitative Psychology, University of Barcelona, Barcelona, Spain, <sup>4</sup>Department of Physical and Sport Education, University of A Coruña, A Coruña, Spain, <sup>5</sup>Department of Physical Education and Sport, Pontifical University of Salamanca, Salamanca, Spain, <sup>6</sup>Social Science Research Institute & Human Behavior Laboratory, University of Iceland, Reykjavik, Iceland

## KEYWORDS

behavior analysis, performance analysis, sports psychology, innovative methodologies, women's sport, adapted sport

## Editorial on the Research Topic

**Advances in sport science: latest findings and new scientific proposals, volume II**

Research in Sport Science is shaped by technological advancements (Oviedo-Caro and Sánchez-Trigo, 2024), shifting trends, and social influences (Chan et al., 2019). In recent years, significant progress has been made in this field through various technologies, methodologies, and research approaches. Wearable sensors, increasingly accessible in both professional and amateur sports, have facilitated the collection of a vast amount of physiological data (Seshadri et al., 2019). In other sports, where financial investment is greater, technologies based on computer vision and neural networks have enabled athlete monitoring, producing data volumes capable of providing valuable insights into player performance (Komorowski and Kurzejamski, 2022). Simultaneously, there has been a rise in the prominence of women's sports in society, paralleled by an increase in academic publications aimed at analyzing various aspects related to women's sports (Martínez-Rosales et al., 2021). However, even today, areas such as performance analysis remain predominantly skewed toward men's sports (Kryger et al., 2022). In addition, in response to growing concerns and interest in mental health and associated factors, psychological variables in sports have become a recurring research theme (Reyes-Bossio et al., 2022). This highlights the need to approach sports in general, and athletic performance in particular, from a multidisciplinary perspective.

The multidisciplinary team, comprising professionals from dynamic sports communities and experts in research methodology, has not remained unaffected by the evolving changes and emerging trends within the field of Sport Science research. Consequently, the Research Topic *Advances in sport science: latest findings and new scientific proposals, volume II* has sought to address these new needs and trends in each

of these areas. This Research Topic has aimed to strengthen Sport Science through diverse perspectives, such as physiology, technical-tactical performance, and sport psychology. Furthermore, it has created a favorable space for researchers to conduct studies in areas where scientific literature is limited, such as youth sports, women's sports, and adapted sports. The studies published within this Research Topic have expanded the body of knowledge, bringing researchers and practitioners closer to a more comprehensive understanding of their respective sports while narrowing the gap between theoretical knowledge and practical application.

## Contributions of the research articles

Sports practice is socially linked to gender, leading to social stigma and reduced participation. This presents a clear issue, considering the benefits associated with sports practice and physical exercise. Understanding the differences and similarities between men and women in sports participation is essential for advancing effective gender equality. Within this topic, research has been conducted on gender differences in managing competitive contexts among male and female archers. The findings revealed that women were more vulnerable to the negative effects of failure during competition. Moreover, there is a consensus on the positive impact of physical activity on attention levels, academic performance, and social relationships. However, very few studies have focused on analyzing this influence in students with special educational needs. In this Research Topic, a positive association between physical activity and these variables has been demonstrated in students with intellectual disabilities—a population requiring special attention and historically excluded from academic and research domains. This type of socially impactful work highlights the need for research in heterogeneous populations, encompassing the full spectrum of individuals, whether athletes or students. Finally, and in direct relation to sports performance, this Research Topic has highlighted the influence of psychological and personality-related variables on the professional performance of athletes across various sports. In football, differences in players' personalities have been demonstrated based on their level of experience and gender. This is undoubtedly linked to the individual motivations of each athlete, which, as evidenced, can regulate behavior and the degree of effort individuals exert. Similarly, the influence of social, psychological, and demographic variables on emotional regulation in individual athletes has been analyzed, yielding significant conclusions for the field of knowledge.

In summary, the second edition of “*Advances in sport science: latest findings and new scientific proposals*” serves as a valuable platform for researchers worldwide to exchange knowledge and

disseminate novel research in the field of Sport Science. The findings presented, with significant social impact, have the potential to enhance practices and outcomes across diverse domains of application.

## Future research directions

To further advance the field of Sport Science, the third edition of “*Advances in sport science: latest findings and new scientific proposals*” – volume III will be launched. This volume will serve as a dedicated platform for the dissemination of diverse academic contributions, with a particular emphasis on:

- The influence of psychological factors on athletic skill development.
- The development and evaluation of innovative training methodologies.
- The application of advanced statistical techniques in sports research.

These areas of focus will drive continued progress and innovation within the field of Sport Science.

## Author contributions

RM: Conceptualization, Validation, Writing – original draft. II-B: Conceptualization, Validation, Writing – original draft. JL: Writing – original draft. AA: Writing – review & editing. MA: Supervision, Writing – original draft, Validation. GJ: Visualization, Writing – review & editing.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

- Chan, D., Keegan, R., Lee, A., Yang, S., Zhang, L., Rhodes, R., et al. (2019). Toward a better assessment of perceived social influence: the relative role of significant others on young athletes. *Scandinavian J. Med. Sci. Sports* 29, 286–298. doi: 10.1111/sms.13320
- Komorowski, J., and Kurzejamski, G. (2022). “Graph-based multi-camera soccer player tracker,” in *2022 International Joint Conference on Neural Networks (IJCNN)*, 1–8. doi: 10.1109/IJCNN5064.2022.9892562

Kryger, O., Wang, A., Mehta, R., Impellizzeri, F., Massey, A., and McCall, A. (2022). Research on women's football: a scoping review. *Sci. Med. Football* 6, 549–558. doi: 10.1080/24733938.2020.1868560

Martínez-Rosales, E., Hernández-Martínez, A., Sola-Rodríguez, S., Esteban-Cornejo, I., and Soriano-Maldonado, A. (2021). Representation of women in sport sciences research, publications, and editorial leadership positions: are we moving forward? *J. Sci. Med. Sport* 24, 1093–1097. doi: 10.1016/j.jsams.2021.04.010

Oviedo-Caro, M., and Sánchez-Trigo, H. (2024). Special issue on innovative approaches in the implementation of technology in sports science and engineering.

*Proc. Instit. Mechan. Eng. Part P* 238, 115–116. doi: 10.1177/17543371231226346

Reyes-Bossio, M., Corcuera-Bustamante, S., Veliz-Salinas, G., Boas, M., Delgado-Campusano, M., Brocca-Alvarado, P., et al. (2022). Effects of psychological interventions on high sports performance: a systematic review. *Front. Psychol.* 13:1068376. doi: 10.3389/fpsyg.2022.1068376

Seshadri, D., Li, R., Voos, J., Rowbottom, J., Alfes, C., Zorman, C., et al. (2019). Wearable sensors for monitoring the physiological and biochemical profile of the athlete. *NPJ Digital Med.* 2:72. doi: 10.1038/s41746-019-0150-9





## OPEN ACCESS

## EDITED BY

Mario Amatria,  
Pontifical University of Salamanca, Spain

## REVIEWED BY

Charlotte Skau Pawlowski,  
University of Southern Denmark, Denmark  
Rubén Arroyo Del Bosque,  
University of Burgos, Spain

## \*CORRESPONDENCE

Munirah Alsamih  
✉ malsomyh@ksu.edu.sa

RECEIVED 23 November 2023

ACCEPTED 13 February 2024

PUBLISHED 26 February 2024

## CITATION

Alsamih M (2024) Social representation of  
masculine and feminine sports among Saudi  
adolescents.  
*Front. Psychol.* 15:1337157.  
doi: 10.3389/fpsyg.2024.1337157

## COPYRIGHT

© 2024 Alsamih. This is an open-access  
article distributed under the terms of the  
[Creative Commons Attribution License](#)  
(CC BY). The use, distribution or reproduction  
in other forums is permitted, provided the  
original author(s) and the copyright owner(s)  
are credited and that the original publication  
in this journal is cited, in accordance with  
accepted academic practice. No use,  
distribution or reproduction is permitted  
which does not comply with these terms.

# Social representation of masculine and feminine sports among Saudi adolescents

Munirah Alsamih\*

Department of Psychology, King Saud University, Riyadh, Saudi Arabia

**Introduction:** This study examined how certain sports are represented as masculine or feminine in Saudi adolescents, namely, which sports adolescents associate with males and which sports they associate with females. Previous research aligned with this concern was conducted within Western culture; however, there is a need to shed light on how the issues of social representation of masculine and feminine sports affect other cultures such as Middle Eastern cultures.

**Methods:** A survey was completed by 280 Saudi adolescents, aged between 12 and 17 ( $M = 13.5$ ,  $SD = 1.3$ ). The survey contained open-ended recall questions that asked participants to name three masculine, feminine, and natural sports.

**Results:** Most participants were familiar with using feminine and masculine terminology to describe sports, and nearly half had personally used gendered terms to describe sports. Overall, the participants generated 2,195 names of various sports, with the majority classified as natural (appropriate for both men and women), many masculine, and the fewest feminine.

**Discussion:** The connection between specific sports and masculinity or femininity can restrict the activities of adolescents who do not conform to traditional gender roles. Also, adolescents who are interested in sports that are not typically associated with their gender may experience social stigma or exclusion, which can discourage their participation. Therefore, it is important to establish inclusive environments in sports, regardless of the gender.

## KEYWORDS

gender, social representations, sport, adolescents, Saudi Arabia

## Introduction

Gender segregation in sports has created distinct and gendered views of certain activities. Sports can be divided into two categories based on characteristics which are locally perceived as either masculine or feminine: sports that are flexible and light are related to females. For example, football and boxing are typically considered masculine while sports such as gymnastics, figure skating, volleyball, cheerleading, and ballet are typically considered feminine. Finally, sports like tennis, basketball, swimming, and running are considered neutral and can be played by both genders (Riemer and Visio, 2003; Hardin and Greer, 2009; Chalabaev et al., 2013; Gentile et al., 2018; Sobal and Milgrim, 2019).

However, it has been recognized that sports do not have inherent gender characteristics; instead, societies impose gender roles and expectations on people from a young age, even in sports (Birrell, 2000). Riemer and Visio (2003) asked participants aged 4–19 years to rate a list of sports as either feminine, masculine, or neutral. The results showed that participants typically perceived football and wrestling as appropriate for males while aerobics and gymnastics were seen as appropriate for females. This supports traditional gender stereotypes. Adolescent girls in a focus group conducted by Slater and Tiggemann (2010) stated that one



of the reasons for them to stop participating in sports is their desire to respect social conventions by not participating in masculine sports. In the most recent work by Cárcamo et al. (2021), boys and girls considered football a masculine sport while skating and volleyball were considered feminine sports.

In fact, children learn to categorize sports as masculine or feminine based on cultural norms; these categorizations guide their attitudes and behaviors about these sports. Social Representation Theory (SRT) (Farr and Moscovici, 1984) suggests that a society's cultural and historical context shapes beliefs, attitudes and values. These constantly evolve through discourse and interaction with others. Individuals use socially shared representations, or "social representations," to make sense of complex social phenomena and communicate with others.

SRT can be applied to gender and sport to illuminate how gender roles and beliefs about sports are constructed and reinforced through social interactions and media representations. For example, gender stereotypes in sports are perpetuated through media portrayals of male athletes as strong, aggressive, and dominant, while female athletes are portrayed as emotional, graceful, and less competitive (Kane et al., 2013; LaVoi et al., 2019). These representations influence perceptions of gender and sport and perpetuate gender stereotypes in sports participation and performance. Cultural contexts play a crucial role in shaping individuals' attitudes toward sports (Xu et al., 2021). Although this topic has been extensively studied in Western culture, it is essential to shift attention to non-Western cultures and examine how social representations influence individuals' attitudes from young age. A systematic review of physical inactivity, gender, and culture in Arab countries, including Saudi Arabia (Sharara et al., 2018), found that the participation of women in sports and physical activities is less than men due to adherence to social traditions.

In Saudi Arabia, gender roles are traditionally rigid and divided due to the influence of conservative Islamic teachings and cultural norms. This is reflected in various aspects of life, like sports. However, there has been a recent change in Saudi women's participation in different areas of society, including sports. According to statistics from the Saudi Ministry of Sports (2020), there has been a 150% increase in Saudi women's participation in sports in the last 5 years. The first Saudi woman participated in the Olympic Games in London in 2012. Saudi Arabia sent two female athletes: one in judo and one 800 m runner (Boykoff and Yasuoka, 2015). As part of Saudi Arabia's Vision 2030 plan (Human Resources and Social Development, 2023), the government has recognized the importance of empowering woman and increasing women's participation in various sectors. Thus, in recent years, the Saudi government has taken several steps to promote women's sports and encourage female participation in physical activities. For example, the country has hosted international women's sporting events, such as the Saudi Ladies International Golf Tournament, the Women's International Friendly Tournament, and the Dakar Rally. The government has also established sports clubs and facilities exclusively for women and lifted some restrictions on women's participation in sports; for example, they are allowed to attend football matches in stadiums (Alolian, 2022; Bose, 2023).

The goal of this study was to investigate how Saudi adolescents perceive certain sports as either masculine or feminine. Although, Sobal and Milgrim (2019) examined social representations of masculine, feminine, and neither-gendered sports, it had been

limited to a Western cultural context and among university students specifically. So, this study seeks to expand the scope of the current literature for a more complete view on the social representation of gender typing in sports by investigating understudied cultures and populations. This study provides important insights into Saudi Arabia, a Middle Eastern culture, where societal norms strongly influence gender roles regarding physical activity and sport (Sharara et al., 2018). Previous studies that were conducted in Saudi Arabia have focused on the difference between males and females in physical activity and sports participation (e.g., Aljehani et al., 2022; Alharbi et al., 2024). Thus, there is a need to study such issues from a different perspective, and this study tries to solve that by shedding light on how particular sports consider as either masculine or feminine. Given the great effort by the Saudi government for social change, equality, and social inclusion in the field of sports (Boykoff and Yasuoka, 2015; Alolian, 2022; Bose, 2023), it would be important to examine how individuals perceived sports as masculine or feminine especially the young generation of adolescents. Indeed, adolescents are a vital population to study because they are in the process of developing their own gender identities and learning societal expectations about gender roles (Steensma et al., 2013).

## Methods

### Participants

This study included 280 Saudi adolescents, 130 girls and 150 boys, aged between 12 and 17 ( $M = 13.5$ ,  $SD = 1.3$ ).

The participants were recruited using two ways: direct contact with schools and snowball sampling techniques. To recruit participants from schools, the researcher contacted the education ministry to provide a letter for schools to facilitate the recruiting. After obtaining the letter, around 10 elementary and secondary public schools in the center region of Saudi Arabia were reached with the details of the study after the school administration showed a willingness to collaborate.

### Procedures

Before data collection, ethical approval was obtained from the Institutional Review Board at (anonyms). School administration distributed the study details along with the parental consent form to students. Students who returned the consent form, signed by their parents, were provided with a barcode to access the electronic questionnaire and fill it out at home. Additionally, the research author reached out to some mothers who had previously participated in studies with their children and explained the research to them. The author requested that they refer their friends who would be willing to have their children participate. Subsequently, a link to the questionnaire was sent to the parents to pass on to their children.

After data collection, the surveys were checked for completeness and accuracy. The answers to open-ended questions were coded and entered into SPSS for analysis along with the quantitative data. Descriptive statistics and inferential statistics were calculated to analyze the data.

## Measures

A questionnaire was developed based on the free association task, often used to study social representations. This involves participants being asked to recall and list a certain number of words or names that come to mind when they think of a specific topic or concept. This helps researchers to understand the structure and content of the social representations associated with that topic (Idoaga et al., 2020; Martikainen and Sakki, 2021).

The questionnaire was adapted from Sobal and Milgrim's (2019). It consisted of five questions (Appendix 1). The first two questions were yes or no questions that measured the participants' awareness and use of social representations related to gender stereotyping in sport. The first question was, "Have you ever heard sports referred to as 'feminine' or 'masculine'?" The second question was, "Have you ever personally referred to sports as 'feminine' or 'masculine'?" Then, participants were asked to name three sports that they considered feminine, three that they considered masculine and three that they considered both genders.

The questionnaire was pilot tested on 12 adolescents (11 girls and a boy) a similar to those who would participate in the final survey to ensure its clarity and understandability; no significant changes were made.

## Data analysis

The first two questions were scored as 0 for "yes" and 1 for "no." The counts and percentages for each response were calculated to determine adolescents' awareness and use of social representations related to gender stereotyping.

For the open-ended questions, where participants were asked to name three sports that they considered feminine or masculine for both women and men, the author coded and compiled responses. A numerical code was assigned to each sport to facilitate data entry into SPSS. The outcomes were presented in terms of frequencies and proportions, with the prevailing responses exemplifying the central social representations, while the uncommon responses signified marginal or secondary social representations (Abic, 1993; Sobal and Milgrim, 2019).

## Results

### The presence and use of gender-stereotyped sports terminology

Overall, 79% of the participants stated they were familiar with using feminine or masculine terminology to describe sports (48% of girls and 52% of boys). In addition, 47% of the participants had personally used gendered terms to describe sports (49% of girls and 51% of boys). In general, the results for boys and girls were relatively similar.

### Social representations of gender-stereotyped sports

For feminine sports, 88% named three sports, 5% reported two sports, 5% reported only one female sport, and 15% reported no

sports. For masculine sports, 88% named three sports, 4% reported two male sports, 3% reported one male sport, and 10% named no sports. For neutral sports, 94% named three sports, 6% reported two sports, 5% reported only one sport, and 6% reported no sports. Overall, the participants generated 2,195 names for various sports, with 737 classified as masculine, 698 as feminine, and 760 as neither masculine nor feminine (Table 1). The named sports fell into 62 distinct categories across the three gender classifications.

The most frequently named feminine sports were gymnastics (24.3% of all feminine responses), tennis (24%), ballet (24%), swimming (24%), basketball (20%), football (20%), volleyball (14%), yoga (14%), and running (10%). These sports represent 67% of all sports classed as feminine. Overall, 54 sports were classed as feminine by at least one participant. Notably, participants named three types of dance: ballet, modern dance, and Zumba.

The most frequently named masculine sports were football (65% of all masculine responses), basketball (42%), boxing (20%), weightlifting (19%), volleyball (18%), and swimming (10%). These include 54% of all sports classed as masculine. Overall, 61 sports were named masculine sports by at least one participant.

The most frequently cited neutral sports were swimming (47% of all neutral responses), football (42%), basketball (28%), tennis (22%), and walking (13%). These constitute 65% of all sports classed as natural. Overall, 52 sports were recalled as neutral by at least one participant.

## Discussion

This study investigated how Saudi adolescents perceive certain sports as either masculine or feminine. Most participants were familiar with using feminine and masculine terminology to describe sports, and nearly half had personally used gendered terms to describe sports. These results are consistent with prior research on gender and sports, showing that gendered language is often used to describe sports and that gender stereotypes are deeply ingrained in societies (Sobal and Milgrim, 2019).

The use of gendered language around sports may reflect broader cultural beliefs and values around gender and physical activity, highlighting their importance as social representations (Abic, 1993). In many cultures, including Saudi Arabia, masculinity is strongly associated with physical strength, while femininity is associated with fragility and weakness. This can lead to a gendered division of labor and leisure activities, with men typically engaging in more physically demanding and competitive sports, while women are encouraged to participate in more passive or domestic activities (Gentile et al., 2018; Zipp and Nauright, 2018; Alruwaili, 2020).

Social representations theory (Farr and Moscovici, 1984) suggests that the use of gendered language and social representations of sports is particularly salient and influential among adolescents because they are still developing their beliefs, attitudes, and behaviors around gender and physical activity. They may be more susceptible to the influence of societal and cultural norms because they are undergoing socialization and learning how to navigate social expectations and roles.

The social representations of masculine, feminine, and non-gendered sports in this study are consistent with previous research conducted by Sobal and Milgrim (2019) that recognized

masculine sports as crucial social representations, feminine sports are considered less important social representations, while non-gendered sports show more gender inclusivity in sport.

Social representations of feminine sports showed that gymnastics, tennis, ballet, swimming, basketball, football, volleyball, yoga, and running were the most frequently named feminine sports among Saudi adolescents in this study. Saudi Arabia has strict gender norms; traditionally, physical activities have been restricted for women and girls. However, recent significant efforts have been made to promote sports participation among women and girls in the country (Boykoff and Yasuoka, 2015; Bose, 2023). The diverse range of sports that the adolescents cited as feminine may indicate a change in the social representations of sports among the younger generation in Saudi Arabia. Notably, ballet and gymnastics were ranked as the top two feminine sports. This suggests that adolescents in Saudi Arabia view these sports as particularly feminine. Research has shown that gymnastics and ballet are associated with femininity in many cultures worldwide (Riemer and Visio, 2003; Hardin and Greer, 2009; Sobal and Milgrim, 2019). Indeed, the social representation of gymnastics and ballet as a feminine sport is not unique to Saudi Arabia but is a widely recognized cultural phenomenon. The reasons for this social representation may vary across cultures, but it is likely influenced by factors such as social norms, gender role expectations, aesthetics, and sporting performance.

Overall, the results highlight that some sports were socially represented as feminine among Saudi adolescents. These findings could inform efforts to promote sports participation among girls and women in Saudi Arabia by indicating the sports where women will face participation challenges and the barriers that must be addressed to combat these.

Reflecting previous research (Riemer and Visio, 2003; Hardin and Greer, 2009; Sobal and Milgrim, 2019), football, basketball, and boxing were the most commonly named masculine sports by Saudi adolescents. Football was by far the most frequently named masculine sport. This finding indicates a strong cultural association between football and masculinity in Saudi Arabia. From the perspective of social representations (Farr and Moscovici, 1984), football in many cultures is represented as a hegemonic masculine sport (Hardin and Greer, 2009; Sobal and Milgrim, 2019).

Notably, volleyball and swimming were also mentioned as masculine sports, despite being among the top sports associated with femininity. This may indicate that the social representations of certain sports may differ depending on the gender of the participant or the context in which they are played.

Weightlifting and boxing were represented as masculine sports. This suggests that Saudi adolescents may view strength and physical prowess as qualities associated with masculinity. This is consistent with previous research (e.g., Sobal and Milgrim, 2019) identifying that physical strength and athleticism are associated with masculinity in many cultures worldwide.

Swimming was the most frequently named neutral sport, suggesting it is a popular and accessible sport in Saudi Arabia. Indeed, some Saudi families have a swimming pool in their houses, and some families rent a chalet with a swimming pool during weekends and vacations. This may explain why swimming was considered a sport for both genders. Tennis and walking were also among the most commonly cited neutral sports. This suggests a growing interest in health and fitness among the Saudi youth, with a greater focus on

TABLE 1 Feminine, masculine and both genders sports named by adolescents.

Sport	Feminine sports (N = 698)		Masculine sports (N = 737)		Both genders (N = 760)	
	n	%	n	%	n	%
Swimming	65	23.6%	28	10.0%	132	45.5%
Horse riding	16	5.8%	10	3.6%	35	11.8%
Climbing	3	1.1%	4	1.4%	6	2.0%
Volleyball	38	13.8%	49	17.5%	63	23.1%
Basketball	54	19.6%	118	42.1%	78	27.5%
Running	28	10.1%	15	5.4%	42	15.7%
Football	56	20.3%	183	65.4%	118	42.4%
Cycling	5	1.8%	8	2.9%	16	5.9%
Gymnastics	67	24.3%	1	0.4%	9	2.4%
Tennis	66	23.9%	22	7.9%	62	23.5%
Ballet	66	23.9%	0	0.0%	1	0.4%
Badminton	6	2.2%	0	0.0%	2	0.4%
dance	32	11.6%	0	0.0%	2	0.8%
Baseball	3	1.1%	10	3.6%	4	1.2%
Ground tennis	1	0.4%	2	0.7%	2	0.4%
Karate	1	0.4%	14	5.0%	7	2.7%
Tae Kwon Do	0	0.0%	4	1.4%	4	1.2%
Skating	7	2.5%	2	0.7%	3	1.2%
Rowing	1	0.4%	2	0.7%	0	0.0%
Handball	8	2.9%	9	3.2%	8	3.1%
Yoga	38	13.8%	0	0.0%	6	2.0%
Walking	14	5.1%	2	0.7%	37	12.5%
Squash	2	0.7%	0	0.0%	0	0
Hockey	5	1.8%	6	2.1%	8	2.7%
Badel	3	1.1%	1	0.4%	4	1.2%
Table tennis	4	1.4%	2	0.7%	5	1.6%
Zumba	7	2.5%	0	0.0%	0	0.0%
Bowling	5	1.8%	2	0.7%	6	2.4%
Kickboxing	2	0.7%	4	1.4%	0	0.0%
Ice skating	8	2.9%	0	0.0%	3	0.8%
Surfing	2	0.7%	1	0.4%	2	0.4%
Weight-lifting	6	2.2%	53	18.9%	10	3.1%
Modern dance	2	0.7%	0	0.0%	0	0.0%
Golf	10	3.6%	10	3.6%	20	7.1%
Fencing	0	0.0%	0	0.0%	2	0.8%
Softball	2	0.7%	1	0.4%	0	0.0%
Boxing	1	0.4%	56	20.0%	11	3.5%
Cycling race	3	1.1%	5	1.8%	0	0.0%
Martial arts	3	1.1%	3	1.1%	1	0.4%
shooting	3	1.1%	4	1.4%	7	2.0%
American football	1	0.4%	15	5.4%	0	0.0%

(Continued)

TABLE 1 (Continued)

Sport	Feminine sports (N = 698)		Masculine sports (N = 737)		Both genders (N = 760)	
	n	%	n	%	n	%
Javelin	0	0.0%	1	0.4%	0	0.0%
Wrestling	1	0.4%	22	7.9%	0	0.0%
Tent pegging	0	0.0%	1	0.4%	0	0.0%
Camel racing	0	0.0%	1	0.4%	0	0.0%
Rugby	0	0.0%	2	0.7%	0	0.0%
Car racing	0	0.0%	4	1.4%	0	0.0%
Kung fu	0	0.0%	4	1.4%	0	1.6%
Bullfighting	0	0.0%	1	0.4%	0	0.0%
Show jumping	0	0.0%	2	0.7%	1	0.0%
Motorcycle racing	0	0.0%	2	0.7%	0	0.4%
Judo	1	0.4%	2	0.7%	0	0.0%
Hammer throw	0	0.0%	1	0.4%	0	0.0%
High jump	0	0.0%	2	0.7%	0	0.0%
Sprint	1	0.4%	3	1.1%	1	0.4%
Discus throw	0	0.0%	1	0.4%	1	0.4%
Chess	1	0.4%	0	0.0%	1	0.4%
Polo	0	0.0%	0	0.0%	1	0.4%
Marathon	0	0.0%	0	0.0%	5	2.0%
Camel riding	0	0.0%	1	0.4%	0	0.0%
Self defense	2	0.7%	1	0.4%	1	0.4%
Meditation	0	0.0%	1	0.4%	1	0.0%

individual sports and activities that promote physical well-being, such as walking. The Saudi Ministry of Health and the Saudi Federation of Sports for All have collaborated to launch several campaigns encouraging both genders and different ages to walk more (e.g., the Walk 30 campaign) (Saudi Ministry of Health, 2020).

Overall, the results suggest that the social representations of certain sports as neutral in Saudi Arabia, reflecting broader cultural norms and expectations about sports participation. The findings also support that there is a growing interest in individualistic and fitness-oriented activities in Saudi Arabia, which may reflect broader trends toward healthier lifestyles and an increased focus on personal well-being.

There are also efforts to promote sports participation among women and girls in Saudi Arabia (Bose, 2023). These efforts may be reflected in the significant overlap between feminine and masculine sports in this study's findings. This overlap may also reflect changing attitudes about gender roles and sports participation. As more girls and women become involved in sports, there may be increased recognition of individuals' diversity of interests and abilities, regardless of gender. Additionally, the new generation has become more exposed to different cultures through social media, which may lead them to perceive greater gender equality in many sports. Many participants had probably watched or heard of the Olympics; this may have provided them with insight into sports that both genders can play.

## Limitations and future research

While 280 participants is a decent sample size, it may not represent all Saudi adolescents. This limits this research's generalizability; further research with more extensive and more diverse samples should the study's findings. Furthermore, the results may not be generalizable to other cultures with different gender norms and expectations, considering the strict gender norms and expectations that exist in Saudi Arabia.

For future research, it would be beneficial to conduct longitudinal studies that investigate how adolescents' perceptions of gender stereotyping in sports change over time. Additionally, conducting qualitative studies could provide a more comprehensive understanding of how masculine and feminine sports are socially represented. This could involve interviews or focus groups to explore the reasons behind adolescents' responses and the factors influencing their perceptions. Also, comparing Saudi Arabia with different cultures could illuminate the extent to which cultural factors influence gender and sports perceptions. Finally, intervention studies to promote gender equity in sports among adolescents could highlight effective strategies for challenging gender stereotypes and promoting inclusivity in sports.

## Conclusion and implications

This study has highlighted the need for continued research and dialogue about gender and sports in Saudi Arabia and other cultural contexts. Examining the social and cultural factors that shape the formation and expression of gendered language and social representations of sports helps researchers and practitioners to develop more nuanced and effective strategies for promoting gender equity and inclusivity in sports and physical activity. For example, initiatives that challenge traditional gender roles and stereotypes, promote girls' and women's participation in sports, and encourage gender-neutral language around sports may help to create a more inclusive and equitable sports culture in Saudi Arabia and beyond.

As Saudi Arabia undergoes social and cultural changes, the division of gender roles in sports may become less distinct, potentially leading to a decrease in gendered terminology use. However, this claim is speculative and further research should be conducted to confirm it.

Furthermore, the association between certain sports and masculinity or femininity can be limiting for adolescents who do not conform to traditional gender norms. Adolescents interested in sports that are not typically associated with their gender may face social stigma or exclusion, which may discourage their participation. Therefore, it is vital to create inclusive environments for all adolescents to participate in sports and physical activities, regardless of gender identity or expression.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.



## Ethics statement

The studies involving humans were approved by Institutional Review Board in King Saud University. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

MA: Writing – original draft, Writing – review & editing.

## Funding

The author declares that no financial support was received for the research, authorship, and/or publication of this article.

## References

- Abic, J. C. (1993). Central system, peripheral system: their functions and roles in the dynamics of social representations. *Pap. Soc. Rep.* 2, 75–78.
- Alharbi, B. F. H., Baker, P., Pavey, T., and Alharbi, M. F. (2024). Investigating the beliefs of Saudi females regarding physical activity: a qualitative exploration. *Int. J. Qual. Stud. Health Well Being* 19:2296696. doi: 10.1080/17482631.2023.2296696
- Aljehani, N., Razee, H., Ritchie, J., Valenzuela, T., Bunde-Birouste, A., and Alkhalidi, G. (2022). Exploring female university Students' participation in physical activity in Saudi Arabia: a mixed-methods study. *Front. Public Health* 10:829296. doi: 10.3389/fpubh.2022.829296
- Alolian, N. (2022). Saudi woman's steps in sport. Riyadh. Available at: <https://www.alriyadh.com/1948122>.
- Alruwaili, M. (2020). *Females and sport in Saudi Arabia: an analysis of the relationship between sport, region, education, gender, and religion*. [Unpublished Doctoral Thesis]. Scotland: University of Stirling.
- Birrell, S. (2000). "Feminist theories for sport", in *Handb Sports Studies*. eds. J. Coakley and E. Dunning (Routledge), 61–76.
- Bose, S. (2023). Saudi Arabia to host maiden four-nation women's international friendly tournament. Available at: <https://www.fifa.com/fifaplus/en/articles/saudi-arabia-to-host-four-nation-womens-international-friendly-tournament-watch-live>.
- Boykoff, J., and Yasuoka, M. (2015). Gender and politics at the 2012 Olympics: media coverage and its implications. *Sport Soc.* 18, 219–233. doi: 10.1080/17430437.2013.854481
- Cárcamo, C., Moreno, A., and Del Barrio, C. (2021). Girls do not sweat: the development of gender stereotypes in physical education in primary school. *Hum. Arenas* 4, 196–217. doi: 10.1007/s42087-020-00118-6
- Chalabaev, A., Sarrazin, P., Fontayne, P., Boiché, J., and Clément-Guillotin, C. (2013). The influence of sex stereotypes and gender roles on participation and performance in sport and exercise: review and future directions. *Psychol. Sport Exerc.* 14, 136–144. doi: 10.1016/j.psychsport.2012.10.005
- Farr, R. M., and Moscovici, S. (Eds.). (1984). *Social representations*. New York, NY: Cambridge University Press.
- Gentile, A., Boca, S., and Giammusso, I. (2018). 'You play like a woman!' effects of gender stereotype threat on women's performance in physical and sport activities: a meta-analysis. *Psychol. Sport Exerc.* 39, 95–103. doi: 10.1016/j.psychsport.2018.07.013
- Hardin, M., and Greer, J. D. (2009). The influence of gender-role socialization, media use and sports participation on perceptions of gender-appropriate sports. *J. Sport Behav.* 32:207.
- Human Resources and Social Development (2023). Women's empowerment. Available at: <https://www.hrsd.gov.sa/en/womens-empowerment>
- Idoaga, N., Berasategi, N., Eiguren, A., and Picaza, M. (2020). Exploring children's social and emotional representations of the Covid-19 pandemic. *Front. Psychol.* 11:1952. doi: 10.3389/fpsyg.2020.01952
- Kane, M. J., LaVoi, N. M., and Fink, J. S. (2013). Exploring elite female athletes' interpretations of sport media images: a window into the construction of social identity and "selling sex" in women's sports. *Commun. Sport* 1, 269–298. doi: 10.1177/2167479512473585
- LaVoi, N. M., Baeth, A., and Calhoun, A. S. (2019). "Sociological perspectives of women in sport" in *Routledge handbook of the business of women's sport*. eds. N. Lough and N. Gurin (London: Routledge), 36–46.
- Martikainen, J., and Sakki, I. (2021). How newspaper images position different groups of people in relation to the COVID-19 pandemic: a social representations approach. *J. Commun. Appl. Soc. Psychol.* 31, 465–494. doi: 10.1002/casp.2515
- Riemer, B. A., and Visio, M. E. (2003). Gender typing of sports: an investigation of Metheny's classification. *Res. Q. Exerc. Sport* 74, 193–204. doi: 10.1080/02701367.2003.10609081
- Saudi Ministry of Health (2020). MOH to launch "walk 30" campaign across the kingdom. Available at: <https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-01-09-001.aspx>.
- Saudi Ministry of Sports (2020). Annual report. Available at: <https://mos.gov.sa/ar/mediacenter/Documents/Mos-R2020-AR.pdf>
- Sharara, E., Akik, C., Ghattas, H., and Makhoulf Obermeyer, C. (2018). Physical inactivity, gender and culture in Arab countries: a systematic assessment of the literature. *BMC public health*, 18, 1–19.
- Slater, A., and Tiggemann, M. (2010). "Uncool to do sport": a focus group study of adolescent girls' reasons for withdrawing from physical activity. *Psychol. Sport Exerc.* 11, 619–626. doi: 10.1016/j.psychsport.2010.07.006
- Sobal, J., and Milgrim, M. (2019). Gendertyping sports: social representations of masculine, feminine, and neither-gendered sports among US university students. *J. Gend. Stud.* 28, 29–44. doi: 10.1080/09589236.2017.1386094
- Steensma, T. D., Kreukels, B. P., de Vries, A. L., and Cohen-Kettenis, P. T. (2013). Gender identity development in adolescence. *Horm. Behav.* 64, 288–297. doi: 10.1016/j.yhbeh.2013.02.020
- Xu, Q., Fan, M., and Brown, K. A. (2021). Men's Sports or Women's Sports?: Gender Norms, Sports Participation, and Media Consumption as Predictors of Sports Gender Typing in China. *Communication & Sport* 9, 264–286. doi: 10.1177/2167479519860209
- Zipp, S., and Nauright, J. (2018). Levelling the playing field: human capability approach and lived realities for sport and gender in the West Indies. *J. Sport Dev.* 6, 38–50.

## Acknowledgments

The author would like to thank Miss Raghad Almutairi, Miss Reem Albaidhani, Miss Sharefa Aloud for helping in data collection.

## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## Appendix 1

### *Questionnaire*

1. Have you ever heard sports referred to as 'feminine' or 'masculine'?  
- -Yes -No
2. Have you ever personally referred to sports as 'feminine' or 'masculine'?  
- -Yes -No
3. Name three sports that you considered "feminine"
4. Name three sports that you considered masculine
5. Name three sports that you considered for both genders



## OPEN ACCESS

## EDITED BY

Mario Amatria,  
Pontifical University of Salamanca, Spain

## REVIEWED BY

Cristina Lopez de Subijana,  
Polytechnic University of Madrid, Spain  
Tshepang Tshube,  
University of Botswana, Botswana

## \*CORRESPONDENCE

Hee Jung Hong  
✉ heejung.hong@stir.ac.uk

RECEIVED 25 November 2023

ACCEPTED 08 March 2024

PUBLISHED 22 March 2024

## CITATION

Murdoch R and Hong HJ (2024) British elite swimmers' experiences and perspectives on life skill development.  
*Front. Psychol.* 15:1344352.  
doi: 10.3389/fpsyg.2024.1344352

## COPYRIGHT

© 2024 Murdoch and Hong. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# British elite swimmers' experiences and perspectives on life skill development

Ross Murdoch and Hee Jung Hong\*

Faculty of Health Sciences and Sport, University of Stirling, Stirling, Scotland, United Kingdom

This study explores the experiences of British elite swimmers in developing life skills during and throughout their athletic careers, examining the factors that influence their perspectives on this skill development. Six high-profile British swimmers, who have competed at the Commonwealth and/or Olympic Games, were recruited for this study. Semi-structured interviews were conducted, and thematic analysis was applied. Through the analysis, two key themes were identified from the thematic analysis: (a) Implicit life skill development through athletic and educational experience, and (b) Understanding the influence of swimming on life skill development. The first theme includes three sub-themes: (a) Establishment of athletic identity, (b) Prioritization of athletic identity, and (c) Navigating life skills through athletic challenges. The findings show that the swimming careers of participants and their associated identities contributed to the development of a wide range of implicit life skills. This growth was facilitated by both educational and sporting experiences, with all participants reporting positive personal development from their time in competitive swimming. The findings in this study enhance our understanding of life skill development and provide insights into how to more effectively support high-performance athletes in both their athletic careers and educational endeavors.

## KEYWORDS

athletic career, career development, career transition, elite swimming, transferrable skills

## 1 Introduction

The development of life skills through sports participation has long been a subject of interest among researchers in the field of sport psychology (Pierce et al., 2017). Life skills are defined as “those internal personal assets, characteristics, and skills such as goal setting, emotional control, self-esteem, and hard work ethic that can be facilitated or developed in sport and transferred for use in non-sport settings” (Gould and Carson, 2008, p. 60). UNICEF (2003) also describes life skills as “psychosocial abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life” (para. 3). Indeed, for elite athletes, life skills developed in sports are crucial for excelling in competitive environments and managing life beyond their athletic careers (de Subijana et al., 2022). The widespread belief among sports practitioners is that skills such as leadership and teamwork, nurtured through sports participation, as a matter of course prepare athletes for success in other life domains (Trottier and Robitaille, 2014). Sports organizations often highlight the belief that participating in sports develops life skills crucial for societal and personal growth (Pierce et al., 2017). This indicates that life skills developed in sports are beneficial in other areas of life. However, such perspective has been also challenged by some researchers (e.g., Coakley, 2011) that question the actual



learning of these skills through sports and their applicability to non-sporting situations. On the other hand, researchers have studied positive youth development (PYD) and life skills in sport, which advocate life skills development via sport. PYD and life skills have become significant to exploring psychosocial evolution in the context of youth sports studies (Camiré et al., 2022). In this context, life skills are frequently identified as crucial developmental outcomes, highlighting their importance in the growth of youth as Holt et al. (2017) pointed out, “life skill building activities are an essential feature of programs designed to foster PYD” (p.3). Holt et al. (2017) also suggested that integrating an indirect method such as developing PYD environment into a direct strategy including focusing on a life skills program can result in positive effects, which can be more likely to happen in sports setting that are well-organized and guided by skilled and supportive adults (Camiré et al., 2022).

Despite considerable research over the past decade focusing on life skills development in sports (e.g., Gould et al., 2007; Holt et al., 2008), there is a notable scarcity of studies that explicitly explore the transfer of life skills. Martinek and Lee (2012) highlighted the gap in our understanding of how life skills are transferred in the context of sports. In this context, the research by Jones and Lavalley (2009) involved a detailed study of a former top-tier tennis athlete, focusing on her use of communication skills and self-assurance acquired during her sports career in her educational environment. In a related study, Camiré et al. (2012) investigated the perceptions of life skills transfer among high school coaches and athletes, finding a consensus that such skills, developed in the athletic realm, were indeed being applied by the athletes in other areas of their lives. While the previous studies offer insights into the development and transfer of life skills from athletic careers to non-athletic domains, much of this research centers on youth populations. Investigations specifically targeting high-performance athletes, such as Olympians, are still limited. While research on high-performance athletes’ development of life skills through sport is under-developed, de Subijana et al. (2022) explored the perspectives of retired high-performance athletes regarding their life skill development in sports. In a cross-sectional study involving 477 former elite athletes who completed a questionnaire, it was found that athletes with higher education levels at the time of their retirement reported possessing more advanced individual and social life skills. Specifically, athletes from team sports and those who trained less than 27 h per week perceived themselves as having superior social skills. Age was also a factor, with older athletes indicating a higher proficiency in social life skills. In addition, athletes with higher monthly salaries felt more confident in their individual and social life skills (de Subijana et al., 2022). These findings imply that sports stakeholders should provide life skills courses to athletes and guide them on how to transfer these skills to life after sports.

In respect of high-performance career and life after competitive sports, athletic identity plays a significant role. Identity is viewed as a complex and evolving concept, shaped by various stable yet socially influenced dimensions (Markus, 1977; Stryker, 1978; Stryker and Serpe, 1994). In sports context, athletic identity refers to the degree to which a person identifies with the role of an athlete and sees themselves in this role. Individuals with a strong athletic identity tend to view their experiences through the lens of an athlete (Lally, 2007). Often, one aspect of an individual’s identity, such as athlete identity, becomes dominant, overshadowing others. This focus on a single identity aspect can lead to the neglect of other potential roles,

potentially causing future identity challenges due to this imbalance (Lally, 2007). In late adolescence, the key developmental challenge is forming a personal identity (Erikson, 1959). While developmental theorists note that diverse experiences and social interactions are key to this process (Jordaan, 1963; Super, 1990), athletes often focus intensely on sports, missing broader exploratory activities, which can hinder their self-identity development (Brown et al., 2000). This limited exploration can lead to what is known as identity foreclosure, where athletes overly identify with their sport to the exclusion of other identities (Petitpas and Champagne, 1988; Pearson and Petitpas, 1990). *Identity foreclosure*, a term first introduced by Erikson (1959), was later detailed by Marcia (1966) as part of adolescent ego-identity development. It describes the premature commitment to roles and ideologies that align with social or parental expectations, often to avoid identity crises. This commitment can offer psychological security but restricts personal freedom and psychosocial growth. Marcia (1966) proposed that the best development of ego-identity comes from exploring diverse possibilities and making conscious, well-informed choices. Individuals in identity foreclosure have not engaged in such exploration but show commitment to specific life roles (Brewer and Petitpas, 2017) such as high-performance athletes.

High-performance sports and career transitions post-athletic life have been widely studied in recent decades. This research covers various phases of an athlete’s career, from shifts in training locations and moving from school to higher education, to transitioning from junior to senior competition levels and retirement (Park et al., 2013; Demetriou et al., 2018; Stambulova et al., 2021). In this context, considerable attention has been directed towards researching and understanding the consequences of retirement from competitive sports for athletes. In particular, the issue of identity reformation post-retirement has been a recurring theme in the literature, highlighting the intricate process athletes experience in redefining their sense of self beyond their sporting careers (Lally, 2007; Park et al., 2013). Torregrosa et al. (2015) highlighted a key indicator of potential issues post-retirement for elite athletes is their exclusive focus on their sport, resulting in a strong, one-dimensional athletic identity. In their study of qualitative longitudinal study that examined the retirement process of Olympians, they pointed out that elite athletes with a linear trajectory, focusing solely on their sporting career (Pallarés et al., 2011), are often ill-prepared for retirement and face involuntary career termination. This might be due to a lack of social support and a tendency to use reactive coping strategies rather than proactive ones, making their transition more challenging. Park et al. (2013) conducted a systematic review of literature consisting of 122 papers that identified 15 factors that relate to the quality of career transitions. These factors included athletic identity, demographics, voluntary retirement, health issues, career and personal growth, achievements in sports, education and financial status, self-perception, life control, disengagement, time elapsed post-retirement, coach-athlete relationship, life changes, and life balance. In total, 35 studies established a connection between athletic identity and the nature of athletes’ career transitions. Of these, 34 studies found a correlation between a strong athletic identity and a high tendency toward identity foreclosure with poorer transition outcomes (Park et al., 2013). The findings indicated that athletes with a pronounced athletic identity at the time of ending their sports career often experienced a sense of identity loss (e.g., Kerr and Dacyshyn, 2000; Lally, 2007) and required a longer duration to adjust to life after sports (e.g., Grove et al., 1997; Warriner and Lavalley, 2008). In addition, a significant number of the reviewed studies (86 in total) discovered that participants faced

challenges and negative feelings during their transition from sports careers. These experiences encompassed feelings of loss, identity crises, and distress associated with concluding their athletic careers and adapting to life beyond sports. Cosh et al. (2015) also suggested that athletes experiencing career transitions often faced challenges such as difficulty integrating into new jobs, anxiety about career uncertainties, and symptoms of body dysmorphia due to changes in personal appearance after sport. They propose that mitigating these negative aspects, especially during retirement from elite sport, can be achieved through social support and a well-planned transition to an alternate career. Control is also regarded as crucial at the retirement stage, as Park et al. (2013) emphasize, to facilitate a smoother transition to life after sport. In this respect, developing and applying life skills can be key in controlling and reducing the adverse effects commonly experienced during this transition.

Focusing specifically on life skills development, Demetriou et al. (2018) studied the negative career transition of an Australian rules footballer, highlighting the challenges faced when retirement is forced by external factors, such as injury. This case study showed that inadequate confidence in communication skills led to a protracted transition period and poor life choices, including alcohol abuse and family neglect (Cosh et al., 2015). It suggests that empowering elite athletes with confidence in skills acquired through sport is critical for a successful transition from sport and better integration into society, irrespective of the reasons for retirement. Stambulova et al. (2021) examined the evolution of athletic career transition research, focusing on dual-career athletes who balance sports with education or work. They suggested that managing sport, educational or work commitments, and social lives equips dual-career athletes with valuable personal resources. These include skills in “dual-career management, career planning, mental toughness, social intelligence, and adaptability” (Stambulova et al., 2021, p.531), which align with the life skills definitions. This implies that engaging in a dual career can impart essential skills transferable to various life aspects. In this regard, it is beneficial for athletes to apply the skills they possess to pre-retirement planning, as this helps them anticipate potential post-retirement issues. Furthermore, the level of satisfaction with their achievements during their athletic careers can predict the extent of challenges they may face in areas such as social networks, leisure, and finance (Barriopedro et al., 2019). While these findings highlight the importance of considering athletes’ skills in supporting elite athletes through their transition out of sports, it has been under-researched how elite athletes have developed and perceive their life skills, which are likely to be advantageous for planning or navigating their post-retirement lives. Given the findings and gap in literature, the present study explores the experiences of British elite swimmers in developing life skills during and throughout their athletic careers, examining the factors that influence their perspectives on this skill development.

## 2 Materials and methods

### 2.1 Design

This study adopted an intrinsic case study design to gain in-depth insight into the experiences of British elite swimmers in developing life skills during and throughout their athletic careers. “An intrinsic case study is typically undertaken to learn about a unique

phenomenon. The researcher should define the uniqueness of the phenomenon, which distinguishes it from all others” (Crowe et al., 2011, p.1–2). This approach enabled us to conduct an in-depth examination of a particular case by concentrating on the individual experiences of those involved. Since our research aimed to deeply understand participants’ insights into their experiences, an interpretive phenomenological approach was regarded as appropriate. This approach is rooted in an interpretivist paradigm, and it is in line with relativist ontology and subjectivist epistemology (Mallett and Tinning, 2014). This philosophical paradigm allowed us to examine how each individual perceives and interprets their own experiences (Sparkes, 1992; Mallett and Tinning, 2014). Interpretive phenomenology is about describing, understanding, and interpreting phenomena to grasp the core of lived experiences (Creswell, 2007; Tuohy et al., 2013). To capture the depth of participants’ personal experiences, semi-structured interviews were conducted (McArdle et al., 2012).

### 2.2 Participants

Six elite swimmers, who have competed in the Commonwealth Games and/or Olympic Games, were recruited for the study. Convenience sampling was utilized, as the lead author had access to a suitable sample group that met the study criteria. The lead author met all the participants in person for a brief initial consultation about their participation in the study. Prior to any interviews, all participants were provided with an information sheet detailing the study and a consent form. At both of these stages, participants were informed that their involvement was completely voluntary, and they could withdraw at any time without any repercussions. The participants were aged between 21 and 33 years old at the time of the interviews ( $M = 26.5$ ;  $SD = 4.14$ ). The group comprised an equal number of female ( $n = 3$ ) and male ( $n = 3$ ) swimmers, with one retired competitor from each gender category (see Table 1). Five participants had competed in one or more Olympic Games, while one had participated in a Commonwealth Games. Their competitive swimming careers ranged from a minimum of 11 years to a maximum of 20 years at the time of the interviews ( $M = 16.17$ ;  $SD = 3.25$ ). These athletes reached their highest competition levels at various stages in their careers, with ages ranging between 19 and 24 years ( $M = 21.17$ ;  $SD = 2.32$ ). Within those participants, five individuals balanced their athletic careers with academic pursuits up to the undergraduate level, whereas one dedicated themselves entirely to swimming, free from any additional obligations. In addition, those swimmers have trained at one of the most high-profile swimming training centers in the U.K., where they could prepare for international competitions.

### 2.3 Data collection

A total of six interviews were conducted with an average duration of 62 min and a range of 51 to 69 min. All interviews were semi-structured allowing for emergent data stemming from personal experiences and anecdotes. Utilizing semi-structured interviews, with open-ended questions, allowed for the subtleties of each interviewee’s experience to be captured and recorded (Smith and Sparkes, 2016). The personal experiences and anecdotes from each of the participants give the data the rawness that the authors wanted to capture. The semi-structured interview questions were shared with the participants

TABLE 1 Participant information.

Participant	Age/Age highest level achieved	Gender	Active or retired	If retired, No. of years retired	Years competitive	Highest level of competition (No. of editions)
P1	30/19	Female	Retired	1	19	Olympic Games (3)
P2	22/21	Female	Active	-	11	Olympic Games (1)
P3	25/19	Male	Active	-	15	Olympic Games (2)
P4	25/24	Female	Active	-	17	Olympic Games (1)
P5	33/20	Male	Retired	6	20	Olympic Games (3)
P6	24/24	Male	Active	-	15	Commonwealth Games (1)

in advance so that they have the opportunity to review and make a decision on which questions they were comfortable answering align with ethical considerations. The lead author conducted all interviews via Teams meeting, which were recorded and transcribed verbatim. With the semi-structured nature of the interviews, we maintained flexibility, allowing participants to share meaningful experiences that were not addressed in the interview guide (McArdle et al., 2012). However, to ensure consistency across interviews, an interview guide was established, drawing from our research questions and existing literature (e.g., Lally, 2007; Park et al., 2013; Trottier and Robitaille, 2014; Pierce et al., 2017). The interview guide was structured to explore the participants’ athletic careers and their life skills throughout their athletic careers, including following key areas: (a) beginning of swimming career (e.g., “How did you get into swimming and when did you start competing? What was your experience joining your first swimming club?”); (b) development and learning throughout their swimming career (e.g., “Throughout your years of training, what do you feel you have learned? Can you share key experiences or lessons gained during your swimming career?”); (c) life skills development (e.g., “What do you think are the most important skills you have learned throughout your swimming career?; What three skills would you place most value on and how important are they for elite swimmers?”); and (d) reflection on career impact and life post-swimming (e.g., “Thinking about your retirement from sport. How do you think having more clarity on life skills makes you feel about your retirement? How different do you think your life would be when it comes to skills if you had not pursued swimming as far as you have done?”). The lead author conducted a pilot interview using the same interview guide. While there were minor adjustments, such as changing the order of the questions, no significant changes were made.

## 2.4 Data analysis and rigor

Thematic analysis (Braun and Clarke, 2006) has been selected for interpreting the data, which is not restricted in the development of themes and codes, thereby offering a more open means to interpret data and the potential for alignment with previous research (Braun and Clarke, 2006; Braun and Clarke, 2019). The procedure started with an in-depth engagement with the data (initial step) and culminated in the articulation of the identified themes (final step). By thoroughly examining the interview transcripts and audio recordings (initial step), preliminary codes were identified, which captured the essence of the participants’ journeys through elite swimming career (second step). To validate and ensure the robustness of our findings, we had regular meetings to discuss the initial codes and the key themes identified from the data (third step). These discussions, carried out via both online and

face-to-face meetings, were critical in fine-tuning and reaching a consensus on the themes, thereby ensuring a coherent and unified interpretation of the data. This methodical approach to data analysis was adopted with the intention of building confidence in our results, offering a credible account of the participants’ experiences. In the later phases, to further refine and clarify the findings, both authors thoroughly reviewed, defined, and labeled the themes (fourth and fifth steps). In addition, to ensure the quality of our thematic analysis, we rigorously referred to Braun and Clarke’s (2006) 15-point checklist, applying it throughout the six-step analytical process.

Rose and Johnson (2020) highlighted the critical need to minimize researcher bias. They suggested *member checking* as an effective method to achieve this. Member checking involves compiling and anonymizing the collected data, then sharing it with research participants to verify if it accurately reflects their views on the research question. This process enables researchers to have their findings validated by those directly affected by the results. To ensure the credibility of our study, we followed this approach. The fully anonymized results section of our paper was sent to and confirmed by each respondent for accuracy before finalizing the results section (Rose and Johnson 2020). All research participants reviewed and confirmed the shared results section, and no further amendments were required.

## 3 Results

Two key themes were identified from the thematic analysis: (a) Implicit life skill development through athletic and educational experience, and (b) Understanding the influence of swimming on life skill development. The first theme includes three sub-themes: (a) Establishment of athletic identity, (b) Prioritization of athletic identity, and (c) Navigating life skills through athletic challenges.

### 3.1 Implicit life skill development through athletic and educational experiences

The consensus among participants was that life skills were generally developed unintentionally and implicitly throughout their lives, influenced by both educational and athletic experiences. For instance, P3 shared, “When it comes to life skills, I think throughout my sporting journey it has been mostly subconscious learning. I think moving to boarding school forced me to learn a lot of lessons early in and out of the water... Unconsciously I was learning different skills through studying, swimming, and my downtime.” In a similar sense, P5 reflected on his experiences during his mid-to-late teen years: “I found that you really start to build up a mental resilience and find out



what you are capable of. This all happens without you realizing it.” The participants’ narratives frequently reference the implicit acquisition of life skills, either directly or inferred. These skills were developed throughout their careers, shaped by three major factors: (a) Establishment of athletic identity, (b) Prioritization of athletic identity, and (c) Navigating life skills through athletic challenges. These factors are derived from six distinct life experiences (see Table 2). This pattern indicates a common pathway followed by these six participants, primarily through their commitment to excelling in swimming. Notably, all participants acknowledged that there were no specific life skills interventions in their careers, as far as they were aware.

### 3.1.1 Establishment of athletic identity

During the early stages of their careers, without significant results to demonstrate, participants found it necessary to justify their sporting and career choices through early demonstrations of life skills such as work ethic, communication, self-awareness, and teamwork. Five participants shared that despite aspiring to compete in major international championships, they had modest beginnings in their careers, which led to the need to justify their positions to parents, peers, coaches, and themselves. P3 marked, “just trying to gain respect.” P2 needed to prove her intentions to her parents, saying, “I just wanted to prove to them that I wanted to, and I could (do it).” P6, reflecting on a failed trial, said, “I wanted to prove I was good enough....” This need for self and external validation was identified as a common early experience among young swimmers, coinciding with the formation of their foundational athletic identity and the development of life skills such as goal setting and self-drive. It is interesting to note that P6 discussed the impact of his swimming identity on his early personality, noting how it led to him having dual personas – one for school and one for swimming. He viewed this duality negatively, as it hindered his social development at school.

Following the establishment of their athletic identities, participants navigated career transitions and increasingly competitive environments. This progression was crucial for the further development of life skills. As participants moved through more competitive environments, their athletic identity and identification with the sport strengthened. P4, describing her experience at the Commonwealth Games, said, “the environment changes you and you learn so much... it gives you a purpose... It always starts with wanting to be the best... Your reality changes and your expectations rise with the occasion.” The term *environment* was frequently mentioned across the participants’ narratives, encompassing various settings such as home swimming clubs, school, performance center, and levels of competition ranging from regional to the Olympic Games. P5, reflecting on his final years of competitive swimming, spoke of finding an “environment that would help reshape me and learn more about how to keep me at the top of my

game.” This indicated high self-awareness among all participants, noted as the most prominent life skill. Along with this, their critical thinking and decision-making skills also improved. When reflecting on *the environment*, P3 observed, “we create the environment we want to work in, and we are products of that environment. You want a group of challenging people that are highly motivated and turn up every day chasing high performance. This is something that swimming has changed in me for sure.” P2 also spoke about her experience after participating in her first Commonwealth Games and how it influenced her identity. She described a mindset shift, with new goals set towards the 2021 Olympics: “there was a mindset shift at that point as well... I knew I wanted to go as far as I could with it [swimming] after coming back from the Commonwealth Games.” P3’s reflection highlights how the self-crafted, challenging environment in competitive swimming shapes an athlete’s ambition and performance. Likewise, P2’s experience at the Commonwealth Games illustrates how significant competitive environments can catalyze a profound shift in an athlete’s mindset and goals, marking critical turning points in their sporting journey.

### 3.1.2 Prioritization of athletic identity

Early in their careers, around mid-teens, all participants started developing self-awareness of their athletic abilities and identities, influencing their self-definition and career paths. P5 realized his swimming talent at about 15 years old, a time when he began to appreciate his work ethic and team support: “All the hard work I had done in the years prior started paying dividends... once I had got a little more confident, I got the hunger for training and competing... 5:30am training is not a conventional thing for a 12-year-old to do and it was hard work.” For four participants, a critical moment in shaping their athletic identity occurred after qualifying for or competing in their first Commonwealth Games. P4 felt that swimming gave her a purpose, a sentiment echoed by others and influential in defining their athletic careers. The formation of this athletic identity and pursuit of excellence led to the development of key life skills. P3, after the Commonwealth Games, felt “it fully cemented that this is what I love to do,” while P5 saw it as a steppingstone to “chase the Olympic dream.” P4 described major competitions as transformative environments, stating, “...the environment changes you and you learn so much, and it makes you want to keep going... it gives you purpose.” These reflections suggest that swimming competitions are more than just sporting events; they are crucial for identity formation and full immersion in the sport. During the specialization phase, participants needed guidance for direction and final athletic identity formation. This support was psychological such as emotional support from families, support for goal setting. P5 attributes his career success to his supportive environment: “Looking back, I put most of my success down to the environment and the team around me... I would say that

TABLE 2 Factors influencing life skills development.

Factors influencing on life skills development	Associated life experiences
Establishment of athletic identity	Validating self and gaining recognition from others Navigating competitive environments for athletic and life success
Prioritization of athletic identity	Specialization in Swimming Guidance and support from mentors
Navigating life skills through athletic challenges	Balancing dual careers (i.e., sport and study) Recognizing life skills in higher education and post-retirement

I favored the team and the friends I made during that time... it was hard work, but the team and the coaches got me through it.”

Identifying a pathway through higher education was crucial for further developing athletic identity. P4 discussed her transition from junior to senior swimming, coinciding with her move from school to university: “I had good guidance from my coach and parents that some people move quicker than others biologically and that the results very much follow that instead of the work they put in at that age, that really helped me be patient and focus on the things that I could control, which was my work ethic and process goals, things I could control day-to-day.” These career transitions presented rich opportunities for life skill development, although the reporting of these skills did not always reflect the opportunities available. P4 reflected on the broader importance of challenges in life: “more important just to have something in your life than challenges you and it’s more the pursuit of excellence or mastery that teaches those key skills like work ethic.” She questioned whether sport was the only avenue for learning life skills, suggesting that self-challenging situations are key to their development. P2 considered the challenges faced by others: “What do these people find hard? What is hard in your life, where is your limit, do you know? I love the satisfaction of working hard, not floating, taking ownership, and working towards something. I’d love to know what others outside of sport keeps them from floating.” This ties back to the idea that swimming provided a purpose, through which they found challenges and learned life skills. P6 talked about the lessons of ownership and honesty learned through swimming: “I think if you have not done sport, you can develop this idea of victimizing yourself. A really important thing about an individual sport is you have to look at yourself first and ask what could I have done better? At the end of the day, you are the only one in the pool doing it.” He felt that sport prevented him from blaming others for his problems, a tendency he noticed in non-athletes. The participants felt more grounded and decisive in their life choices than their non-athletic peers, highlighting the importance of finding a purpose outside of education, especially during adolescence, for a greater uptake of life skills.

### 3.1.3 Navigating life skills through athletic challenges

Challenging life skills was identified as a final influential factor in learning before the transfer of skills was possible or achieved, and it was also seen as a crucial aspect of athletic development. Among our participants, five were dual career athletes up to the undergraduate level, while one pursued swimming full-time without other commitments. The development of life skills through sport, which often happens implicitly, can be further enhanced by balancing education with sports. As noted earlier, athletic identity was a primary consideration during schooling, with university choices often influenced by the presence of dedicated performance centers in the UK. This prioritization of swimming influenced how participants managed their academic and athletic commitments.

P3 described the autonomy and ownership gained through balancing school and swimming: “Once I moved to school it was down to me... I knew early on it was down to me... I had to be independent at a young age, stretching myself, just cracking on... Having school and swimming together worked well for setting me up for university as I became really independent.” P4 reflected on how her dual career during school years developed her time-management, discipline, autonomy, work ethic, and positively changed her self-talk during challenging times: “I had to do 2 sessions a week by myself in

a more local pool... I had to do my training after I was dropped off then walk to school afterwards, so I started to become more independent around this time, I did not even have a coach during these sessions. I found these sessions quite testing... As I got older, I realized that no one could do the work for me and if I missed it, it was only me that was missing out... it was more positive my self-talk thinking more like I have 30 min left to make a difference.”

P5, who did not initially pursue higher education, reflected on his school years and their enduring impact: “At this stage I found that you really start to build up a mental resilience and find out what you are capable of... Balancing my studies alongside swimming was just something that everyone had to do. Looking back, I realize how hard it was and that it is not an easy thing to do... you just get used to having a lot on your plate... It really helped me after I retired because I started work and went back to university where I was able to manage both well and get a distinction in my MSc. I think the thing that helped me the most on both occasions was being able to look at it and see small steps to achievement the larger goal.” Four participants transitioned directly from secondary to higher education, strategically choosing institutions that supported their swimming careers. P3 noted, “Higher education gave me the challenges I was looking for outside of the pool and I can see now that I have my degree and doing it alongside swimming really helped me.” Participants perceived higher education as a critical arena for learning to manage adversity and uncontrollable life aspects such as relationships or work. P6 summed up this sentiment: “Sometimes you have to grit your teeth, get your head down, and get it done... You need to learn to cope with these challenges in your life because they will always exist or have the potential to exist.” P3’s experience suggests that higher education served not only as an academic pursuit but also as a parallel challenge to athletic training, offering a holistic growth environment. This dual engagement in academia and sports appears to have enhanced the participants’ resilience and adaptability, equipping them with skills to navigate various life challenges, as echoed by P6’s emphasis on perseverance and coping strategies.

### 3.2 Understanding the influence of swimming on life skill development

All participants positively reflected on the influence of swimming in shaping their careers and lives, suggesting that their paths would have been significantly different without it. P5 emphasized learning from non-performance periods, highlighting the importance of handling adversity for career longevity: “I find it’s the times where do not swim a pb [personal best] or do not get to where you want, that’s where you learn the most. Understanding what success and failure looks like and learning from them is key to being able to do as good a job as you can.” Confidence was a recurring skill, with P3 noting, “If I had not pursued swimming as far, I do not think I would be as confident as I am now... [swimming helped] me find purpose and feeling like I belonged.” He believed that swimming also influenced his educational pursuits, contributing to his undergraduate degree attainment. P6 credited swimming for instilling a sense of competence and confidence: “it gave me the confidence I needed to succeed in my life so far and I am sure that it’ll will always help me.”

The ability to translate hard work into progress and *perceived success* was a significant life skill noted by all participants, impacting their life outlook. This led to the development of a strong work ethic.

P4 expressed: “Without swimming and pursuing it as far as I have, I think I would be lazier... I think having swimming has really helped my work ethic and mental resilience to things... it really helped me at school and University, being able to look inward and competed against myself to be better than I was yesterday has been a great skill that I have learned.” P2 also shared similar sentiments: “I just do not know what I would do without sport, I think without it I would be more likely to take the easy options or rely on others more..., I think I would probably just float through life.” P1, now retired, actively seeks *uncomfortable* situations, mirroring her swimming experiences. She credits swimming with developing emotional intelligence and stress management skills. Participants acknowledged the role of swimming in teaching competitiveness and emotional control, extending beyond the sporting context. P1 shared: “[swimming helped] in terms of managing yourself, nerves etc. [Being able to] stand in front of millions of people without realizing on the tele, that kind of pressure, heightened environment. That has helped me... putting yourself in a vulnerable position which not many people will do.” When asked about potential differences had they not pursued swimming to their current extents, all participants believed they would lack the same level of self-confidence. P3 added that despite being academically capable, swimming was a key motivator in pursuing university education: “I do not think I would be as confident as I am now... I also do not think university would have been for me without swimming. I am not that academic so if I only had university to do, I’m not sure that would have been my thing.” The participants’ reflections indicate that their commitment to swimming was crucial in developing their self-confidence, extending beyond athletic achievements to influence their educational and personal choices. P3’s experience, in particular, highlights how the discipline and self-assurance gained from swimming not only complemented but also compensated for his academic pursuits, suggesting that sports can play a critical role in shaping broader life trajectories and self-perception.

## 4 Discussion

This study aims to explore the experiences of British elite swimmers in developing life skills during and throughout their athletic careers, examining the factors that influence their perspectives on this skill development. This study offers detailed insights into the experiences of British elite swimmers, focusing on the development of life skills throughout their athletic careers and beyond. As a result, these findings enrich the existing literature on life skill development in elite athletes and inform practical approaches for effectively supporting athletes in both developing and transferring these skills.

Life skill development in the elite swimmers, particularly those engaged in both swimming and academics, often occurs in a subconscious and natural manner, rather than through direct and intentional learning. This suggests that environments and experiences, both in educational settings and in sports, play a crucial role in shaping essential life skills. In the initial phases of their careers, when significant achievements were scarce, the participants felt pressure to justify their career choices in swimming. This justification is often manifested through the early display of life skills (e.g., work ethic, communication, self-awareness, and teamwork). It was found in literature that participation in sports nurtures life skills like teamwork, assisting athletes in both their athletic and non-athletic life pursuits

(Trottier and Robitaille, 2014). However, the findings from the present study expand on this understanding by demonstrating that athletes develop these life skills under the pressure of having to validate their abilities and career choices in elite sports. Such prevalent early experience among these young swimmers was also the necessity for both self-validation and external affirmation. This period is not just about athletic performance but also about establishing a strong athletic identity and foundational life skills. Individuals possessing a exclusive athletic identity often interpret their experiences from the perspective of an athlete (Lally, 2007), which is supported by the findings in the present study. While previous studies have viewed this single-minded identity and perspective as concerning, as it may hinder the development of other identities and exploration of career options beyond sports (e.g., Kerr and Dacshyn, 2000; Lally, 2007; Park et al., 2013), the findings in our study suggest that such an athletic identity assists in the development of life skills through sport, which is highly valued by the participants. This provides a new perspective to the existing body of literature.

As they progressed into more competitive environments, the participants’ athletic identity strengthened, leading to a significant increase in self-awareness, identified as a key life skill. These stages of career development, from early justification to navigating competitive challenges, were crucial for holistic life skill development. On the other hand, previous studies have identified various stressors in stressful situations for athletes, such as the competitive environment in elite sports, which may lead to psychological issues such as anxiety (e.g., Hanton et al., 2005, 2009). However, the participants in this study focused more on discussing the positive role of the competitive environment in their life skill development, an aspect that warrants further exploration. This also emphasizes the potential for career assistance programs for high-performance athletes to focus on creating environments that nurture both athletic and personal growth (Torregrossa et al., 2020; Hong and Minikin, 2023), encouraging them to foster life skills that can be applied during and beyond their athletic careers.

The transition to higher education was identified as a critical period for further solidifying their athletic identity and life skill development. Participants felt more confident and decisive in their life choices compared to non-athletic peers, highlighting the value of finding a meaningful pursuit outside of formal education for enhanced life skill acquisition. This suggests the significant value of integrating sports with educational pathways and broader life experiences for comprehensive youth development. Previous studies explored the evolution of athletic career transition research, highlighting that dual career athletes balancing sports with education or work develop valuable personal resources, including dual career management, mental toughness, and adaptability, which are transferable to different life aspects (Stambulova et al., 2021). Lally and Kerr (2005) also suggest that athletes in a dual career setting are more likely to explore non-sporting professions post-retirement, indicating a belief among athletes that life skills acquired in sports are valuable in non-sporting contexts. Aquilina (2013) supports this view and identified benefits leading student athletes to value their dual career, including the development, transferability, and external value of life skills. In the context of the transfer of life skills, as Martinek and Lee (2012) pointed out, there is a gap in our understanding of how life skills are transferred in the context of sports, in particular among high-performance athletes such as Olympians. The findings of this study show that

challenging life skills were identified as a crucial factor in athletic development and skill transfer among participants, most of whom balanced their sports careers with academic pursuits. This dual engagement in education and athletics significantly enhanced life skills such as time management, discipline, and positive self-talk. In this regard, higher education was perceived as essential for managing adversity and uncontrollable life aspects. The combination of academic and athletic endeavors was found to significantly strengthen resilience and adaptability in swimmers, preparing them for various life challenges. The findings highlight the value of integrating education with sports in athlete development, suggesting that such a balance can greatly enhance life skill acquisition and overall personal growth. This also emphasizes the importance of educational support (e.g., academic flexibility; English et al., 2022) within athlete support programs and the role of higher education in complementing athletic training. Educational support during the prioritization stage of an individual's career is critical for assisting with current process goals and guiding the direction of their future career path (Côté and Hancock, 2016). This finding aligns with previous research by de Subijana et al. (2022), showing that athletes with higher education levels at retirement have more advanced individual and social life skills.

Participants highlighted that swimming significantly shaped their careers and personal lives, instilling self-confidence, competence, and a strong work ethic. They credited swimming for positively influencing their educational pursuits and developing essential life skills, such as emotional intelligence and stress management. The sport was seen as key to their success and personal growth, with many expressing that their lives would have been considerably different without their swimming experiences. These findings highlight the significant impact of sport on personal and educational development (Gould et al., 2007; Holt et al., 2008; Trottier and Robitaille, 2014; Pierce et al., 2017). The role of sport in building life skills and self-confidence emphasizes the value of integrating sports into broader developmental programs, suggesting its importance in shaping individuals' overall life trajectories and self-perception. The acknowledgment by all participants that their careers lacked specific life skills interventions suggests a potential gap in supporting initiatives and services for high-performance athletes. This highlights an opportunity for sports organizations and educational institutions to integrate structured life skills training into their curriculums and programs. Developing explicit programs aimed at enhancing life skills could complement the natural, implicit learning that occurs through sports participation, leading to more well-rounded athlete development (Pummell et al., 2008; Debois et al., 2015; Ryan, 2015). This could also ensure that athletes are better equipped with essential skills for both their sports careers and life after sports. While it has been reported that sport governing bodies and organizations have established career assistance programs for high-performance athletes (e.g., Torregrossa et al., 2020; Hong and Minikin, 2023), our participants' lack of support in developing and transferring life skills indicates a need for more proactive support and better promotion of such resources to the target population.

Our study, focusing on high-profile elite swimmers in the U.K., provides significant implications and contributions, but it is crucial to recognize its limitations and suggest directions for future research. Although the narratives of six elite swimmers at the Olympic and Commonwealth level were rich and sufficient for answering our

research questions, the sample size is relatively small. Future research could benefit from a larger and more diverse sample, such as including more retired swimmers for balance, athletes from different sports, varying levels, and nationalities, to gain broader insights into life skill development and transfer in elite sports. Future studies should also consider focusing on exploring the experiences of retired athletes in transferring their athletic skills to other domains, examining any encountered barriers and coping strategies. This could offer valuable insights into career assistance programs and other athlete support services.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by General University Ethics Panel (GUEP), University of Stirling. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

RM: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. HH: Writing – review & editing, Supervision, Methodology, Conceptualization.

## Funding

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

## Acknowledgments

We extend our sincere appreciation to the participants whose willingness to share their valuable experiences made this study possible. Their contributions were critical to the successful completion of our research. We also appreciate the University of Stirling's APC support for the publication.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations,

or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

- Aquilina, D. (2013). A study of the relationship between elite athletes' educational development and sporting performance. *Int. J. Hist. Sport* 30, 374–392. doi: 10.1080/09523367.2013.765723
- Barriopedro, M., López de Subijana, C., Muniesa, C., Ramos, J., Guidotti, F., and Lupo, C. (2019). Retirement difficulties in Spanish athletes: the importance of the career path. *Sport Exerc. Perform. Psychol.* 8, 387–400. doi: 10.1037/spy0000136
- Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa
- Braun, V., and Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qual. Res. Sport Exerc. Health* 11, 589–597. doi: 10.1080/2159676X.2019.1628806
- Brewer, B. W., and Petitpas, A. J. (2017). Athletic identity foreclosure. *Curr. Opin. Psychol.* 16, 118–122. doi: 10.1016/j.copsyc.2017.05.004
- Brown, C., Glastetter-Fender, C., and Shelton, M. (2000). Psychosocial identity and career control in college student-athletes. *J. Vocat. Behav.* 56, 53–62. doi: 10.1006/jvbe.1999.1691
- Camiré, M., Newman, T. J., Bean, C., and Strachan, L. (2022). Reimagining positive youth development and life skills in sport through a social justice lens. *J. Appl. Sport Psychol.* 34, 1058–1076. doi: 10.1080/10413200.2021.1958954
- Camiré, M., Trudel, P., and Forneris, T. (2012). Coaching and transferring life skills: philosophies and strategies used by model high school coaches. *Sport Psychol.* 26, 243–260. doi: 10.1123/tsp.26.2.243
- Coakley, J. (2011). Youth sports: what counts as “positive development?” *J. Sport Soc. Issues* 35, 306–324. doi: 10.1177/0193723511417311
- Cosh, S., Crabb, S., and Tully, P. J. (2015). A champion out of the pool? A discursive exploration of two Australian Olympic swimmers' transition from elite sport to retirement. *Psychol. Sport Exerc.* 19, 33–41. doi: 10.1016/j.psychsport.2015.02.006
- Côté, J., and Hancock, D. J. (2016). Evidence-based policies for youth sport programmes. *Int. J. Sport Policy*, 8, 51–65.
- Creswell, J. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage.
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., and Sheikh, A. (2011). The case study approach. *BMC Med. Res. Methodol.* 11:100. doi: 10.1186/1471-2288-11-100
- Debois, N., Ledon, A., and Wylleman, P. (2015). A lifespan perspective on the dual career of elite male athletes. *Psychol. Sport Exerc.* 21, 15–26. doi: 10.1016/j.psychsport.2014.07.011
- Demetriou, A., Jago, A., Gill, P. R., Mesagno, C., and Ali, L. (2018). Forced retirement transition: a narrative case study of an elite Australian rules football player. *Int. J. Sport Exerc. Psychol.* 18, 321–335. doi: 10.1080/1612197x.2018.1519839
- de Subijana, C. L., Ramos, J., Harrison, C. K., and Lupo, C. (2022). Life skills from sport: the former elite athlete's perception. *Sport Soc.* 25, 1051–1064. doi: 10.1080/17430437.2020.1820991
- English, P., Fleischman, D., Kean, B., Stevenson, T., Broome, K., and Cury, R. (2022). Academic flexibility and support for student-athletes: an Australian perspective on university teaching staff perceptions. *J. Study Sports Athl. Educ.* 16, 45–65. doi: 10.1080/19357397.2022.2026111
- Erikson, E. H. (1959). Identity and the life cycle: selected papers. *Psychol. Issues* 1, 1–71.
- Gould, D., and Carson, S. (2008). Life skills development through sport: current status and future directions. *Int. Rev. Sport Exerc. Psychol.* 1, 58–78. doi: 10.1080/17509840701834573
- Gould, D., Collins, K., Lauer, L., and Chung, Y. (2007). Coaching life skills through football: a study of award-winning high school coaches. *J. Appl. Sport Psychol.* 19, 16–37. doi: 10.1080/10413200601113786
- Grove, J. R., Lavalley, D., and Gordon, S. (1997). Coping with retirement from sport: the influence of athletic identity. *J. Appl. Sport Psychol.* 9, 191–203. doi: 10.1080/10413209708406462
- Hanton, S., Fletcher, D., and Coughlan, G. (2005). Stress in elite sport performers: a comparative study of competitive and organizational stressors. *J. Sports Sci.* 23, 1129–1141. doi: 10.1080/02640410500131480
- Hanton, S., Thomas, O., and Mellalieu, S. D. (2009). Management of competitive stress in elite sport. *Sport Psychol.* 4, 30–42. doi: 10.1002/9781444303650.ch4
- Holt, N. L., Neely, K. C., Slater, L. G., Camiré, M., Côté, J., Fraser-Thomas, J., et al. (2017). A grounded theory of positive youth development through sport based on results from a qualitative meta-study. *Int. Rev. Sport Exerc. Psychol.* 10, 1–49. doi: 10.1080/1750984X.2016.1180704
- Holt, N. L., Tink, L. N., Mandigo, J. L., and Fox, K. R. (2008). Do youth learn life skills through their involvement in high school sport? A case study. *Can. J. Educ.* 31, 281–304. doi: 10.2307/20466702
- Hong, J., and Minikin, B. (2023). An international analysis of career assistance programmes for high-performance athletes. *Int. J. Sport Policy Polit.* 15, 705–724. doi: 10.1080/19406940.2023.2242873
- Jones, M. I., and Lavalley, D. (2009). Exploring perceived life skills development and participation in sport. *Qual. Res. Sport Exerc. Health* 1, 36–50. doi: 10.1080/19398440802567931
- Jordaan, J. P. (1963). “Exploratory behavior: the foundation of self and occupational concepts” in *Career development: self-concept theory*. eds. D. E. Super, R. Starishevsky, N. Matlin and J. P. Jordaan (New York: CEEB Research Monographs), 46–57.
- Kerr, G., and Dacyschyn, A. (2000). The retirement experiences of elite, female gymnasts. *J. Appl. Sport Psychol.* 12, 115–133. doi: 10.1080/1041320000804218
- Lally, P. (2007). Identity and athletic retirement: a prospective study. *Psychol. Sport Exerc.* 8, 85–99. doi: 10.1016/j.psychsport.2006.03.003
- Lally, P. S., and Kerr, G. A. (2005). The career planning, athletic identity, and student role identity of intercollegiate student athletes. *Res. Q. Exerc. Sport* 76, 275–285. doi: 10.1080/02701367.2005.10599299
- Mallett, C. J., and Tinning, R. (2014). “Philosophy of knowledge” in *Research methods in sports coaching*. eds. L. Nelson, R. Groom and P. Potrac (London: Routledge), 9–17.
- Marcia, J. E. (1966). Development and validation of ego-identity status. *J. Pers. Soc. Psychol.* 3, 551–558. doi: 10.1037/h0023281
- Markus, H. (1977). Self-schemata and processing information about the self. *J. Pers. Soc. Psychol.* 35, 63–78. doi: 10.1037/0022-3514.35.2.63
- Martinez, T., and Lee, O. (2012). From community gyms to classrooms: a framework for values-transfer in schools. *J. Phys. Educ. Recreat. Dance* 83, 33–51. doi: 10.1080/07303084.2012.10598709
- McArdle, S., McGale, N., and Gaffney, P. (2012). A qualitative exploration of men's experiences of an integrated exercise/CBT mental health promotion programme. *Int J Mens Health*, 11, 240–257.
- Pallarés, S., Azocar, F., Torregrosa, M., Selva, C., and Ramis, Y. (2011). Modelos de trayectoria deportiva en waterpolo y su implicación en la transición hacia una carrera profesional alternativa [athletic career models in water polo and their involvement in the transition to an alternative career]. *Cult. Cienc. Deporte* 6, 93–103. doi: 10.12800/ccd.v6i17.36
- Park, S., Lavalley, D., and Tod, D. (2013). Athletes' career transition out of sport: a systematic review. *Int. Rev. Sport Exerc. Psychol.* 6, 22–53. doi: 10.1080/1750984x.2012.687053
- Pearson, R., and Petitpas, A. (1990). Transitions of athletes: developmental and preventive perspectives. *J. Couns. Dev.* 69, 7–10. doi: 10.1002/j.1556-6676.1990.tb01445.x
- Petitpas, A. J., and Champagne, D. E. (1988). Developmental programming for intercollegiate athletes. *J. Coll. Stud. Dev.* 22, 454–460.
- Pierce, S., Gould, D., and Camiré, M. (2017). Definition and model of life skills transfer. *Int. Rev. Sport Exerc. Psychol.* 10, 186–211. doi: 10.1080/1750984x.2016.1199727
- Pummell, B., Harwood, C., and Lavalley, D. (2008). Jumping to the next level: a qualitative examination of within-career transition in adolescent event riders. *Psychol. Sport Exerc.* 9, 427–447. doi: 10.1016/j.psychsport.2007.07.004
- Rose, J., and Johnson, C. W. (2020). Contextualizing reliability and validity in qualitative research: toward more rigorous and trustworthy qualitative social science in leisure research. *J. Leis. Res.* 51, 432–451.
- Ryan, C. (2015). Factors impacting carded athlete's readiness for dual careers. *Psychol. Sport Exerc.* 21, 91–97. doi: 10.1016/j.psychsport.2015.04.008
- Smith, B., and Sparkes, A. C. (2016). *Routledge handbook of qualitative research in sport and exercise*. London, Routledge.
- Sparkes, A. C. (1992). “The paradigms debate” in *Research in physical education and sport: Exploring alternative visions*. ed. A. C. Sparkes (London: Falmer Press), 9–60.
- Stambulova, N. B., Ryba, T. V., and Henriksen, K. (2021). Career development and transitions of athletes: the International Society of Sport Psychology Position Stand Revisited. *Int. J. Sport Exerc. Psychol.* 19, 524–550. doi: 10.1080/1612197x.2020.1737836
- Stryker, S. (1978). Status inconsistency and role conflict. *Annu. Rev. Sociol.* 4, 57–90. doi: 10.1146/annurev.so.04.080178.000421

- Stryker, S., and Serpe, R. T. (1994). Identity salience and psychological centrality: equivalent, overlapping, or complementary concepts? *Soc. Psychol. Q.* 57, 16–35. doi: 10.2307/2786972
- Super, D. E. (1990). “A life-span, life-space approach to career development” in *Career choice and development*. eds. D. Brown and L. Brooks (Hoboken: Jossey-Bass), 197–261.
- Torregrossa, M., Ramis, Y., Pallarés, S., Azócar, F., and Selva, C. (2015). Olympic athletes back to retirement: a qualitative longitudinal study. *Psychol. Sport Exerc.* 21, 50–56. doi: 10.1016/j.psychsport.2015.03.003
- Torregrossa, M., Regüela, S., and Mateos, M. (2020). “Career assistance programs” in *The Routledge international encyclopedia of sport and exercise psychology*. eds. D. Hackfort and R. J. Schinke (London: Routledge)
- Trottier, C., and Robitaille, S. (2014). Fostering life skills development in high school and community sport: a comparative analysis of the coach's role. *Sport Psychol.* 28, 10–21. doi: 10.1123/tsp.2012-0094
- Tuohy, D., Cooney, A., Dowling, M., Murphy, K., and Sixsmith, J. (2013). An overview of interpretive phenomenology as a research methodology. *Nurse Res.* 20, 17–20. doi: 10.7748/nr2013.07.20.6.17.e315
- UNICEF. (2003). Definition of terms. Available at: [https://www.unicef.org/lifeskills/index\\_7308.html](https://www.unicef.org/lifeskills/index_7308.html)
- Warriner, K., and Lavalley, D. (2008). The retirement experiences of elite female gymnasts: self identity and the physical self. *J. Appl. Sport Psychol.* 20, 301–317. doi: 10.1080/10413200801998564



## OPEN ACCESS

## EDITED BY

Iván Iván-Baragaño,  
European University of Madrid, Spain

## REVIEWED BY

Nieves Gutiérrez Ángel,  
University of Almería, Spain  
María Antonia Parra Rizo,  
Miguel Hernández University of Elche, Spain  
José Carlos Fernández,  
University of Malaga, Spain

## \*CORRESPONDENCE

Antonio Castillo-Paredes  
✉ acastillop85@gmail.com

RECEIVED 14 January 2024

ACCEPTED 04 April 2024

PUBLISHED 16 April 2024

## CITATION

Rojo-Ramos P, Galán-Arroyo C,  
Gómez-Paniagua S, Castillo-Paredes A and  
Rojo-Ramos J (2024) Emotional regulation  
and self-perceived quality of life in high-  
performance mountain sports athletes.  
*Front. Psychol.* 15:1370124.  
doi: 10.3389/fpsyg.2024.1370124

## COPYRIGHT

© 2024 Rojo-Ramos, Galán-Arroyo, Gómez-Paniagua, Castillo-Paredes and Rojo-Ramos. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Emotional regulation and self-perceived quality of life in high-performance mountain sports athletes

Pablo Rojo-Ramos<sup>1</sup>, Carmen Galán-Arroyo<sup>2</sup>,  
Santiago Gómez-Paniagua<sup>3</sup>, Antonio Castillo-Paredes<sup>4\*</sup> and  
Jorge Rojo-Ramos<sup>1</sup>

<sup>1</sup>Physical Activity for Education, Performance and Health (PAEPH) Research Group, Faculty of Sports Sciences, University of Extremadura, Cáceres, Spain, <sup>2</sup>Physical and Health Literacy and Health-Related Quality of Life (PHYQoL), Faculty of Sport Science, University of Extremadura, Cáceres, Spain, <sup>3</sup>BioErgon Research Group, University of Extremadura, Cáceres, Spain, <sup>4</sup>Grupo AFySE, Escuela de Pedagogía en Educación Física, Facultad de Educación, Investigación en Actividad Física y Salud Escolar, Universidad de Las Américas, Santiago, Chile

Emotional regulation is an indispensable capacity for human beings, so that alterations in it can lead to the appearance of psychological, social and/or cognitive disorders. Therefore, possessing adequate emotional strategies is intimately related to the quality of life that a person presents. In this sense, high-level athletes suffer constant setbacks and frustrations due to the performance of their sporting activity, in addition to continuous modifications of their daily life activities. Thus, the objective of this research is to explore the emotional regulation and self-perceived quality of life of high-level athletes in mountain sports, analyzing the possible influences of gender, demographic location, body mass index and age. Fifty-four athletes belonging to the High Performance Technification Center of Cáceres (Extremadura, Spain) completed a sociodemographic questionnaire, as well as the Cognitive Emotion Regulation Questionnaire and the WHOQOL-BREF. The Shapiro–Wilkins test was used to analyze the normality of the variables collected and nonparametric statistics were used since the assumption was not met. Both gender and demographic location showed significant differences in the dimensions of the two questionnaires. Likewise, age was associated with the dimensions of both scales, but not body mass index, which was only associated with self-perceived quality of life. In addition, the stepwise linear regression model predicted self-perceived quality of life with a value of 60% across self-culpability, gender body mass index and planning. Therefore, it appears that gender, demographic location, age and body mass index could exert modifications on the levels of emotional regulation and self-perceived quality of life of high-level mountain athletes.

## KEYWORDS

emotional regulation, quality of life, high-level athletes, natural environment, physical activity

# 1 Introduction

Emotions are a crucial part of the human condition. Without them, there would be no such thing as the exhilaration of victory or the agony of defeat (Ford and Gross, 2018). Learning to regulate them is crucial in the pursuit of well-being, in fact Koechlin et al. (2018), conclude that people who rate themselves as effective in regulating their emotions also report less negative affect and better quality of life. Valenzuela and La Portillo (2018) in their study, conclude that a relationship can be observed between people's emotional intelligence and the achievement of the goals they set for themselves, just as Vaquero Solis et al. (2018), who deduce from the results obtained in their study that physical activity (PA), motivation levels and adaptability or emotional regulation are closely related. Psychologists Salovey and Mayer (1990) coined the concept of "emotional intelligence," being directly linked to the term emotional regulation which constitutes the key process of emotional intelligence. This refers to those processes by which people exert an influence on the emotions they have, when they have them and how they experience and express them (Gross, 1999). Likewise, the regular practice of PA has a direct impact on emotional regulation and quality of life (Barbosa Granados and Urrea Cuéllar, 2018). Since the beginning, human beings have lived through movement, whether for utilitarian or recreational purposes. In contrast, nowadays sedentary lifestyles have become part of people's lives, bringing with them a decrease in health, not only physical but also psychological (García Matamoros, 2019). The World Health Organization (WHO) (OMS, 2022) defines PA as any bodily movement produced by skeletal muscles, with consequent energy consumption. It further adds that PA refers to any movement, including during leisure time, to move to and from certain places, or as part of a person's work.

Both PA and emotional regulation are an essential part of a person's quality of life, so it is important to reject behaviors that diminish it (Ahrendt et al., 2016) and to stay active (Perea-Caballero et al., 2020). The widespread use of the term "quality of life" and research on it developed since the 1970s (Ramírez-Coronel et al., 2021). Years later, the WHO (OMS, 1998) defined it as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals. Additionally, the transition to adolescence is marked by enormous changes in social, biological and personality development (Brandes et al., 2020), with some of the main challenges of this stage being the lack of social discipline or the influence of negative emotions from family members (Verdecia et al., 2018). Thus, the increase in the quality of life in adolescence lies in leaving behind sedentary lifestyles, adopting healthy and higher quality dietary patterns or behaviors, as evidence has been found of their importance in increasing it (Wu et al., 2019). The latest research, the importance of adolescence as a critical period for the development of emotional regulation has been recognized by several investigations (Lennarz et al., 2019), as for example shown by Silva et al. (2018), where they specify that the level of affect, expressive suppression and cognitive reappraisal influence the emotional regulation of adolescents and their daily lives. Adaptive processes and changes that occur within adolescence (Verdecia et al., 2018), as well as interpersonal relationships, are complex processes that require self-analysis, however, that capacity is not completely internalized (Bernal et al., 2018), hence the importance of emotional regulation at this stage of life.

As discussed, being physically active is one of the most important things people can do to improve physical and mental health (OECD, 2023). However, sedentary lifestyles and the rise of social networks, as well as the way adolescents communicate and interact nowadays, have contributed to a decrease in the level of PA, which is associated with a greater risk of suffering alterations in the psychological, emotional and social state of adolescents (Mascia et al., 2020). In summary, the practice of PA prevents the onset of diseases (Warburton and Bredin, 2016), which consequently leads to an increase in the quality of life (Yagüe Nogué et al., 2021), which in turn allows adolescents to acquire higher levels of emotional regulation (Simón-Saiz et al., 2018). In this sense, during the last few years and in favor of achieving a high quality of life, there has been growing interest in the positive benefits that can be obtained from natural environments and time spent outdoors (Ballester Martínez et al., 2022). PA carried out in nature brings with it a positive impact and even has synergistic effects (Eigenschenk et al., 2019). In fact, in the systematic review by Ballester Martínez et al. (2022) on studies related to PA, nature and mental well-being, the existence of a significant influence of PA in nature on the psychological well-being of the participants is shown.

In this context, there are numerous studies that analyze the relationships between emotional regulation or quality of life (Hervás and Moral, 2017; Lennarz et al., 2019; Salinas Ponce and Villacres, 2021), as well as the influence that PA has on these psychological issues, however these terms have been little explored in high performance athletes who develop their activity in the natural environment. Therefore, the aim of this study is to analyze emotional regulation and quality of life, as well as their relationship with sex, age and body mass index (BMI), in athletes of mountain sports modalities who carry out their activity regularly in the natural environment. Consequently, the main hypothesis for this study would be: There is a significant direct relationship between emotional regulation and quality of life in high-performance mountain athletes and the secondary hypothesis would be: Variables of sex, demographic location, age and body mass index could exert modifications on the levels of emotional regulation and self-perceived quality of life of high-level mountain athletes.

## 2 Materials and methods

### 2.1 Participants

The sample was selected using the non-probabilistic sampling method based on convenience sampling (Salkind et al., 1999). Of the total sample ( $n = 54$ ), 68.5% were boys and 31.5% were girls, so it can be considered a gender-balanced sample. The inclusion criteria of the participants were to have the accreditation of technification, high performance or high-level athletes in any of the disciplines considered as mountain sports by the Spanish Federation of Mountaineering and Climbing.

To characterize the sample (Table 1), other variables were defined, such as level of education, demographic location, considering rural centers to be those with less than 20,000 inhabitants, and the sports modality of the athletes. The mean age was 21.78 years ( $SD = 7.88$ ) and the mean BMI was 20.99 ( $SD = 2.64$ ), calculated from the height and weight data self-reported by the participants.

TABLE 1 Sample characterization ( $N = 54$ ).

Variable	Categories	<i>N</i>	%
Sex	Men	37	68.5
	Women	17	31.5
Education level	Secondary education	28	51.9
	Professional training	8	14.8
	University	10	18.5
	Master's or doctorate	8	14.8
Demographic location	Rural environment	23	42.6
	Urban environment	31	57.4
Athlete's condition	Technification	23	42.6
	High performance	28	51.9
	High-level	3	5.6

*N*, number; %, percentage; SD, standard deviation; M, Mean.

## 2.2 Procedure

The method of data collection was by digital means and the technique used was the realization of self-administered questionnaires, this type of technique facilitates the collection of data to be able to work with them later, saving time and costs (Anderson and Kanuka, 2003). Its main advantage is the possibility of being able to carry them out remotely, in this case the questionnaire was elaborated with the digital application Google Forms.

The questionnaire was completely anonymous and consisted of three parts, two of which were the instruments and one of which was the instruction sheet for proper understanding. The average completion time was about 3 min. All data were collected between October 2022 and March 2023.

It was distributed through telephone contacts, social networks and by email to the various federations that have athletes at the National Technification Center in Cáceres (Spain).

## 2.3 Instruments

First, a questionnaire was designed with six sociodemographic questions (sex, age, demographic location, height, weight and sport modality) through self-reporting. The BMI ( $\text{kg/m}^2$ ) was obtained by applying the following formula:  $\text{BMI} = \text{weight in kilograms} / (\text{height in meters})^2$ .

Emotional regulation was also assessed using the Cognitive Emotion Regulation Questionnaire (CERQ) (Garnefski et al., 2001). The CERQ instrument is composed of 36 items that evaluate nine cognitive-emotional coping strategies for dealing with stressful situations and events. This scale is based on a 5-point Likert-type scale, where 1 is "Sometimes" and 5 is "Always." The dimensions that make up the questionnaire are the following: (1) Self-blame (e.g., "I feel that I am to blame for what happened"); (2) Acceptance (e.g., "I think I have to accept what has happened"); (3) Rumination (e.g., "I often think about how I feel in relation to what has happened to me"); (4) Positive focus (e.g., "I think of something more pleasant than what has happened to me"); (5) Planning (e.g., "I think about what is the best thing I could do"); (6) Positive

reassessment (e.g., "I think I can learn something from the situation"); (7) Perspective taking (e.g., "I think it could have been much worse"); (8) Catastrophism (e.g., "I often think that what has happened to me is much worse than what has happened to other people"); and (9) Blame others (e.g., "It seems to me that others are to blame for what happened"). Similarly, these 9 dimensions can be grouped into adaptive strategies (Acceptance, Positive focus, Planning, Positive reassessment and Perspective taking) and disadaptive strategies (Self-blame, Rumination, Catastrophism and Blame others). The internal consistency reported through Cronbach's alpha in the different subscales ranges from 0.68 (Blame others) to 0.83 (Rumination). Also, in the Spanish version for adolescents (Chamizo-Nieto et al., 2020), the internal consistency of the different subscales ranges from 0.62 (Catastrophism) to 0.83 (Positive focus).

Finally, the self-perceived quality of life was analyzed using the WHOQOL-BREF (Nejat et al., 2006). The instrument has 26 items consisting of four domains: (1) Physical health (7 items), including items on mobility, daily activities, functional ability, energy, pain, and sleep; (2) Psychological health (6 items), referring to self-image, negative thoughts, positive attitudes, self-esteem, mentality, learning ability, memory concentration, religion and state of mind; (3) Social relationships (3 items), complementing information on personal relationships, social support and sex life; and (4) Environmental health (8 items); covering issues related to financial resources, safety, health and social services, physical living environment, opportunities for acquiring new skills and knowledge, recreation, general environment (noise, air pollution, etc.) and transportation. Each individual item of the questionnaire is scored from 1 to 5 on a Likert-type response scale, and the scores for each dimension are then transformed into a scale from 1 to 100.

## 2.4 Statistical analysis

Prior to the analysis, 3 negative WHOQOL-BREF items were inverted to unify the analysis domain. Then, to determine the type of statistical tests to be used, the distribution of the data was explored to



see if the normality assumption was met using the Shapiro–Wilk test, since a sample size of around 50 participants was obtained (Mendes and Pala, 2003). This test determined that this assumption was not met, so it was decided to use nonparametric statistical tests.

In order to analyze the differences between the scores of each of the dimensions according to sex or demographic location, the Mann–Whitney U test was used, establishing a significance level of  $p < 0.05$ . Also, to determine the degree of relationship between each of the dimensions and age or BMI, Spearman’s Rho test was used. For the interpretation of this statistic, the ranges established by Mondragón Barrera (2014) were taken into account: coefficients between 0.01 and 0.10 determine the existence of a low correlation, values between 0.11 and 0.50 imply a medium degree of correlation, from 0.51 to 0.75 a strong correlation, from 0.76 to 0.90 a high correlation, and above 0.91 the correlation is perfect.

In addition, a simple stepwise regression test was used to analyze changes in quality of life taken as a construct consisting of the dimensions that make up the WHOQOL-BREF in relation to the CERQ dimensions, gender and BMI of the participants. A significance level of less than 0.05 was required to enter the variables in the predictive model.

Finally, Cronbach’s Alpha was used to analyze the reliability of the instrument. According to Nunnally and Bernstein (1994), reliability values between 0.60 and 0.70 can be considered acceptable, while values between 0.70 and 0.90 can be considered satisfactory.

3 Results

Table 2 shows the descriptive data for each of the CERQ dimensions according to sex and demographic location based on the mean and standard deviation. The statistical significance was obtained from the Mann–Whitney U test to analyze differences between groups.

Girls scored higher than boys on the dimensions self-blame, acceptance, rumination, planning, positive reassessment, perspective taking, adaptive strategies and disadaptive strategies. In turn, boys scored higher on the dimensions positive focus, catastrophism and blame others. However, significant differences with respect to gender were only obtained in the third (Rumination) and fifth dimension (Planning). On the other hand, demographic location exhibited the highest scores in rural settings on most factors, except for self-blame and catastrophism. Statistically significant differences were also found in acceptance, planning, positive reassessment and adaptive strategies, all of which were in favor of rural settings.

Table 3 shows the scores and differences obtained in each of the dimensions of the WHOQOL-BREF instrument. With regard to sex, significant differences were observed in the psychological health dimension, with men showing higher scores in all dimensions of the scale. With regard to demographic location, significant differences were again observed in the psychological health dimension, and physical health was added. Similarly, the scores follow a clear trend,

TABLE 2 Descriptive analysis and differences in the CERQ dimensions.

Dimension	Sex			Demographic location		
	Men	Women		Rural	Urban	$p$
	M (SD)	M (SD)	$p$	M (SD)	M (SD)	
Self-blame	3.09 (0.80)	3.38 (0.76)	0.21	3.09 (0.77)	3.25 (0.81)	0.44
Acceptance	11.02 (2.18)	11.85 (2.72)	0.26	12.26 (1.84)	10.56 (2.49)	0.01*
Rumination	10.30 (2.55)	12.10 (2.61)	0.03*	11.09 (2.41)	10.70 (2.89)	0.74
Positive focus	8.48 (2.42)	8.27 (2.89)	0.70	8.63 (2.73)	8.26 (2.45)	0.67
Planning	11.77 (2.37)	13.26 (2.68)	0.03*	13.67 (1.97)	11.17 (2.42)	0.01*
Positive reassessment	12.15 (2.90)	13.05 (3.26)	0.26	13.91 (2.93)	11.34 (2.63)	0.01*
Perspective taking	10.97 (2.17)	11.45 (2.93)	0.41	11.48 (2.76)	10.86 (2.14)	0.43
Catastrophism	7.80 (2.73)	7.17 (2.96)	0.29	7.56 (3.13)	7.83 (2.57)	0.68
Blame others	7.35 (2.42)	6.50 (2.19)	0.30	7.13 (2.31)	7.08 (2.43)	0.81
Adaptive strategies	10.88 (1.62)	11.58 (1.94)	0.16	11.99 (1.47)	10.44 (1.64)	0.01*
Disadaptive strategies	7.13 (1.65)	7.30 (1.50)	0.68	7.22 (1.44)	7.16 (1.72)	0.94

M, Mean; SD, standard deviation. Each score obtained is based on a Likert scale (1–5). \* $p$  is significant  $< 0.05$ .

TABLE 3 Descriptive data and differences in each dimension of the WHOQOL-BREF as a function of gender and demographic location.

Dimension	Sex			Demographic location		
	Men	Women		Rural	Urban	
	M (SD)	M (SD)	$p$	M (SD)	M (SD)	$p$
Physical Health	4.15 (0.52)	3.93 (0.58)	0.13	4.31 (0.42)	3.90 (0.56)	0.01*
Psychological Health	4.09 (0.64)	3.56 (0.65)	$< 0.01^*$	4.19 (0.53)	3.73 (0.73)	0.02*
Social relationships	3.71 (0.75)	3.45 (0.97)	0.33	3.82 (0.79)	3.48 (0.83)	0.14
Environmental health	3.95 (0.05)	3.63 (0.65)	0.15	3.76 (0.58)	3.92 (0.57)	0.30

M, Mean; SD, standard deviation. Each score obtained is based on a Likert scale (1–5). \* $p$  is significant  $< 0.05$ .

with the rural locations scoring higher except in the environment dimension.

Table 4 used Spearman’s Rho test to analyze the relationship between each of the dimensions with age and BMI. As for CERQ, age appears to be directly, mean and significantly related to positive focus and adaptive strategies. Also, with the same characteristics but inversely, the dimension of catastrophism is related to age. Likewise, BMI does not seem to be related to CERQ factors. With regard to the WHOQOL-BREF, only environmental health showed significance when associated with age and BMI, with both relationships being mean and inverse.

Table 5 shows a model for predicting quality of life using the simple regression test. This predictive model (perceived quality of life scores = 0.057 x Planning – 0.312 x Self-blame – 0.052 x BMI – 0.374 x Gender) shows a predictive capacity for changes in quality of life of approximately 60%, with R2 being 0.60.

Finally, Table 6 shows the Cronbach’s alpha values reported for each of the CERQ and WHOQOL-BREF dimensions. Even with a small sample, satisfactory values were obtained (between 0.70 and 0.90), except in the social relations dimension.

## 4 Discussion

The purpose of this study was to determine the influence of emotional regulation on the quality of life of high-performance athletes. In the analysis of the main hypothesis between emotional regulation and self-perceived quality of life in athletes, no significant relationships were found between the dimensions; this may be due to the low sample size and low internal consistency of the items and dimensions of the instruments used. However, differences were found between different items and dimensions of the instruments used.

Emotional regulation as an influential factor in the quality of life of athletes is an aspect that has been addressed in several studies, inferring that, possessing emotional regulation strategies helps to improve mental well-being in the daily lives of people (Lennarz et al., 2019; Bird et al., 2021) and in this case athletes (Tamminen et al., 2021). Furthermore, in the study by Ono et al. (2019), testimonies of athletes are shared in which they consider that the pressure of training combined with the rest of daily tasks generates a mental impact on their life. Likewise Simón-Saiz et al. (2018) also show that resilience, an aspect closely linked to emotional regulation, generates a positive

TABLE 4 Relationships between the dimensions of the questionnaires with age and BMI variables.

Instrument	Age <i>p</i> ( <i>p</i> )	BMI <i>p</i> ( <i>p</i> )
CERQ		
1. Self-blame	−0.08 (0.55)	−0.12 (0.38)
2. Acceptance	0.20 (0.14)	−0.07 (0.61)
3. Rumination	0.02 (0.83)	0.06 (0.66)
4. Positive focus	0.35 (0.01)*	0.03 (0.80)
5. Planning	0.14 (0.28)	−0.10 (0.44)
6. Positive reassessment	0.25 (0.06)	−0.04 (0.73)
7. Perspective taking	0.05 (0.72)	−0.06 (0.63)
8. Catastrophism	−0.29 (0.03)*	0.07 (0.59)
9. Blame others	−0.10 (0.46)	0.20 (0.13)
10. Adaptive strategies	0.33 (0.01)*	0.01 (0.99)
11. Disadaptive strategies	−0.17 (0.21)	0.11 (0.39)
WHOQOL-BREF		
12. Physical health	0.02 (0.88)	−0.13 (0.33)
13. Psychological health	0.01 (0.97)	−0.05 (0.67)
14. Social relationships	−0.07 (0.61)	−0.02 (0.88)
15. Environmental health	−0.33 (0.01)*	−0.43 (0.01)*

BMI, Body Mass Index. Each score obtained is based on a Likert scale (1–5). \**p* is significant < 0.05.

TABLE 5 Model predicting changes in quality of life.

Variable	Model 1 (R2) = 0.60			
	<i>β</i>	SE	<i>t</i>	<i>p</i>
Self-blame	−0.312	0.079	−3.923	<0.01
BMI	−0.052	0.024	−2.175	0.03
Gender	−0.374	0.137	−2.742	0.01
Planning	0.057	0.025	2.270	0.03
Constant	5.358	0.676	7.927	<0.01



TABLE 6 Cronbach's alpha coefficients for each dimension of the scales.

Instrument	Cronbach's alpha
CERQ	
1. Self-blame	0.70
2. Acceptance	0.72
3. Rumination	0.77
4. Positive focus	0.72
5. Planning	0.72
6. Positive reassessment	0.85
7. Perspective taking	0.71
8. Catastrophism	0.70
9. Blame others	0.74
10. Adaptive strategies	0.70
11. Disadaptive strategies	0.70
WHOQOL-BREF	
12. Physical health	0.70
13. Psychological health	0.74
14. Social relationships	0.60
15. Environmental health	0.70

effect on quality of life, being able to conclude then that the acquisition of emotional regulation strategies helps athletes to improve it. Regarding the gender variable, the scientific literature provides information in which, as in this study, there are differences between the male and female sexes in emotional regulation processes (Kwon et al., 2013; Dixon-Gordon et al., 2015). Goubet and Chrysikou (2019) demonstrated in their research results that women possessed a significantly higher repertoire than men, suggesting that they may have access to a greater number of strategies, coinciding with the results obtained in the present study where girls presented higher scores in the different dimensions of the CERQ. On the other hand, the influence of demographic location on emotional regulation has not been a focus extensively investigated by the authors. On this issue there are contrary results, on the one hand some research shows that the place of residence influences emotional regulation (Kar et al., 2014) while on the other hand there are studies that reflect that there is no significant evidence between both aspects (Kant, 2019; Sørensen, 2021).

Since the WHO created the WHOQOL-BREF instrument, several authors have made use of this tool to determine the quality of life of people in a given context. In this study, the relationships that exist between the sex and demographic location of the participants and their quality of life have been verified, revealing that there are differences between both sexes in relation to the "psychological health" dimension. Several studies corroborate this result (Fisk, 2018; Esteban-Gonzalo et al., 2020; Walton et al., 2021) concluding that gender may be a factor influencing quality of life. On the other hand, in the present study higher levels of quality of life in most dimensions are seen in the rural setting (Cai and Wang, 2018) also obtained similar results, while in the study of (Sompolska-Rzechula and Kurdys-Kujawska, 2020) the results show significant variation between quality of life between rural and urban settings.

Using Spearman's Rho test, the relationship between the different dimensions of the CERQ and the WHOQOL-BREF was analyzed to see if age and BMI influenced them. The results shown in this study linked to age and the different dimensions of the CERQ hint that there is some relationship between them, coinciding with the results of different studies (Deng et al., 2019; Perry et al., 2019; Burr et al., 2021) in which it is shown that there is a significant relationship between these two aspects, with a large number of age-related changes occurring in emotional regulation during adolescence (Deng et al., 2019). In contrast, the values found in the CERQ results focused on BMI show that no relationship is found with the dimensions of that instrument. No research has been found that specifically addresses the influence of emotional regulation on BMI in high-performance athletes, but evidence of some influence of emotional regulation on BMI can be found in people who practice PA at a non-professional level (Jones et al., 2019; Ruzanska and Warschburger, 2019). Quality of life measured through the WHOQOL-BREF instrument has also been the subject of study with a focus on how age and BMI affect it. In our study we only found a relationship with both variables in the environmental health dimension, as Wallas et al. (2019), whose results provide an environmental influence on BMI, or Lange et al. (2011) who state that environmental factors are significantly associated with adolescent BMI.

Quality of life is a concept that is determined by multiple factors involving physical, psychological and social aspects (Irigaray and Trentini, 2009). In this research, a prediction of change in quality of life of 60% was found based on the correlation between variables such as self-culpability, BMI, sex and planning. Although there are not many findings in the scientific literature on the correlation between these four elements in favor of quality of life, we do find studies such as that of Kyeong et al. (2020) in which it is explained that those with low quality of life may be more vulnerable to being negatively affected by self-criticism. On the other hand, different research has found findings of a correlation between sex and BMI in different populations (Aksoydan and Çakır, 2011; Nwizu et al., 2011).

Therefore, the first hypothesis was declined but the second hypothesis has been reaffirmed.

## 4.1 Limitations

Some limitations can be found in this study. The research was carried out by means of non-probabilistic convenience sampling, which did not fully ensure the representativeness of the sample and could have generated various biases. Likewise, another limitation of the study is the low sample size, which could have limited the results. Likewise, data collection was done through online surveys being faster and cheaper than standard surveys but may entail disadvantages such as low response rates (Iversen et al., 2020).

## 4.2 Future lines of research

Future research could try to extend the information in the current scientific literature on the correlation between dimensions such as self-culpability, planning and aspects such as gender and BMI and how they influence the quality of life of a larger sample of high-performance athletes. Similarly, a line of research could be opened in

relation to the rural or urban environment and how it influences the quality of life of athletes.

## 5 Conclusion

The influence of emotional regulation on the quality of life of high-performance athletes was the main object of analysis of this study and results were found that may indicate that emotional regulation influences the quality of life of these athletes, although not significantly. Women scored higher on some of the CERQ dimensions, indicating that they may possess more regulation strategies than men. In addition, demographic location, age and body mass index could exert modifications on the levels of emotional regulation and self-perceived quality of life of high-performance athletes. Studies such as this one allow a better understanding of the importance of the application of emotional regulation strategies and it would be interesting for coaches to be aware of them in order to favor not only the performance of athletes, but also to increase their mental well-being and their self-perceived quality of life.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The use of these data did not require approval from an accredited ethics committee, as they are not covered by data protection principles, i.e., they are non-identifiable, anonymous data collected through an anonymous survey for teachers. In addition, based on Regulation (EU) 2016/679 of the European Parliament and of the Council on 27 April 2016 on the protection of individuals concerning the processing of personal data and on the free movement of such data (which entered into force on 25 May 2016 and has been compulsory since 25 May 2018), data protection principles do not need to be applied to anonymous information (i.e., information related to an identifiable natural person, nor to data of a subject that is not, or is no longer, identifiable). Consequently, the Regulation does not affect the processing of our information. Even for statistical or research purposes, its use does not require the approval of an

accredited ethics committee. The informed consent of the subjects participating in the study was not necessary, as the data were collected anonymously and there were no minors under 14 years of age. Therefore, and in compliance with paper 13.1 of the LOPD Regulation, which states that “in the case of minors under fourteen years of age, the consent of the parents or guardians shall be required”, although the document was created, it was not required.

## Author contributions

PR-R: Conceptualization, Investigation, Project administration, Resources, Writing – original draft, Writing – review & editing. CG-A: Investigation, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SG-P: Investigation, Resources, Writing – original draft, Writing – review & editing, Methodology, Software. AC-P: Supervision, Visualization, Writing – original draft, Writing – review & editing, Funding acquisition, Investigation, Resources. JR-R: Methodology, Software, Writing – original draft, Writing – review & editing, Data curation, Project administration, Supervision, Visualization.

## Funding

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

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

- Ahrendt, D., Anderson, R., Dubois, H., Jungblut, J. M., Leončikas, T., Sándor, E., et al. *Eurofound European Quality of Life Survey* (2016). doi: 10.2806/964014
- Aksoydan, E., and Çakır, N. (2011). Evaluation of nutritional behavior, physical activity level and body mass index of adolescents. *Gulhane Med. J.* 2011:11.
- Anderson, T., and Kanuka, H. (2003). *E-research: Methods, strategies, and issues*. Boston, MA, Munich: Allyn and Bacon.
- Ballester Martínez, O., Baños, R., and Navarro Mateu, F. (2022). Actividad física, naturaleza y bienestar mental: una revisión sistemática: Actividad física, naturaleza y bienestar mental. *Cuad. Psicol. Deporte* 22, 62–84. doi: 10.6018/cpd.465781
- Barbosa Granados, S. H., and Urrea Cuéllar, Á. M. (2018). Influencia del deporte y la actividad física en el estado de salud físico y mental: una revisión bibliográfica. *Rev. Cienc. Soc.* 25, 141–160. doi: 10.25057/issn.2500-5731
- Bernal, S. M. B., Rodríguez, Y. D. L. C. H., Quizhpi, O. S. V., Armijos, M. D. L. C., Maldonado, H. A., and Guerrero, J. A. C. (2018). Adolescentes de básica superior con adición a internet y redes sociales y relaciones interpersonales. *Rev. Electrón. Psicol. Iztacala* 20, 42–68.
- Bird, G. A., Quinton, M. L., and Cumming, J. (2021). Promoting athlete mental health: the role of emotion regulation. *J. Clin. Sport Psychol.* 17, 112–130. doi: 10.1123/jcsp.2021-0022
- Brandes, C., Kushner, S., Herzhoff, K., and Tackett, J. *Facet-level personality development in the transition to adolescence: Maturity, disruption, and gender differences* (2020).
- Burr, D. A., Castrellon, J. J., Zald, D. H., and Samanez-Larkin, G. R. (2021). Emotion dynamics across adulthood in everyday life: older adults are more emotionally stable and better at regulating desires. *Emot. Wash. DC* 21, 453–464. doi: 10.1037/emo0000734

- Cai, S., and Wang, J. (2018). Less advantaged, more optimistic? Subjective well-being among rural, migrant and urban populations in contemporary China. *China Econ. Rev.* 52, 95–110. doi: 10.1016/j.chieco.2018.06.005
- Chamizo-Nieto, M. T., Rey, L., and Sánchez-Álvarez, N. (2020). Validation of the Spanish version of the cognitive emotion regulation questionnaire in adolescents. *Psicothema* 32, 153–159. doi: 10.7334/psicothema2019.156
- Deng, X., Sang, B., Ku, Y., and Sai, L. (2019). Age-related differences in the late positive potential during emotion regulation between adolescents and adults. *Sci. Rep.* 9:5738. doi: 10.1038/s41598-019-42139-4
- Dixon-Gordon, K. L., Aldao, A., and De Los Reyes, A. (2015). Repertoires of emotion regulation: a person-centered approach to assessing emotion regulation strategies and links to psychopathology. *Cogn. Emot.* 29, 1314–1325. doi: 10.1080/02699931.2014.983046
- Eigenschenk, B., Thomann, A., McClure, M., Davies, L., Gregory, M., Dettweiler, U., et al. (2019). Benefits of outdoor sports for society. A systematic literature review and reflections on evidence. *Int. J. Environ. Res. Public Health* 16:937. doi: 10.3390/ijerph16060937
- Esteban-Gonzalo, S., Esteban-Gonzalo, L., Cabanas-Sánchez, V., Miret, M., and Veiga, O. L. (2020). The investigation of gender differences in subjective wellbeing in children and adolescents: the UP&DOWN study. *Int. J. Environ. Res. Public Health* 17:2732. doi: 10.3390/ijerph17082732
- Fisk, S. R. (2018). Who's on top? Gender differences in risk-taking produce unequal outcomes for high-ability women and men. *Soc. Psychol. Q.* 81, 185–206. doi: 10.1177/0190272518796512
- Ford, B. Q., and Gross, J. J. (2018). Emotion regulation: why beliefs matter. *Can. Psychol. Psychol. Can.* 59, 1–14. doi: 10.1037/cap0000142
- García Matamoros, W. F. (2019). Sedentarismo en niños y adolescentes: Factor de riesgo en aumento. *RECIMUNDO Rev. Cien. Investig. El Conoc.* 3, 1602–1624. doi: 10.26820/recimundo/3.(1).enero.2019.1602-1624
- Garnefski, N., Kraaij, V., and Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Personal. Individ. Differ.* 30, 1311–1327. doi: 10.1016/S0191-8869(00)00113-6
- Goubet, K. E., and Chrysikou, E. G. (2019). Emotion regulation flexibility: gender differences in context sensitivity and repertoire. *Front. Psychol.* 10:935. doi: 10.3389/fpsyg.2019.00935
- Gross, J. J. (1999). "Emotion and emotion regulation" in *Handbook of personality: Theory and research*. 2nd ed (New York: Guilford Press)
- Hervás, G., and Moral, G. (2017). *Regulación emocional aplicada al campo clínico*.
- Irigaray, T. Q., and Trentini, C. M. (2009). Qualidade de vida em idosas: a importância da dimensão subjetiva. *Estud. Psicol. Camp.* 26, 297–304. doi: 10.1590/S0103-166X2009000300003
- Iversen, H. H., Holmboe, O., and Bjertnaes, O. (2020). Patient-reported experiences with general practitioners: a randomised study of mail and web-based approaches following a National Survey. *BMJ Open* 10:e036533. doi: 10.1136/bmjopen-2019-036533
- Jones, J., Kauffman, B. Y., Rosenfield, D., Smits, J. A. J., and Zvolensky, M. J. (2019). Emotion dysregulation and body mass index: the explanatory role of emotional eating among adult smokers. *Eat. Behav.* 33, 97–101. doi: 10.1016/j.eatbeh.2019.05.003
- Kant, R. (2019). Emotional intelligence: a study on university students. *J. Educ. Learn. EduLearn* 13, 441–446. doi: 10.11591/edulearn.v13i4.13592
- Kar, D., Saha, B., and Chandra Mondal, B. (2014). Measuring emotional intelligence of secondary school students in relation to gender and residence: an empirical study. *Am. J. Educ. Res.* 2, 193–196. doi: 10.12691/education-2-4-3
- Koechlin, H., Coakley, R., Schechter, N., Werner, C., and Kossowsky, J. (2018). The role of emotion regulation in chronic pain: a systematic literature review. *J. Psychosom. Res.* 107, 38–45. doi: 10.1016/j.jpsychores.2018.02.002
- Kwon, H., Yoon, K. L., Joormann, J., and Kwon, J.-H. (2013). Cultural and gender differences in emotion regulation: relation to depression. *Cogn. Emot.* 27, 769–782. doi: 10.1080/02699931.2013.792244
- Kyeong, S., Kim, J., Kim, J., Kim, E. J., Kim, H. E., and Kim, J.-J. (2020). Differences in the modulation of functional connectivity by self-talk tasks between people with low and high life satisfaction. *NeuroImage* 217:116929. doi: 10.1016/j.neuroimage.2020.116929
- Lange, D., Wahrenndorf, M., Siegrist, J., Plachta-Danielzik, S., Landsberg, B., and Müller, M. J. (2011). Associations between Neighbourhood characteristics, body mass index and health-related Behaviours of adolescents in the Kiel obesity prevention study: a multilevel analysis. *Eur. J. Clin. Nutr.* 65, 711–719. doi: 10.1038/ejcn.2011.21
- Lennarz, H. K., Hollenstein, T., Lichtwarck-Aschoff, A., Kuntsche, E., and Granic, I. (2019). Emotion regulation in action: use, selection, and success of emotion regulation in adolescents' daily lives. *Int. J. Behav. Dev.* 43, 1–11. doi: 10.1177/0165025418755540
- Mascia, M. L., Agus, M., and Penna, M. P. (2020). Emotional intelligence, self-regulation, smartphone addiction: which relationship with student well-being and quality of life? *Front. Psychol.* 11:375. doi: 10.3389/fpsyg.2020.00375
- Mendes, M., and Pala, A. (2003). Type I error rate and power of three normality tests. *Inf. Technol. J.* 2, 135–139. doi: 10.3923/ijtj.2003.135.139
- Mondragón Barrera, M. A. (2014). Uso de La Correlación de Spearman En Un Estudio de Intervención En Fisioterapia. *Mov. Cien.* 8, 98–104. doi: 10.33881/2011-7191.mct.08111
- Nejat, S., Montazeri, A., Holakouie Naieni, K., Mohammad, K., and Majdzadeh, S. R. (2006). The World Health Organization quality of life (WHOQOL-BREF) questionnaire: translation and validation study of the Iranian version. *J. School Public Health Inst. Public Health Res.* 4, 1–12.
- Nunnally, J. C., and Bernstein, I. H. (1994). *Psychometric theory*. New York: McGraw-Hill.
- Nwizu, E. N., Iliyasu, Z., Ibrahim, S. A., and Galadanci, H. S. (2011). Socio-demographic and maternal factors in Anaemia in pregnancy at booking in Kano, northern Nigeria. *Afr. J. Reprod. Health* 15, 33–41.
- OECD. (2023). *Why physical activity?*; OECD: Paris.
- OMS. *Programme on mental health: WHOQOL user manual*; World Health Organization. Geneva: World Health Organization (1998).
- OMS. (2022). *Informe sobre la situación mundial de la actividad física 2022: resumen ejecutivo*. Available at: <https://www.who.int/es/publications/i/item/9789240060449> (Accessed May 29, 2023).
- Ono, C., Sassano, A., Villanueva, J. R., and Wolffe, A. (2019). *Environmental factors influencing college student athletes quality of life*. Master of Science in Occupational Therapy, Dominican University of California: San Rafael, California.
- Perea-Caballero, A. L., López-Navarrete, G. E., Perea-Martínez, A., Reyes-Gómez, U., Santiago-Lagunes, L. M., Ríos-Gallardo, P. A., et al. (2020). Importancia de la Actividad Física. *Salud Jalisco* 6, 121–125. Available at: <https://www.imbiomed.com.mx/articulo.php?id=114088>
- Perry, N. B., Donzella, B., Parenteau, A. M., Desjardins, C., and Gunnar, M. R. (2019). Emotion regulation and cortisol reactivity during a social evaluative stressor: a study of post-institutionalized youth. *Dev. Psychobiol.* 61, 557–572. doi: 10.1002/dev.21828
- Ramírez-Coronel, A. A., Malo-Larrea, A., Martínez-Suarez, P. C., Montánchez-Torres, M. L., Torracchi-Carrasco, E., and González-León, F. M. (2021). Origen, evolución e investigaciones sobre la Calidad de Vida. *Rev. Sist.* 2021:649. doi: 10.5281/ZENODO.4543649
- Ruzanska, U. A., and Warschburger, P. (2019). Intuitive eating mediates the relationship between self-regulation and BMI - results from a cross-sectional study in a community sample. *Eat. Behav.* 33, 23–29. doi: 10.1016/j.eatbeh.2019.02.004
- Salinas Ponce, J. F., and Villacres, V. (2021). Relación entre resiliencia y calidad de vida en adolescentes. *Polo Conoc. Rev. Cien. Prof.* 6, 2417–2429.
- Salkind, N. J., Escalona, R. L., and Valdés Salmerón, V. (1999). *Métodos de investigación*. México: Prentice-Hall.
- Salovey, P., and Mayer, J. D. (1990). Emotional intelligence. *Imagin Cogn. Pers.* 9, 185–211. doi: 10.2190/DUGG-P24E-52WK-6CDG
- Silva, E., Freire, T., and Faria, S. (2018). Concurrent and lagged relations between emotion regulation and affect in adolescents' daily life. *Span. J. Psychol.* 21:E67. doi: 10.1017/sjp.2018.61
- Simón-Saiz, M. J., Fuentes-Chacón, R. M., Garrido-Abejar, M., Serrano-Parra, M. D., Larrañaga-Rubio, E., and Yubero-Jiménez, S. (2018). Influencia de la resiliencia sobre la calidad de vida relacionada con la salud en adolescentes. *Enferm. Clín.* 28, 283–291. doi: 10.1016/j.enfcli.2018.06.003
- Sompolska-Rzechula, A., and Kurdys-Kujawska, A. (2020). Quality of life of rural and urban population in Poland: evaluation and comparison. *Eur. Res. Stud.* XXIII, 645–656. doi: 10.35808/ersj/1660
- Sorensen, J. F. L. (2021). The rural happiness paradox in developed countries. *Soc. Sci. Res.* 98:102581. doi: 10.1016/j.ssresearch.2021.102581
- Tamminen, K. A., Kim, J., Danyluck, C., McEwen, C. E., Wagstaff, C. R. D., and Wolf, S. A. (2021). The effect of self- and interpersonal emotion regulation on athletes' anxiety and goal achievement in competition. *Psychol. Sport Exerc.* 57:102034. doi: 10.1016/j.psychsport.2021.102034
- Valenzuela, A. D. C., and La Portillo, S. A. (2018). inteligencia emocional en educación primaria y su relación con el rendimiento académico. *Rev. Electrón. Educ.* 22, 1–15. doi: 10.15359/ree.22-3.11
- Vaquero Solis, M., Cerro Herrero, D., Tapia Serrano, M. Á., Iglesias Gallego, D., and Sánchez Miguel, P. A. (2018). *Actividad física, adaptabilidad emocional y regulación intrínseca: un estudio predictivo en adolescentes*. Physical activity, emotional adaptability and intrinsic regulation: A predictive study in adolescents.
- Verdecia, D., Sánchez, Y., and Guzmán, F. (2018). Situación Actual de La Adolescencia y Sus Principales Desafíos. *Gac. Méd. Espirituana* 20, 98–105. Available at: [http://scielo.sld.cu/scielo.php?script=sci\\_arttext&pid=S1608-89212018000100012&lng=es](http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1608-89212018000100012&lng=es).
- Wallas, A., Ekström, S., Bergström, A., Eriksson, C., Gruzdeva, O., Sjöström, M., et al. (2019). Traffic noise exposure in relation to adverse birth outcomes and body mass between birth and adolescence. *Environ. Res.* 169, 362–367. doi: 10.1016/j.envres.2018.11.039

Walton, C. C., Rice, S., Gao, C. X., Butterworth, M., Clements, M., and Purcell, R. (2021). Gender differences in mental health symptoms and risk factors in Australian elite athletes. *BMJ Open Sport Exerc. Med.* 7:e000984. doi: 10.1136/bmjsem-2020-000984

Warburton, D. E. R., and Bredin, S. S. D. (2016). Reflections on physical activity and health: what should we recommend? *Can. J. Cardiol.* 32, 495–504. doi: 10.1016/j.cjca.2016.01.024

Wu, X. Y., Zhuang, L. H., Li, W., Guo, H. W., Zhang, J. H., Zhao, Y. K., et al. (2019). The influence of diet quality and dietary behavior on health-related quality of life in the general population of children and adolescents: a systematic review and Meta-analysis. *Qual. Life Res.* 28, 1989–2015. doi: 10.1007/s11136-019-02162-4

Yagüe Nogué, M., Lasheras Uriel, A. S., Redondo Benito, N. S., Sánchez Ortega, D., and Ruiz Lorente, S. (2021). Beneficios de la actividad física y el deporte en adolescentes y calidad de vida, artículo monográfico. *Rev. Sanit. Investig.* 2:77.



## OPEN ACCESS

## EDITED BY

Gudberg K. Jonsson,  
University of Iceland, Iceland

## REVIEWED BY

João Nunes Prudente,  
University of Madeira, Portugal  
Valentino Zurloni,  
University of Milano-Bicocca, Italy

## \*CORRESPONDENCE

Stefanie Klatt  
✉ s.klatt@dshs-koeln.de

<sup>†</sup>These authors have contributed equally to this work and share first authorship

RECEIVED 23 February 2024

ACCEPTED 09 April 2024

PUBLISHED 29 April 2024

## CITATION

Klatt S, Otte FW, Beavan A, Schumacher T and Millar SK (2024) How did you perform? Investigating football players' perception of self-regulated passing performances under auditory noise environments.  
*Front. Psychol.* 15:1390487.  
10.3389/fpsyg.2024.1390487

## COPYRIGHT

© 2024 Klatt, Otte, Beavan, Schumacher and Millar. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# How did you perform? Investigating football players' perception of self-regulated passing performances under auditory noise environments

Stefanie Klatt<sup>1\*†</sup>, Fabian Werner Otte<sup>1†</sup>, Adam Beavan<sup>2</sup>,  
Tom Schumacher<sup>1</sup> and Sarah Kate Millar<sup>3</sup>

<sup>1</sup>Section Cognition in Team Sports, Institute of Exercise Training and Sport Informatics, German Sport University Cologne, Cologne, Germany, <sup>2</sup>TSG Research Lab gGmbH, Zuzenhausen, Germany, <sup>3</sup>Faculty of Health, School of Health Sciences, University of Canterbury, Christchurch, New Zealand

**Introduction:** This paper deals with the question on how sport performances may be influenced by internal, emotional processes, which stem from outside feedback.

**Methods:** In terms of methods, players' subjective performance ratings for four experimental auditory cue conditions were examined; these included both 'positive' and 'negative' stadium noise, 'no (auditory) conditions,' and a control/'baseline' condition. This resulted in a qualitative-analytic data set that was obtained succeeding each auditory cue condition using a unique football training machine (i.e., known as 'Footbonaut'). Without having received any coaching/performance feedback, players were asked to rate and individually comment on their perceived performance ratings for each experimental auditory condition.

**Results:** Findings indicate stronger and more significant correlations between auditory conditions and subjective ratings compared to the non-auditory condition and its subjective rating. Furthermore, data provides initial insight into players' emotional experiences during each of the practice conditions.

**Discussion:** These noteworthy findings on players' abilities to accurately judge their performances based on selfmonitoring and intrinsic feedback are discussed from an Ecological Dynamics perspective, linked to a Nonlinear Pedagogy for coaching. Here, representative and affective learning designs for skill learning and performance preparation are presented. Finally, a hypothetical catalyst effect of auditory stadium noise on subjective performance rating is proposed.

## KEYWORDS

affective learning design, representative learning design, athlete self-regulation, Ecological Dynamics, Nonlinear Pedagogy, Footbonaut, skill learning, auditory cues

## Highlights

- This study aims to better understand players' emotional experiences of auditory noise environments and their subjective abilities to accurately perceive and judge their performances to them.
- Results show that skilled football players use self-monitoring and intrinsic feedback to judge their performances; and emotionally and positively respond to (game-representative) auditory noise environments.



- A link between auditory information, its effects as a catalyst on task performance and subjective emotional regulation is proposed.
- Findings underline the benefits of representative and affective learning designs and a hands-off coaching approach.

## Introduction

During the COVID-19 pandemic, professional sports leagues worldwide experienced significant disruptions, often halting mid-season. Association football, with the first national league to resume being the German Bundesliga, tried to restart its schedule under stringent regulation. Notably, stadiums remained devoid of spectators—a measure intended to mitigate the spread of the virus. Consequently, professional players encountered a peculiar situation: the once vibrant and emotionally charged atmosphere of stadiums was replaced by silence. This prompts an intriguing inquiry: Did this change in auditory information affect the players temporarily in their playing ability, and if so, how?

Research into stadium noise and its impact on performance has surged during the COVID-19 pandemic. A meta-analysis by [Leitner et al. \(2023\)](#) comprehensively examines numerous studies conducted during the pandemic era, focusing on the home-field advantage. While the home-field advantage has been well documented across various sports and contexts by scientists over the last 30 years, no one clearly dominant factor for it has been established ([Legaz-Arrese et al., 2012](#)). Rather, research highlights a multitude of causes, such as crowd and travel effects, territoriality, referee bias, and other psychological factors (see [Pollard, 2008](#), for an initial review). Here, [Pollard \(2008, p. 13\)](#) stresses that “ultimately it is what goes on in the mind of players, coaches and referees that determine their actions and hence the result of a game and the role played by home advantage.” Connecting this research area on home-field advantages along with potential crowd noise effects back to the current study, it is of interest to what degree emotionally-laden (positively or negatively perceived) auditory stadium environments – in contrast to silent, no noise (COVID-19 pandemic-like) environments – may impact player performances, perceptions, enjoyment, and motivation ([Otte et al., 2021](#)). While existing studies predominantly rely on in-field analytics, investigations into athletes’ behavior amidst altered auditory environments remain scarce. Previous studies examining the influence of stadium noise under controlled laboratory settings, such as [Otte et al. \(2021\)](#), have primarily focused on objective metrics like passing accuracy and time. These experiments revealed that athletes exhibited quicker passing times when exposed to pertinent auditory cues compared to negative (e.g., booing) or silent conditions. However, these findings, though valuable, present an incomplete picture. The fundamental question that remains unanswered is the underlying mechanism driving divergent behavioral responses across varied noise conditions.

This paper aims to address this research gap by delving into the subjective experiences and perceptions of athletes amidst varying stadium noise levels. By analyzing a previously collected yet unexplored qualitative dataset concerning football players’ perceived performances under different auditory cue conditions, we aim to shed light on the nuanced interplay between auditory stimuli and athletes’ cognitive and emotional responses. This novel approach will not only enhance our understanding of athletes’ adaptability to stadium noise

but also elucidate their ability to evaluate performance independently of coach-led feedback. Furthermore, we seek to correlate these perceptual abilities with players’ emotional engagement with distinct football-specific auditory cues.

## Key concepts in Ecological Dynamics to highlight the importance of emotional processing in regards to self-regulation and self-monitoring

To understand why this research is a welcoming contribution to the expanding literature on behaviors of football players in different auditory contexts, we first must explain why it is important to view this study from the lens of the athlete’s emotional perspective. To do so, we will use an Ecological Dynamics perspective, highlighting the deeply intertwined relationships between perception, action, cognition, intentions, and emotions. From this perspective, understanding athletes as complex and adaptive systems, composed of numerous interacting parts, is critical ([Phillips et al., 2010](#)). Particularly, it is the scale of analyzing athletes’ performances holistically on perceptual-cognitive, physical and emotional levels that further concerns their ability to self-regulate under varying contexts ([Davids, 2015](#)). For practice and competition contexts, it is therefore the coach’s role to guide players’ *self-regulation* and *self-monitoring* toward goal-oriented and functional behavior ([Davids, 2015](#); [Woods et al., 2020a](#)). Self-regulation is understood as the human capacity to manage one’s urges according to previously defined goals or ideas ([Baumeister et al., 2007](#)). These goals/ideas can be both from an external source but also stem from an internal one. An important subcomponent of self-regulation is self-monitoring, and as laid out by [Zimmerman \(2000, 2001\)](#), self-monitoring displays a way for the individual to implicitly sense and assess whether the current task is done effectively from the person’s own point of view. More importantly, papers from [Diamond and Aspinwall \(2003\)](#) or [Bridgett et al. \(2013\)](#) showcase that emotions can heavily affect the self-regulation process. These authors state that while negatively charged emotions often hinder the transfer of mental into task-related skills, positively charged emotions facilitate this transfer. If we keep the previous definition in the back of our mind, it becomes therefore essential to analyze the player’s own perceived emotional state, as without it, our ecological view would miss a key variable.

In addition, the bidirectionality of the *player-environment relationship* provides some clear principles for guiding the design of practice activities ([Woods et al., 2020a](#)). For example, the use of nonlinear pedagogical concepts, such as *representative learning* and *affective learning designs*, has been advocated by research for numerous years (see [Otte et al., 2019, 2020](#), and [Headrick et al., 2015](#), for recent conceptual discussions for each learning design, respectively). Representative learning designs emphasize the notion for practice activities to replicate constraints and key information that is present

in the competitive performance environment (Woods et al., 2021), whereas affective learning designs highlight the embedment of emotions into these representative (practice) tasks, potentially evoking individualized behavioral tendencies in different athletes (Headrick et al., 2015). These constraints are defined as part of the Constraints-Led Approach, which is in turn underpinned by principles of Ecological Dynamics and Nonlinear Pedagogy (Renshaw et al., 2016; Button et al., 2020). Constraints are viewed as individual, task-related and environmental characteristics and features that guide a player's search for and perception of relevant information. Examples can be objects, like specific passing targets or auditory conditions, such as stadium noise (e.g., Fajen et al., 2009). From an applied coaching perspective, it would therefore be ideal if one uses constraint manipulations (e.g., adding stadium noise conditions) to design these representative and affective practice environments, which focus on holistically integrating all performance-regulating sub-systems (i.e., perception, action, cognitions, intentions, and emotion; Woods et al., 2020a). Put simply, the practice design and its constraints drive athlete self-regulation and exploration (Woods et al., 2020b). These processes are intentionally regulated in constant interaction between athletes and their surrounding environments (Davids et al., 2015).

Without further coach-induced or similar types of augmented feedback, athletes learn to search for and perceptually attune to relevant environmental information and invitations for action (also termed affordances; see Fajen et al., 2009). It is important to note that search in this case stems from the perceptual-cognitive entanglement, highlighting how externally and internally perceived information are mutually dependent in driving athlete self-regulation. An example of this would be an internal appraisal of a whistling crowd, which would startle the athlete. This in an essence means that in absence of augmented feedback, people (and athletes) aim to enhance the use of intrinsic (sensory) feedback sources such as emotional feedback to self-monitor and adapt task-specific behavior (Hodges and Franks, 2002; Otte et al., 2019, 2020). For example, a football player would always feel and see the consequence of a pass without receiving further extrinsic and augmented coaching feedback (Williams and Hodges, 2005). Particularly, the notions of task-intrinsic feedback and self-monitoring relate to this investigation, in that it aims to examine skilled football players' abilities to accurately, and independently, judge their own performances. This idea may be further supported by previous research demonstrating athletes' abilities to use acquired and specified knowledge to accurately assess movement performances (Hadfield, 2005; Fajen et al., 2011; Millar et al., 2011, 2017). For example, Millar et al. (2017) found Olympic rowers show accuracy in judging and successfully identifying quality rowing stroke performances by accessing knowledge of their performances. This finding may be extended by research demonstrating expert rowers to accurately perceive and monitor their own catch efficiency, which was objectively reflected by changes in boat speed (Millar et al., 2017). While to the authors' knowledge, there has been no investigation to date into football players' abilities to accurately self-monitor performances (under varying noise conditions), previous research commonly emphasizes "high-level performers as expert systems adept at detecting and evaluating change focussed on performance" (Millar et al., 2015, p. 3). Yet a special importance of these ecological factors and emotions so far has neither taken place in research, nor in the common training regimen of athletes. In an essence, this leads the training tasks to become non-representative or at least less

representative for a stadium-based (noise) atmosphere. This could lead to a missing transfer of training skills in a professional sporting environment, these being the stadium environment. Consequently, based on the proposed theoretical rationale with a focus on emerging player-environment relationships (Davids et al., 2008) and the existing research gap, this article aims to investigate:

- i To what extent skilled football players accurately judge their performance in absence of augmented, coach-led performance feedback; and
- ii How football players perceive and self-regulate their emotional reactions to various auditory cue environments in practice.

## Method

### Participants

An initial *a priori* analysis was conducted to determine the required sample size for this study using the computer program G\*power 3.1.9.7. The estimated effect size for this study was unknown, as the few studies that analyzed stadium noise at a professional level all failed to include effect sizes. However, conceptually similar studies focusing on auditory stimuli affecting treadmill walking ( $\eta^2 = 0.24$ ; Karageorghis et al., 2009) and running performance ( $\eta^2 = 0.20$ ; Bood et al., 2013) demonstrated rather large effects. We, therefore, estimated the participants of a correlation analysis using a medium to strong effect of  $r = 0.6$  with a relative power of 0.80 and a critical alpha of 0.05. This resulted in 19 participants that we needed to recruit for this study. Unfortunately, this margin was missed by four participants due to the requirement of a highly specialized sample size of elite athletes. Therefore, the final participant number of the experiment is a sample of 15 male football players ( $n = 15$ , U23s age group) and results from this study should be taken with care due to possible type-1 error inflation. The ethical approval for the presented study protocols was granted by the lead author's university ethics commission in 2019.

### Procedure

The highly skilled sub-elite players were tested on objective metrics such as their passing performances [i.e., passing accuracy score (in %) and average passing time (in s)], using the standardized and validated robotic football training tool, known as 'Footbonaut' (CGoal GmbH, Berlin, Germany; see Beavan et al., 2019, and McGowan, 2012). In said training, after a warmup procedure consisting of 10 passing repetitions, the players were instructed to perform four identical football passing rounds consisting of 32 low passes over the course of 2–3 min. The Footbonaut is a high-tech robotic cage where footballers can improve their technical skills without any other players (Beavan et al., 2019). The four sessions differed due to different randomized auditory noise conditions. These four different conditions are: (1) A 'Baseline' condition: the training environment allows for participants to perceive all relevant visual information (i.e., light signals) and auditory cues (i.e., 'beep' sound signals at a volume of approximately 75 dB) on passing source and passing target 'window,' as provided by the Footbonaut (i.e.,



participant's hearing was not distracted). (2) A 'No auditory' cue condition: the training environment significantly limits the participant's perception of auditory information (i.e., 'beep' sound signals) on passing source and target 'window' provided by the Footbonaut (i.e., participants were asked to wear ear defenders throughout the training session). (3) A positive auditory cue condition: the training environment displays loud stadium noises (i.e., a football crowd singing) played through speakers in the Footbonaut (i.e., with a volume of approximately 85 dB); thus, the participant's perception of auditory information (i.e., 'beep' sound signals) on passing source and target 'window' provided by the Footbonaut are impaired. or (4) A negative auditory cue condition: the training environment displays loud stadium noises (i.e., a football crowd whistling and 'booing') played through speakers in the Footbonaut (i.e., with a volume of approximately 85 dB); thus, the participant's perception of auditory information (i.e., 'beep' sound signals) on passing source and target 'window' provided by the Footbonaut are impaired. The crowd sounds of fans singing and chanting were pre-tested for their validity (Otte et al., 2021).

The task was instructed to the players at the beginning, indicating that they should "receive and pass the ball as quickly as possible." All conditions were completed by each participant in a randomized order. Notably, emotional valence of auditory stadium conditions was pre-tested by 30 participants ( $n=30$ ) and the Footbonaut training machine allowed the researchers to control for various variables (e.g., passing repetition numbers, ball release speeds and angles from the machine, light and ball conditions). Additionally, all available information remained the same for each passing repetition per session (e.g., visual information, auditory conditions, ball speed and trajectories; see Otte et al., 2021).

After all the information from the participants was recorded, feedback was provided for the athlete by the lead experimenter and the participant debriefed and dismissed.

## Measures

Additionally, to the physical data already analyzed by Otte et al. (2021) with help of the Footbonaut, players were also asked to provide subjective statements regarding their own performance. These subjective statements will be the focus for the following analysis. Without disclosing players' performance scores nor providing any augmented (verbal) coaching feedback, players were asked to provide both standardized and open statements following each of the four auditory conditions (i.e., under the 'baseline,' 'no auditory cue,' 'positive auditory cue' and 'negative auditory cue' conditions). Recordings were made by athletes answering a questionnaire after completing each practice condition. The lead experimenter was always present during the data collection of the Footbonaut and handed out the questionnaire, however the experimenter was not present during the time the athlete was filling out the answers. To further control for possible cognitive and emotional biases during the experiment, there was no feedback or consultations provided regarding the information on the questionnaires for the athletes during the four conditions. In detail, ratings and perceptions after each auditory cue conditions were measured in two ways. Both of these measurements were collected in a previous study (Otte et al., 2021), but were not analyzed upon:

- 1 Players were asked to rate their performance for each session on a Likert-type scale from 0 (i.e., strongly unsatisfied) to 10 (strongly satisfied); and
- 2 Players were questioned on their performances and subjective perceptions of the auditory cue conditions. In particular, they were asked to 'please comment on your perceptions of/ feelings about each auditory cue conditions' after each of the four sessions.

## Data analysis

For the data analysis, subjective ratings and statements were compared to objective performance data obtained from the Footbonaut system, as previously mentioned in Otte et al. (2021), but briefly summarized here. The results of this experiment revealed that under negatively valenced sounds, such as negative auditory conditions or absolute silence, reaction times in the Footbonaut were slower. Conversely, positively valenced sounds, such as cheerful crowd noise, did not yield any significant improvements. Similarly, passing accuracy was not affected by any of the auditory conditions. To establish a connection with the present study, a Spearman-rho correlation analysis was employed to investigate whether subjective emotional scores are associated with average reaction time and passing accuracy. This correlation analysis was conducted for each of the eight conditions, and results are presented in Table 1.

Additionally, a manipulation check was done to see whether participants correctly can assess their subjective performance this was done by comparing the perceived subjective rating to the accuracy achieved in the Footbonaut.

Qualitative-analytic exploration considered each player's standardized ratings and subjective statements following each auditory cue conditions. Here, players' perceived performance ratings (i.e., between 0 and 10) were used for correlation analysis with the two objective performance scores (i.e., passing accuracy and average passing time). Further, an inductive, data-driven theming process was used to code the qualitative, open statements that players provided after each auditory cue conditions (Braun and Clarke, 2006). Specifically, in order to explore players' subjective statements regarding each auditory cue condition, thematic analysis allowed to examine individual players' perspectives and feelings (King, 2004; Nowell et al., 2017).

A thematic analysis was conducted by the experimenters based on the open statements voluntarily filled out by each player. The result from these statements were filtered and subsequently divided into three coding themes, which include: (i) ability to perceive acoustic

TABLE 1 Overview of the different correlations between the different subjective emotional categories and the objective stats.

	Accuracy score	Average time taken
Baseline	0.657*	0.413
Positive	0.841*	0.102
Negative	0.790*	-0.131
Noise-canceling headphones	0.514	0.246

Significant correlations ( $p < 0.05$ ) are marked with an asterisk (\*).

information; (ii) perceived positive influence on performance; and (iii) perceived positive influence on emotional engagement. All experimenters spoke the native language of the athletes, German.

# Results

Qualitative-quantitative exploration of players' subjective statements following each Footbonaut auditory cue conditions provides insight into: (1) the correlation between players' subjective performance ratings and two objective performance data measures of passing accuracy and average passing time; and (2) players' subjective and internal emotional regulations to the auditory cue conditions.

## Players' subjective performance ratings

A spearman-rho correlation analysis was performed with all of the different emotional conditions (baseline, positive, negative, and headphones) in relation to average passing time and passing accuracy. Due to time-related issues, one participant out of 15 only managed to be tested in the objective conditions and could not be questioned regarding their subjective emotional analysis. This participant was excluded in the correlational analysis. In the baseline subjective rating condition, we saw a correlation of 0.657 ( $p=0.011$ ) for the baseline accuracy and a correlation of 0.413 ( $p=0.142$ ) for the average time taken. The positive subjective rating condition was correlated to the accuracy with 0.841 ( $p<0.001$ ) and not correlated to the average time with 0.102 ( $p=0.729$ ). The negative subjective rating condition was correlated to the accuracy with 0.790 ( $p=0.001$ ) and not correlated to the average time with  $-0.131$  ( $p=0.657$ ). The headphone subjective rating condition was not correlated to the accuracy with 0.514 ( $p=0.06$ ) nor to the average time with 0.246 ( $p=0.397$ ) for the average time taken. Table 2 presents an overview of all correlations. Significant correlations are marked with an asterisk (\*).

Furthermore, as a validation check, Table 2 presents a qualitative analysis of a simple yes (✓) or no (X) to represent when each player was accurate about their highest (or lowest) subjective rating, matches their highest (or lowest) accuracy score or time taken. For example, a tick (✓) indicated a direct match between subjective rating and a performance score. Here, it can be observed in Table 1 (highest score), that 93% of players were accurate and knew when they had their most accurate round (of the four conditions) and subjectively rated it their highest. Likewise, players were mostly accurate to know when they had their lowest score. While players were less accurate about their performance time, all 14 players were accurate about at least one of the four measures and over 55% of players were accurate in 3 of the 4 measures. When all measures were taken together ( $n=56$ ), a significant correlation of 0.735 ( $p<0.001$ ) was given between own subjective rating and performance of the players. A non-significant correlation of 0.132 ( $p=0.13$ ) was shown between subjective rating and time taken of the scores.

## Players' subjective perceptions of the auditory cue conditions

Qualitative analysis of players' subjective perceptions and statements after each practice round led to three coding themes; these

TABLE 2 Spearman-rho correlational analysis between subjective performance ratings and their accuracy performance score, where a simple yes (✓) or no (X) represents when each player was accurate about their highest (or lowest) subjective rating, matches their highest (or lowest) accuracy score or time taken.

Player	Highest score	Fastest time	Lowest score	Slowest time
1	✓	✓	X	✓
2	✓	X	✓	X
3	✓	X	✓	✓
4	✓	✓	✓	X
5	✓	X	✓	X
6	✓	✓	✓	✓
7	✓	✓	✓	X
8	✓	✓	X	✓
9	✓	✓	✓	X
10	✓	✓	✓	✓
11	✓	X	✓	X
12	✓	X	✓	X
13	X	X	X	✓
14	✓	X	✓	X
Averages	93%	50%	79%	43%

include: (i) ability to perceive acoustic information; (ii) perceived positive influence on performance; and (iii) perceived positive influence on emotional engagement. Notably, due the analysis of participants' perceptions of each practice condition concerned open and voluntary statements (i.e., statements about the 'baseline,' 'no auditory cue,' 'positive auditory cue,' and 'negative auditory cue' conditions). First, the 'baseline' practice condition was clearly perceived to be "easiest" in regard to multimodal cues providing support for passing performance. Its accessibility concerning perceiving acoustic information to support their passing performances was stated by 10 of 14 players ( $n=10$ ). For instance, while one player stated that "signals are clearly hearable," another player expressed that "one can perceive both noises (ball machine and target) very well and one can often find the optimal position." In regard to this condition's impact on emotional engagement, remarkably no player made a statement leading to the notion that the baseline condition had a rather neutral effect on emotional engagement.

Second, eight players ( $n=8$ ) claimed that the 'noise-canceling headphones condition,' as expected, had influence on their performances by, for example, making statements such as: headphones made it "difficult to hear the signals" and (more) "difficult to perceive the noises." Whereas these statements indicate perception of increased practice task complexity under a 'no auditory cue condition,' mixed feelings regarding its influence on performance were specified (i.e., eleven players mentioned for this condition to either have positive or negative impact on performance). For example, some players provide statements such as: "No noise helps because I was more concentrated through the silence" and "I felt more concentrated and force[d] to find more [visual] orientation." In contrast, other players mentioned this cue condition to be "harder," because "too much concentration on noises and because of that a bad

*focus on passing performance*,” and to lead to (internal) body-focused attention. Furthermore, the feeling of increased focus through impaired hearing was expressed. This, however, at the cost of feeling “*slower*,” “*rather annoyed*” and subjectively perceiving multimodal environmental cues with a delay.

Third, both stadium noise conditions (i.e., positive and negative stadium noise conditions) were stated to impede perception of acoustic Footbonaut sounds and thus, likely increase perceived task complexity, compared to the ‘baseline’ condition (i.e., nine and eight players mentioned this for the conditions, respectively). However, both auditory cue conditions were rated to increase players’ “*focus*” and “*concentration*” to perform in emotionally engaging football practice environments. This notion may be highlighted by one participant’s quote concerning the positive auditory cue condition: “*Because it is very loud, I had to focus more on orientating myself.*” Finally, while both stadium noise conditions supposedly led to increased stimulation and motivation (e.g., a player stating: “*the whistling has motivated me*”), the lead researcher’s informal conversations with players after concluding the experiment found that the ‘positive auditory cue’ condition appeared to be slightly more favorable. This condition was explicitly stated to positively influence perceived performance, and perceived positive emotional engagement with the training space. This overall insight may be appreciated by one player’s written quote: “*The singing fans were positively perceived – I found the chanting wicked!*”

## Discussion

While the initial study by [Otte et al. \(2021\)](#) assessed the effect of auditory cue conditions with varying representativeness on football players’ objective passing performances, this article aims at approaching the study from an athlete-centered perspective on individuals’ performance perceptions and emotional engagement with practice under varying auditory noise conditions. Findings are discussed regarding (1) *skilled players’ subjective perception of performance* (i.e., as compared to objective performance data); and (2) *skilled players’ emotional engagement during practice under auditory noise conditions*.

### Skilled players’ subjective perception of performances

The evaluation of players’ perceptions of their own performances compared to actual performance data reveals a strong correlation. The finding that the majority of skilled players correctly perceive and evaluate their own performances (in absence of any augmented feedback of results) aligns with the literature on expertise in sports. [Table 1](#) also demonstrates that players were highly accurate in discerning whether they were successful or not in their performance, with all but one player being aware of which auditory condition they were most successful in. In contrast, players were less accurate in identifying which condition resulted in the fastest or lowest performance. This outcome might be expected in a sport like football, where players are constantly engaged in the dynamics of successful passes, thus arguably possessing expert knowledge of whether a pass was successful or not.

The correlations themselves show an interesting finding. The emotional engagement of the players was significantly correlated with their respective score in all conditions – except the one condition where players could not hear any outside information. In the baseline condition, outside noise from the Footbonaut informed them about their performance, similarly to the positive and negative emotional categories. That effect is not present in the category where the players do not hear any outside information (i.e., where they wear headphones). The correlations are also stronger in the emotionally charged conditions compared to the baseline condition. One reasoning for that might be that outside noise affects the players as a sort of “catalyst” which charges the player’s motivation or reasoning and with that, their performance. A player that was previously defined only by his technical ability (like in the headphone condition) is now rewarded or ridiculed by their outside noise. A good performance then might be enhanced and increased by the noise in the same way a bad performance may be diminished and decreased by crowd noise.

Overall, experiential knowledge of expert performers, here, supports self-monitoring and intrinsic feedback processes that naturally occur within all athletes ([Vereijken and Whiting, 1990](#); [Hadfield, 2005](#); [Greenwood et al., 2012](#)). In other words, “it may be argued that over time, athlete knowledge will be superior to that of the coach in some aspects of performance” ([Millar et al., 2017](#), p. 808). This advanced ability to accurately judge own performances may refer back to an ecological view on players’ attuning to their direct environments and thus, developing adequate *knowledge of information* that effectively supports monitoring of performance ([Gibson, 1966, 1979](#); [Fajen et al., 2009](#)). Given this high level of player self-awareness, coaches may need to tailor both coaching approaches and informational constraints (e.g., in forms of augmented feedback and instructions) toward players’ needs ([Williams and Hodges, 2005](#); [Chow et al., 2016](#)). Put simply, coaches may rather act as (hands-off) facilitators of the practice environment, should consider players’ knowledge and wealth of experience and leave further exploration and problem solving to the players ([Millar et al., 2015](#); [Renshaw et al., 2019](#)).

### Skilled athletes’ emotional engagement during practice under auditory noise conditions

Evidently, inducing auditory stadium noise into football practice had some impact on players’ performances and emotional engagement with the environment. This is supported not only by the statistically significant differences for passing times (see [Otte et al., 2021](#)), but also in terms of emotional disposition during various practice conditions. Based on an Ecological Dynamics rationale, a critical challenge for coaches concerns the design of holistic athlete practice experiences that support the search for adaptable movement solutions under emotional constraints present in competitive environments ([Davids et al., 2013](#)). While continuous interaction between perception, action, and cognition is commonly considered, the presence and role of emotionally engaging training spaces remains underexplored. To theoretically discuss this matter in relation to the concept of *affective learning design* ([Headrick et al., 2015](#)), two points appear to be critical: (1) representative and auditory stadium noise environments seemingly

increase emotional engagement with the practice design; and (2) individual players rate various auditory noise environments as differently engaging on an emotional level.

First, it is suggested that emotional engagement supports search for relevant action invitations under game-representative informational constraints (Seifert et al., 2013; Headrick et al., 2015). For example, a player unable to hear and communicate with his teammates due to crowd noise may effectively learn to rely on visual environmental information, while the player will also get perceptually attuned to these stadium noises. In other words: “emotions add context to actions” (Headrick et al., 2015, p. 87). Aligned with Constraints-Led Approach, we argue that the manipulation of task and environmental constraints can be critical for skill learning and increased player motivation; e.g., several players stated that both stadium noise conditions influenced emotional engagement in various ways. Thus, facilitating for players to experience training under stadium noise conditions may display one effective way of replicating environmental constraints experienced in football games (Seifert et al., 2017; Otte et al., 2021). Notably, this notion connects back to the aforementioned home-field advantage and crowd noise as one potential reason for it (Pollard, 2008) and hence, the impact of emotionally-laden auditory/crowd environments on players’ and teams’ perceptions and performances warrants further research in this context.

Second, the results indicate that various players had different perceptions of the auditory conditions. This finding is also supported by the original study, which demonstrated that the conditions impacted passing time scores across various situations (Otte et al., 2021). Players in this study cited the four auditory conditions as influencing both performance and emotional engagement, highlighting a critical notion within a Nonlinear Pedagogy (NLP): the necessity for individualized learning designs tailored to players with different skill levels, personalities, and intrinsic dynamics (Renshaw et al., 2009). In simple terms, there is not one ‘cookie-cutter practice drill’ or ideal practice environment (including its auditory noise environment) that is suitable for every athlete, and coaches must be aware of this.

## Limitations and future research

Due to the articles’ highly specialized and unique sample size, findings in this paper should be carefully considered. The decreased representativeness of the practice task in the Footbonaut compared to an actual football task in a packed stadium is also something that should not be discounted easily. Additionally, we would suggest that in future studies with usage of the Footbonaut, the “no noise” earmuff condition could be replaced as a control condition with a condition using non-emotional/non-representative noise, such as white noise. That way, a user of the Footbonaut would still obtain physical information, and one could discern better the effects from stadium information. Furthermore, collected qualitative statements (complementing standardized performance ratings) were open-ended and thus, varied in depth and scope. However, this was deemed acceptable in order to receive an initial and honest insight into players’ emotional engagement and perceptions of the various practice conditions. Notably, since no player was obliged to make

statements about particular feelings, any personal comments regarding emotional engagement and perceived performances may carry increased value and display players’ genuine emotional dispositions. Due to the unique sample in this paper, the data set in its depth is limited to an initial overview, demanding future profound investigation by additional studies.

Finally, and due to abovementioned limitations, this research extension may provide a direction for future research on (i) skilled athletes’ abilities to effectively use self-monitoring and intrinsic feedback sources for movement self-regulation; and (ii) athletes’ emotional engagement with different auditory noise environments in practice. Consequently, it is recommended for future studies to investigate these two areas with larger samples of (skilled) athletes.

## Conclusion

Previous studies have aimed to assess football players’ passing performances under auditory cue conditions, such as stadium noise (Otte et al., 2021). The findings of these studies include slower passing times in some auditory cue conditions, which are now supplemented by novel insight into players’ accurate judgments, self-awareness and self-monitoring of their own performances by the data presented in this paper. Thus, these advanced players may benefit from a hands-off coaching approach that focuses on the coach becoming a facilitator, manipulating (task and environmental) constraints within the practice environment. Additionally, use of emotion-laden and affective learning designs may warrant further attention by both researchers studying the effect of representative practice environments and coaches aiming to co-design practice sessions in accordance with principles from an NLP.

## Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by German Sport University Cologne. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

SK: Conceptualization, Formal analysis, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. FO: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing. AB: Methodology, Writing – review & editing. TS: Formal analysis, Writing – review & editing. SM: Conceptualization, Supervision, Writing – review & editing.



## Funding

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

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## References

- Baumeister, R. F., Schmeichel, B. J., and Vohs, K. D. (2007). "Self-regulation and the executive function: the self as controlling agent" in *Social psychology: handbook of basic principles*. eds. A. W. Kruglanski and E. T. Higgins. 2nd ed (New York: The Guilford Press), 516–539.
- Beavan, A., Fransen, J., Spielmann, J., Mayer, J., Skorski, S., and Meyer, T. (2019). The Footbonaut as a new football-specific skills test: reproducibility and age-related differences in highly trained youth players. *Sci. Med. Footb.* 3, 177–182.
- Bood, R. J., Nijssen, M., Van Der Kamp, J., and Roerdink, M. (2013). The power of auditory-motor synchronization in sports: enhancing running performance by coupling cadence with the right beats. *PLoS One* 8:e70758. doi: 10.1371/journal.pone.0070758
- Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa
- Bridgett, D. J., Oddi, K. B., Laake, L. M., Murdock, K. W., and Bachmann, M. N. (2013). Integrating and differentiating aspects of self-regulation: effortful control, executive functioning, and links to negative affectivity. *Emotion* 13, 47–63. doi: 10.1037/a0029536
- Button, C., Seifert, L., Chow, J.-Y., Araújo, D., and Davids, K. (2020). *Dynamics of Skill Acquisition: an Ecological Dynamics rationale*, 2nd Edn. Champaign, IL: Human Kinetics.
- Chow, J. Y., Davids, K., Button, C., and Renshaw, I. (2016). *Nonlinear pedagogy in skill acquisition: an introduction*. London: Routledge.
- Davids, K. (2015). Athletes and sports teams as complex adaptive system: a review of implications for learning design. *Revista Internacional de Ciencias del Deporte* 11, 46–61. doi: 10.5232/ricyde2015.03904
- Davids, K., Araújo, D., Seifert, L., and Orth, D. (2015). Expert performance in sport: an ecological dynamics perspective. In J. Baker & Farrow, D. (Eds.), *Routledge handbook of sport expertise* (pp. 273–303). London: Routledge.
- Davids, K., Araújo, D., Vilar, L., Renshaw, I., and Pinder, R. A. (2013). An ecological dynamics approach to skill acquisition: implications for development of talent in sport. *Talent Dev. Excellence* 5:21e34.
- Davids, K., Bennett, K., and Button, C. (2008). *Dynamics of Skill Acquisition*. Champaign, IL: Human Kinetics.
- Diamond, L. M., and Aspinwall, L. G. (2003). Emotion regulation across the life span: an integrative perspective emphasizing self-regulation, positive affect, and dyadic processes. *Motiv. Emot.* 27, 125–156. doi: 10.1023/A:1024521920068
- Fajen, B., Diaz, G., and Cramer, C. (2011). Reconsidering the role of movement in perceiving action-scaled affordances. *Hum. Mov. Sci.* 30, 504–533. doi: 10.1016/j.humov.2010.07.016
- Fajen, B. R., Riley, M. A., and Turvey, M. T. (2009). Information, affordances, and the control of action in sport. *Int. J. Sport Psychol.* 40, 79–107.
- Gibson, J. J. (1966). *The senses considered as perceptual systems*. Boston: Houghton Mifflin.
- Gibson, J. (1979). *The ecological approach to visual perception*. Boston: Houghton-Mifflin.
- Greenwood, D., Davids, K., and Renshaw, I. (2012). How elite coaches' experiential knowledge might enhance empirical research on sport performance. *Int. J. Sports Sci. Coaching* 7, 411–422. doi: 10.1260/1747-9541.7.2.411
- Hadfield, D. (2005). "The change challenge: facilitating self-awareness and improvement in your athletes" in *Athlete-centred coaching*. ed. L. Kidman (Christchurch: Innovative Print Communications), 288–295.
- Headrick, J., Renshaw, I., Davids, K., Pinder, R. A., and Araújo, D. (2015). The dynamics of expertise acquisition in sport: the role of affective learning design. *Psychol. Sport Exerc.* 16, 83–90. doi: 10.1016/j.psychsport.2014.08.006
- Hodges, N., and Franks, I. (2002). Modelling coaching practice: the role of instruction and demonstration. *J. Sports Sci.* 20, 793–811. doi: 10.1080/026404102320675648
- Karageorghis, C. I., Mouzourides, D. A., Priest, D., Sasso, T. A., Morrish, D. J., and Walley, C. L. (2009). Psychophysical and ergogenic effects of synchronous music during treadmill walking. *J. Sport Exerc. Psychol.* 31, 18–36. doi: 10.1123/jsep.31.1.18
- King, N. (2004). "Using templates in the thematic analysis of text" in *Essential guide to qualitative methods in organizational research*. eds. C. Cassell and G. Symon (London: Sage), 257–270.
- Legaz-Arrese, A., Moliner-Urdiales, D., and Munguía-Izquierdo, D. (2012). Home advantage and sports performance: evidence, causes and psychological implications. *Universitas Psychol.* 12, 933–943. doi: 10.11144/javeriana.upsy12-3.hasp
- Leitner, M. C., Daumann, F., Follert, F., and Richlan, F. (2023). The cauldron has cooled down: a systematic literature review on home advantage in football during the COVID-19 pandemic from a socio-economic and psychological perspective. *Manag. Rev. Q.* 73, 605–633. doi: 10.1007/s11301-021-00254-5
- McGowan, T. (2012). Football enters space age with 'Footbonaut' – CNN. Available at: <https://edition.cnn.com/2012/11/16/sport/football/dortmund-footbonaut-robot-football/index.html>
- Millar, S. K., Oldham, A. R. H., and Donovan, M. (2011). Coaches' self-awareness of timing, nature and intent of verbal instructions to athletes. *Int. J. Sports Sci. Coach.* 6, 503–513. doi: 10.1260/1747-9541.6.4.503
- Millar, S., Oldham, A., Hume, P., and Renshaw, I. (2015). Using rowers' perceptions of on-water stroke success to evaluate sculling catch efficiency variables via a boat instrumentation system. *Sports* 3, 335–345. doi: 10.3390/sports3040335
- Millar, S., Oldham, A., Renshaw, I., and Hopkins, W. (2017). Athlete and coach agreement: identifying successful performance. *Int. J. Sports Sci. Coach.* 12, 807–813. doi: 10.1177/1747954117738886
- Nowell, L., Norris, J., White, D., and Moules, N. (2017). Thematic analysis. *Int J Qual Methods* 16:160940691773384. doi: 10.1177/1609406917733847
- Otte, F. W., Davids, K., Millar, S.-K., and Klatt, S. (2020). When and how to provide feedback and instructions to athletes? – how sport psychology and pedagogy can improve coaching interventions to enhance self-regulation in training. *Front. Psychol.* 11:1444. doi: 10.3389/fpsyg.2020.01444
- Otte, F. W., Millar, S.-K., and Klatt, S. (2019). Skill training periodisation in 'specialist' sports coaching – an introduction of the 'PoST' framework for skill development. *Front. Sports Act. Living Mov. Sci. Sport Psychol.* 1:61. doi: 10.3389/fspor.2019.00061
- Otte, F. W., Millar, S.-K., and Klatt, S. (2021). What do you hear? – the effect of stadium noise on football players' passing performances. *Eur. J. Sport Sci.* 21, 1035–1044. doi: 10.1080/17461391.2020.1809714
- Phillips, E., Davids, K., Renshaw, I., and Portus, M. (2010). Expert performance in sport and the dynamics of talent development. *Sports Med.* 40, 271–283. doi: 10.2165/11319430-000000000-00000
- Pollard, R. (2008). Home advantage in football: a current review of an unsolved puzzle. *Open Sports Sci. J.* 1, 12–14. doi: 10.2174/1875399x00801010012
- Renshaw, I., Davids, K., Shuttleworth, R., and Chow, J.-Y. (2009). Insights from ecological psychology and dynamical systems theory can underpin a philosophy of coaching. *Int. J. Sport Psychol.* 40, 540–602.
- Renshaw, I., Araújo, D., Button, C., Chow, J. Y., Davids, K., and Moy, B. (2016). Why the constraints-led approach is not teaching games for understanding: A clarification. *Physical Education and Sport Pedagogy.* 21, 459–480. doi: 10.1080/17408989.2015.1095870

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.



- Renshaw, I., Davids, K., Newcombe, D., and Roberts, W. (2019). The constraints-led approach: principles for sports coaching and practice design (routledge studies in constraints-based methodologies in sport). 1st Edn. London: Routledge.
- Seifert, L., Araújo, D., Komar, J., and Davids, K. (2017). Understanding constraints on sport performance from the complexity sciences paradigm: an ecological dynamics framework. *Hum. Mov. Sci.* 56, 178–180. doi: 10.1016/j.humov.2017.05.001
- Seifert, L., Button, C., and Davids, K. (2013). Key properties of expert movement systems in sport: an ecological dynamics perspective. *Sports Med.* 43, 167–178. doi: 10.1007/s40279-012-0011-z
- Vereijken, B., and Whiting, H. T. A. (1990). In defence of discovery learning. *Can. J. Sports Sci.* 15, 99–106.
- Williams, A., and Hodges, N. (2005). Practice, instruction and skill acquisition in soccer: challenging tradition. *J. Sports Sci.* 23, 637–650. doi: 10.1080/02640410400021328
- Woods, C., McKeown, I., Rothwell, M., Araújo, D., Robertson, S., and Davids, K. (2020a). Sport practitioners as sport ecology designers: how ecological dynamics has progressively changed perceptions of skill “acquisition” in the sporting habitat. *Front. Psychol.* 11:654. doi: 10.3389/fpsyg.2020.00654
- Woods, C., Rothwell, M., Rudd, J., Robertson, S., and Davids, K. (2021). Representative co-design: Utilising a source of experiential knowledge for athlete development and performance preparation. *Psychol. Sport Exerc.* 52:101804. doi: 10.1016/j.psychsport.2020.101804
- Woods, C., Rudd, J., Robertson, S., and Davids, K. (2020b). Wayfinding: how ecological perspectives of navigating dynamic environments can enrich our understanding of the learner and the learning process in sport. *Sports Med.* 6:51. doi: 10.1186/s40798-020-00280-9
- Zimmerman, B. J. (2000). Self-efficacy: an essential motive to learn. *Contemp. Educ. Psychol.* 25, 82–91. doi: 10.1006/ceps.1999.1016
- Zimmerman, B. J. (2001). “Theories of self-regulated learning and academic achievement: an overview and analysis” in *Self-regulated learning and academic achievement: theoretical perspectives*. eds. B. J. Zimmerman and D. H. Schunk (Mahwah: Lawrence Erlbaum Associates Publishers), 1–37.



## OPEN ACCESS

## EDITED BY

Rubén Maneiro,  
Pontifical University of Salamanca, Spain

## REVIEWED BY

Philippe Blondé,  
University of Iceland, Iceland  
Bradford Strand,  
North Dakota State University, United States

## \*CORRESPONDENCE

Bao Tian  
✉ tianbao65@126.com

RECEIVED 01 December 2023

ACCEPTED 14 June 2024

PUBLISHED 01 July 2024

## CITATION

Li J, Liu Y, Xue S and Tian B (2024) Costs over benefits: mind wandering in sporting performance.  
*Front. Psychol.* 15:1347561.  
doi: 10.3389/fpsyg.2024.1347561

## COPYRIGHT

© 2024 Li, Liu, Xue and Tian. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Costs over benefits: mind wandering in sporting performance

Jieling Li<sup>1,2,3</sup>, Yafang Liu<sup>4</sup>, Shuangpeng Xue<sup>1</sup> and Bao Tian<sup>5\*</sup>

<sup>1</sup>School of Physical Education, Hebei Normal University, Shijiazhuang, China, <sup>2</sup>Key Laboratory of Measurement and Evaluation in Exercise Bioinformation of Hebei Province, Shijiazhuang, China, <sup>3</sup>Physical Education Postdoctoral Research Station, Hebei Normal University, Shijiazhuang, China, <sup>4</sup>Department of Physical Education, Tangshan Normal University, Tangshan, China, <sup>5</sup>School of Psychology, Capital Normal University, Beijing, China

**Introduction:** Athletes' mind wandering during competition has positive and negative effects. The purpose of this study was to explore the reason for these bidirectional effects.

**Methods:** We recruited 51 athletes from China to take part in semi-structured interviews in which we explored their experiences of mind wandering in competition. We used grounded theory combined with systems thinking to complete the data analysis and theoretical construction.

**Results:** Results showed that the influence of mind wandering on sporting performance was dynamically influenced by "mind wandering source," "competition anxiety," "content of mind wandering," "attentional resources" and "attentional control," resulting in our development of the theory of "mind wandering in sporting performance (MWSP)." The above factors determine how mind wandering occurs and how it affects the competition.

**Discussion:** Although the occurrence of mind wandering during competition has positive effects, its negative effects cannot be ignored, which may lead to athletes losing the race (costs over benefits). Potential strategies focusing on the mitigation of negative effects and promotion of positive effects of mind wandering are discussed.

## KEYWORDS

athlete, mind wandering, grounded theory, systems thinking, performance

## Introduction

An athlete's mind often wanders in competition, negatively affecting the athlete. In the 2020 Tokyo Olympics, Sergey Kulish, an athlete representing Ukraine, was the first to be eliminated from the men's 50 m rifle three-position final because he mistakenly shot the opponent's target. After the match, Kulish felt very frustrated; he said he felt uncomfortable in his clothes, causing his mind to wander ([Guang Ming Net, 2022](#)).<sup>1</sup> In the 2022 Beijing Winter Olympics, Chinese short-track speed skater Ren Ziwei was eventually disqualified due to a foul in the semi-final. Ren said that he had been thinking about the final and did not pay attention to the details of the race ([China News, 2008](#)).<sup>2</sup>

Psychological studies refer to this phenomenon as mind wandering (MW). MW is a familiar everyday experience ([Killingsworth and Gilbert, 2010](#); [Sherwood, 2014](#);

1 <https://baijiahao.baidu.com/s?id=1724296430892529343&wfr=spider&for=pc>

2 <https://www.chinanews.com/olympic/news/2008/08-17/1350776.shtml>

Seli et al., 2018a), so considerable research efforts have been made to understand its effects (Blondé et al., 2022; Deng et al., 2022; Soemer et al., 2023; Yoshida et al., 2023). Considerable controversy surrounds the concept of MW (Christoff et al., 2018; Seli et al., 2018b). Seli et al. (2018b) argued that MW encompasses a broad range of phenomena, it is an umbrella term like “cognition” and “creativity,” and it is best considered from a family-resemblances perspective. Therefore, the researcher should always define the scope of MW before conducting a study. MW is a situation in which executive control shifts away from a primary task to the processing of personal goals, individuals lack control in this process (Smallwood and Schooler, 2006). The contents of MW arise from intrinsic changes that occur within individuals (Smallwood and Schooler, 2015). MW is different from self-talk and self-regulatory for its characteristic that lack of control. In the present study, we consider the term MW to refer to a mind that is not tied to the sporting tasks that athletes perform in competition but rather becomes focused on an internal thought.

The study of MW in the sports context is in its infancy. But researchers have found that not all MW is harmful. Regarding positive impacts, Miś and Kowalczyk (2020) found that participants' moods improved after long-run training, and the positive emotional shift became more pronounced when their minds wandered toward the future. In addition, it is found that MW was related to helpful distraction, beneficial emotions and sudden insight, as well as to detrimental distraction and debilitating emotions by investigating its specific effects in sports (Latinjak, 2018). Thus, the influence of MW in the sports context is bi-directional. The context regulation hypothesis is a theory developed to analyze the effects of MW and suggests that explaining the effects of MW requires a focus on the task context (Smallwood and Andrews-Hanna, 2013). Therefore, the present study will answer the question in the competition context.

The purpose of grounded theory is to build a theory based on data, emphasizing deeper investigation into the reasons behind the behavior (Glaser, 1978). Grounded theory is suitable for fields that lack explanation and have not been researched and theorized (Flick, 2021), and it is especially suitable for solving the problems of this study. Grounded theory is a systematic and flexible approach to collecting and analyzing qualitative data to construct theories that are grounded in the data (Charmaz, 2006; Corbin and Strauss, 2015). Therefore, we conducted this study based on grounded theory to explain MW's bidirectional effects and develop a theory that may provide scientific guidance for intervention in athletes' MW.

## Materials and methods

### Participants

The selection of participants was based on the following considerations: First, only athletes themselves know the phenomenon of MW in competition best; other stakeholders such as coaches cannot accurately observe and measure it, let alone feel the process of its occurrence and influence. Therefore, only athletes were selected as the participants. The introspective method requires participants to report their mental activity and then draw

a certain psychological conclusion by analyzing the reported data. Introspective method was chosen to guarantee that MW is indeed being investigated, and to assess both its occurrence and influence. Second, the total number of participants was determined by the principle of theoretical saturation, that is, the point at which new participants could neither provide new properties of a category nor generate new insights about the theory (Bryant and Charmaz, 2007). Third, different sporting events must be considered. Cases with high information intensity were selected on the basis of the principle of intensity sampling. The sporting events that are prone to MW must first be identified. Shooting is a type of static sport that requires a high ability of continuous attention. Shooters need to process less information on the field, and their tasks have lower cognitive loads. According to Cheyne et al. (2009), when the task difficulty is low (the cognitive load is low), more cognitive resources will be used for MW. Therefore, in the present study, shooters were first selected for data collection, and then athletes in other sports were selected for comparison and validation. Specifically, sampling was adopted in three steps. In the first step, 14 shooters were selected. Then, to enrich and compare the research results of the first step, considering the differences in gender and sports level, we selected 19 more shooters in the second step. In the third step, aiming to ensure the universality of the results, we selected 18 athletes from 9 other sporting events, namely, golf (1 person), archery (1 person), gymnastics (1 person), dance sports (1 person), table tennis (2 people), basketball (2 people), volleyball (2 people), tennis (3 people), and track and field (5 people). The participants were from professional sport teams and competitive sport schools in six cities in China, namely, Beijing, Tianjin, Shijiazhuang, Chongqing, Zhengzhou, and Wenzhou. They must train for more than 10 h a week and had to participate in competitions at or above the provincial level. A total of 51 athletes were selected for the study, comprising 26 male and 25 female athletes, aged 15–35 years old. Of the athletes, 2 were at the national elite level, 18 at national level 1, 22 at national level 2, and 9 athletes below national level 2. Approval for the research was obtained from the relevant research ethics committee (2023LLSC031).

### Data collection

Semi-structured interviews were applied to collect data. First, we introduced the research purpose and the meaning of MW to the athletes, and we explained that the findings would be confidential. The interviews were recorded after obtaining the participant's consent. The interview duration varied from 11 to 90 min, average time was about 27 min. The interviews mainly included the context of MW, contents of MW, and MW coping methods and effects. Athletes needed to recall MW experiences from previous competitions. Interview guidelines involving the entire process of MW occurring, specific questions included “Under what circumstances will your mind wander during a competition?”, “What are you thinking when your mind is wandering?”, “What do you do when your mind wanders during the competition?”, and “What is the impact of MW on you?”. After the interview, audio-taped data were converted into verbatim transcripts in Chinese. Then, a corresponding number was set for each interviewed athlete (for example, 01 represents the first athlete

interviewed). Then, NVivo 11.0 qualitative analysis software was used to encode the text data.

## Data analysis

Grounded theory advocates the development of theories based on the collected data in an inductive way (Glaser, 1998). Grounded theory has been developed over the years and has been recognized by academics, and different variants of thought have been formed. It is not a rigid methodology that is in lockstep, as are some statistical methodologies (Glaser, 2008). As long as the grounded advocacy is maintained, specific research methods and techniques can be flexibly adapted, innovated, and improved according to different research areas, problems, and contexts, and they can be used more widely and effectively to bring their true vitality to practice (Glaser, 1998; Flick, 2021).

Systems thinking can be applied to grounded theory. Systems thinking is the analysis of the interplay of factors from a systems perspective. The value of systems thinking is that it recognizes that factors do not exist in isolation, and that related factors interact with each other and are ultimately presented in a systematic way (Sherwood, 2014). The relationships among variables presented by systems thinking are dynamic and can change the static description previously presented by grounded theory.

In this study, we followed the spirit of grounded theory and used three-level coding combined with systems thinking to complete the theoretical construction. The research process is shown in Figure 1.

We mainly used the grounded theory introduced by Strauss and Corbin (1990) as a realist–interpretivist philosophical perspective (Weed, 2016). But the three-level coding is simplified to three processes after local modification (Chen and Wang, 2021), forming categories, determining the core category, and determining the associated categories. At the same time, a constant comparison method was used, alternating among data collection, data analysis, and theory generation.

The primary function of the first level of coding is divided into three steps. The first step is labeling, or conceptual naming of the data. The second step is combining similar or identical codes into categories. The third step is identifying the attributes and dimensions of the categories. This approach focuses on the description of the nature of the category, highlighting the purpose of the explanation of the phenomenon by grounded theory. At the first level we obtained results as shown in Table 1. Using “MW Source” for example, the presence of spectators mentioned by the athletes will be MW, which belongs to the attribute of “interference from others” in the category of “MW Source,” and the dimension of its change is from strong to weak.

For the second level of coding, we referred to Glaser’s approach of directly finding the core category (Glaser, 1978). In addition, we used the technique of a clarifying storyline to summarize the research. We found the core category of this study was “costs over benefits.” The storyline is expressed in level 2 coding of the results section.

For the third level of coding, we referred to advice from Strauss and Corbin (1990) that associated all the important categories with each other, applying systems thinking to do so. This method makes

it easier for us to discuss the interrelationship between variables, which are categories in this study. The basic approach of systems thinking (Sherwood, 2014) is as follows: the interrelationship between variables is represented by connections, which are of two types: S- and O-type. In S-type, the growth of one variable leads to the growth of another variable. In O-type, the growth of one variable leads to the decline of another variable. The connections do not exist in isolation; they may contain a loop, that is, a feedback loop. Each variable in the loop is both a cause and a result and is influenced by and influences other variables. A feedback loop is also divided into two categories: reinforcing and balancing feedback. Reinforcing feedback accelerates the process of change. Benign and malignant cycles are forms of change, so the direction of change is consistent among variables and is known as R-loop. Balancing feedback is the process of regulation, in the form of fluctuations around the desired levels up and down. The direction of change is opposite among variables and is known as B-loop. Therefore, the number of O-type connections in the loop determines the type of loop: an even number of O-types is an R-loop, and an odd number of O-types is a B-loop. The interrelationship between categories is expressed in level 3 coding of the results section.

## Rigor

The rigor of this research is reflected in the entire study process of sampling, data collection, data analysis, and theory generation.

In the sampling process, the principles of intensity sampling, and theoretical saturation were followed. The analysis of research data alternates with sampling to avoid problems in research quality caused by one-time sampling. We trained interviewers to ensure consistency in data collection, and the training emphasized interview skills and content.

A total of two researchers participated in the data analysis, which was done independently and without interference from others. We also kept an open attitude during the analysis of the data, and the results were grounded in the original data. To improve the reliability of the data analysis, this study compared the coded results among athletes of different sports. Memos were used throughout the research process to record at any time the generated ideas, codes, and associations. The purpose of the memos is to actively think about the original data, stimulate inspiration, and generate new concepts and relationships to facilitate theory generation. These memos also helped us find loopholes in data collection and analysis and ensured that the data were examined from different perspectives, enhancing the validity of the entire study.

Member checking and non-participant checking were applied to test the study results. The codes and results were returned to the participants, and they were asked to judge whether the results accurately reflected their experiences. In this study, four athletes were selected to provide feedback on the results. For example, the dimensions of “physical environment acceptability” were originally expressed as “strong” and “weak,” but later the athletes determined that the appropriate expressions were “acceptable” and “unacceptable.” The results of the coding of the athletes’ MW were initially coded as “cognitive resources,” but we ultimately changed them to “attentional resources” after athlete insights. We also provided feedback to non-participants, including sports

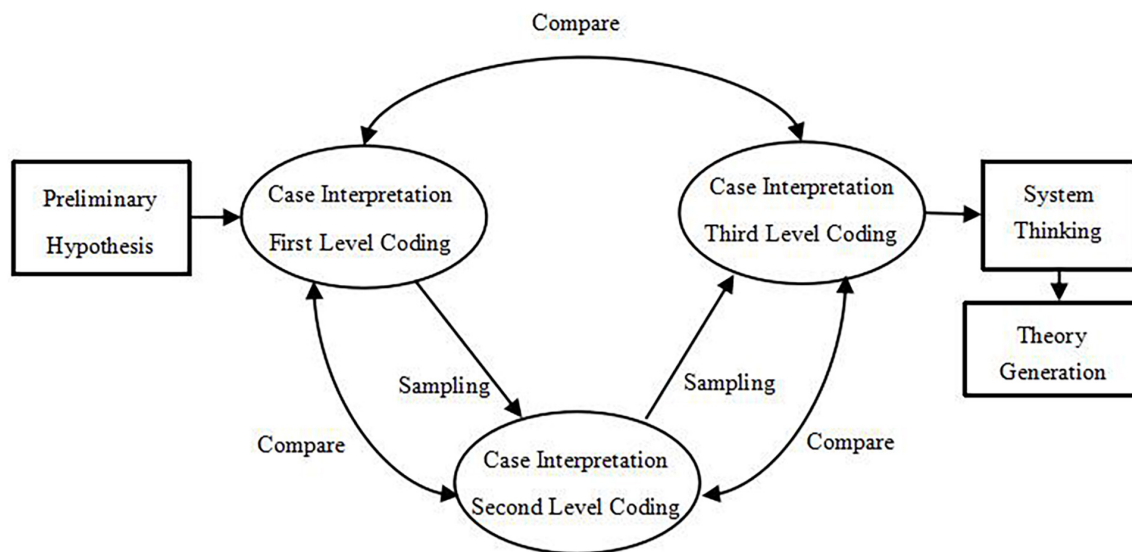


FIGURE 1

The research process of combining grounded theory with system thinking.

TABLE 1 Categories, attributes, and dimensions.

Category	Attributes	Dimension
MW source	Interference from others (18.10)	Strong, weak
	Time constraint (25.86)	Urgent, non-urgent
	Performance fluctuation (49.14)	Good, bad
	Environmental acceptance (6.90)	Acceptable, unacceptable
Competition anxiety	Somatic anxiety (33.90)	High, low
	Cognitive anxiety (66.10)	High, low
Content of MW	Relationship to the competition (25.52)	Relevant, irrelevant
	Time orientation (22.89)	Past, present, future
	Emotional valence (5.25)	Positive, negative
	Intention (15.76)	Yes, no
	Meta-consciousness (24.95)	Yes, no
	Degree (2.06)	Deep, shallow
	Duration (3.56)	Long, short
Attentional resource	Required for MW (48.28)	More, less
	Required for sport (51.72)	More, less
Attentional control	Attentional shifting (54.55)	Strong, weak
	Attentional focusing (45.45)	Strong, weak
Costs over benefits	Positive effect (21.21)	Strong, weak
	Negative effect (78.79)	Strong, weak

Numbers in parentheses indicate percentage of the number of codes for its category. MW, mind wandering.

psychology majors (five people) and organizational behavior majors (two people), to control and correct coders' subjective biases and to verify the authenticity of the coding results and the rationality

of theory generation. For example: the naming of "costs over benefits" and "MW source" was decided through discussion with and verification by sports psychology colleagues. The theory of athletes' MW was determined by reflection and judgment, and specific explanations were made in terms of the symbols and meanings of the loops. Finally, they were verified from the aspects of logic and comprehensibility.

## Results

### Level 1 coding: determining the categories, attributes, and dimensions

The primary function of the first level of coding is the formation of categories, as shown in Table 1.

#### MW source

In competition, there are four main MW sources: (1) Interference from others. Leaders, spectators, and opponents can cause MW in the athlete. As illustrated by 26: "When leaders are around (resulting in MW), maybe this causes pressure in my mind." As 05 described: "When you care about the spectators behind you and what they're thinking." and "Sometimes, when I meet opponents in front of or behind me, MW will occur." (2) Time constraint. The competition period results in urgent and non-urgent feelings in athletes, both of which tend to cause MW. Some events require athletes to complete a task within a short time, and the sense of time urgency can lead to MW in athletes. As conveyed by 23: "Every shot has a time limit, and you have to make sure that you shoot within that time. So I would think... (MW)." However, sometimes idle situations occur during the competition when the sense of urgency of the athlete decreases or disappears. This was expressed by 40: "Four people stand like this when they've been pulling the oblique line. I have nothing to do with the ball, and



*I've been waiting for my partners in the completion of this task. If the time is a little longer, under these circumstances, MW occurs."*

(3) Performance fluctuation. When sporting performance does not match an athlete's expectations (good or bad), MW easily arises. As 20 illustrated, *"When I played, I did not play well, and I hit several unsatisfactory ring numbers, easily resulting in MW."* Respondent 30 also emphasized, *"If the result is better, I might think more."* (4) Environmental acceptance. MW can be easily caused by the sound, temperature, and light on the field being beyond the acceptable range for the athlete. For example, 26 said, *"I may also wander when the audience makes heckling sounds."* Respondent 21 also emphasized, *"It's easy to wander if it's quiet."* As 08 explained: *"For example, if it's hot or cold, you can't accept the environment and you'll be MW."* Notably, the "audience" in the first MW source "interference from others" is different from the audience in environmental acceptance because the former emphasizes that the athlete cares about the audience's evaluation of them, while the latter emphasizes the athletes' receptivity to the sound produced by the audience.

## Competition anxiety

When the level of competition anxiety is high, the athlete's mind tends to wander. As stated by 32: *"When I am competing, I am especially anxious, and I will think about the results or the outcome, and I can't concentrate on the task (MW)." Respondent 05 said, "When I shoot at points, I suddenly become a different person, that is, my body starts to shake and I can't aim at the target at all. Then, when I am nervous, I would bare my teeth and make a sound, and I would worry about what to do, 'What should I do here?' (MW)." In these cases, nervousness and worry represent cognitive anxiety, while shaking and making noises represent somatic anxiety. MW can also lead to an increase in athletes' competition anxiety. Respondent 07 stated: "A wandering mind easily upsets the mood." and 05 said: "Wandering also increases my tension even more." A mutual influence is observed between the athletes' MW and competition anxiety.*

## Content of MW

First, an athlete's content of MW can exhibit a crossover of certain attributes. For example, 38 recalled: *"I look at this pedal (track and field) and I think about (MW) what if I don't step on it, and I panic."* Typical features are the "relevant" dimension in the "relationship to the competition" attribute, the "future" dimension in the "time orientation" attribute, the "negative" dimension in the "emotional valence" attribute, and the "yes" dimension in the "meta-consciousness" attribute. Respondent 11 stated: *"If I calculate the scores and think about the outcome of the competition, I can't get out of [MW] because I have gotten myself into it and my head is not clear."* The expressions are the "relevant" dimension in the "relationship to the competition" attribute, the "yes" dimension in the "meta-consciousness" attribute, "deep" in the "degree" attribute, and "long" in the duration attribute. Respondent 35 said: *"I avoid being so nervous. I just think about other things, like what we're going to eat if we win and what's going to happen."* The expressions are the "irrelevant" dimension of the "relationship to the competition" attribute, the "future" dimension of the "time orientation" attribute, the "yes" dimension of the "intention" attribute, and the "positive" dimension in the "emotional valence" attribute.

Different content of MW affects athletes in different ways, but positive and negative effects co-exist. For example, 13 said, *"A good impact on you is when you think more positively. But when you think about not playing well or some other miscellaneous things, it will have some negative impacts on you."* Respondent 46 explained: *"It's not good for you if you're thinking about life and not focusing on the ball. It's not good for your performance in the game."* But 17 also said, *"Thinking about something else will cause me to relax, and it's not so tense."*

## Attentional resources

Mind wandering in competition often occurs when the demand for attentional resources for task is low so that some attentional resources can be allocated to MW. For example, 40 said: *"In singles matches, instances of MW are still quite few. Singles matches are one-on-one, in which the ball goes over and immediately comes back."* Respondent 28 stated: *"[MW] should be in the preparation session."* Respondent 22 explained: *"It's easier to get MW with slow shots because it's so slow."* As regards when MW occurs, 19 said: *"Probably during practice before the match."* As 11 described: *"I feel like you shouldn't be able to do that much at the same time because human 'energy' is limited. You're just going to have to keep an eye on the flat square, and you don't have the 'energy' to think about how your index finger is going to pull the trigger."* Respondent 49 also explained: *"Attention is also limited and may require some 'energy' as a base."* In response to this question, we did post-interview member checks. After explaining the concept of attentional resources to the athletes, we finally recognized that the "energy" they were talking about was attentional resources. Athletes' MW will therefore occupy attention resources. Individual attention resources are limited; both sport tasks and MW occupy attention resources. Thus, the phenomenon described by these athletes will occur: when the demand for attention resources for task is low, MW easily occurs.

## Attentional control

In a competition, athletes use the method of attentional control to prevent MW when they encounter MW sources. For example, 07 stated: *"I just let myself not think about [MW] and just focus on the shot."* Respondent 23 said: *"I try to isolate everything as much as I can. I just don't let [the MW sources] go into my head."* Respondent 08 recalled: *"We had electronic targets by that time and there would be a display in front of it. I would take a piece of paper and cover up that ring count to keep myself from looking at it."* Athletes also have their own specific ways to control attention. For example, 40 said, *"It's about paying attention to whether you're close to wandering, letting yourself relax, and then pulling back."* Respondent 04 described: *"[I give myself] just a little pinch, just a small action. I feel the pain, then I will be reminded that I am in the game, and my state will be a little better."* Respondent 04 shared: *"I will stop, put down the gun, then sit on the bench to rest for a while, causing my brain to think again. I then go through my movements, and then adjust myself to compete again."* Respondent 02 recalled: *"I would put the gun down, take two deep breaths, and then raise the gun again."* Athletes will apply the strategy of "attentional shifting" (for example, deep breathing and pinching themselves) during the competition and then the strategy of "attentional focusing" on the sport task.

## Level 2 coding: identifying the core category

Due to the particularity of the ever-changing situation of competition, the existence of various MW sources will lead to athletes' competition anxiety, making athletes' MW more common. The MW may include worrying about losing the race, keeping track of scores, prizes, rankings, relatives, coaches, and eating and drinking. MW can take many different contents. Athletes will use attention control to reduce its occurrence. However, not all MW is meta-conscious, and sometimes athletes are not aware that MW is occurring. Human attentional resources are limited, and athletes require attentional resources for sport tasks and MW. Therefore, the attentional resources used during MW will inevitably impact the execution of the sport task, and this impact may even lead to abnormal performance. However, athletes believe that MW can sometimes have a positive effect on them. As 17 explained: *"Thinking about other things relaxes the slight tension and makes it less intense."* But its negative effects also exist. As 25 illustrated: *"MW in a game is more constraining to the sport tasks."* Respondent 50 also described: *"Originally you could hit 9 or 10 rings, but if MW occurs, you may only hit 7, 8, or 6 rings."*

We then conceptualized these stories to form the core category of this study. The story revolves around the phenomenon of MW in competition, and in any case, the devastating results of MW in a competitive situation are too much for the athlete to bear. We summarize this as "costs over benefits." This category is not among the aforementioned categories but rather transcends them and consists of them. Therefore, this core category is structural, like all other categories become part of an architecture. Given the properties and dimensions of the core category are made up of other categories, they will not be repeated here, and the process by which they are influenced will be explained in detail in the theory formation section of this article.

## Level 3 coding: applying systems thinking to associate categories

We innovate the theory formation method by combining the systemic thinking approach to relate the categories, resulting in "MW in sporting performance (MWSP)" (Figure 2). MWSP comprises two parts: occurrence mechanism and influence mechanism. The core idea is that MW in competition is influenced by the dynamics of MW source, competition anxiety, content of MW, attentional resources, and attentional control.

### Occurrence mechanism

Athletes show higher attentional control when a competition has more MW sources and lower attentional control when a competition has fewer MW sources. The direction of change between the two variables was the same (S-type). When the athlete shows higher attentional control in the competition, the occurrence of MW decreases, and lower attentional control increases the occurrence of MW, with the direction of change between the two variables being opposite (O-type).

### Mind wandering theory in competition

When a competition has more MW sources, the level of competition anxiety increases. When fewer MW sources are present, the level of competition anxiety decreases. The direction of change between the two variables is the same (S-type). Then, competition anxiety and MW will interact with each other, and the increase or decrease of competition anxiety level will lead to the increase or decrease of MW, and the direction of change between the two variables is the same (S-type). Here, a loop is formed, consisting of two S-type connections, which is an enhancement process, thus forming an "R-loop."

### Effect mechanism

The occurrence of MW occupies attentional resources, thus reducing attentional resources for sport tasks, and the two variables do not change in the same direction (O-type). The intensity of the change in the O-type is determined by content of MW. The content of MW has different attributes, which lead to a difference in the attention resources occupied by athletes and the attention resources for sport tasks.

The attentional resources for sport tasks in turn affect performance. When the attentional resources for sport tasks are reduced, the resources are not able to sustain the task during the competition, and performance will decrease. The two variables change in the same direction (S-type).

## Discussion

This study formed MWSP by grounded theory and systems thinking based on interview data from 51 athletes. MWSP was proposed for the first time in the context of competition, providing a theoretical basis for future research on MW in sports.

## Occurrence of MW in competition

The results of this study suggest that the occurrence of MW in competition is decided by MW sources, competition anxiety, and attentional control.

The MW sources include interference from others, time constraints, performance fluctuations, and environmental acceptance, which more directly reflect the situational specificity of MW during competition. Future intervention studies on MW could first attempt to simulate training on the above sources of MW. The MW sources in competition cannot be avoided, let alone predicted. Therefore, coaches need to conduct targeted simulation training based on these MW sources in daily training to improve athletes' adaptability to MW sources.

Competition anxiety and MW form a positive feedback mechanism, which is reinforcing feedback (R-loop). First, anxiety triggers a higher frequency of MW in athletes. At present, no direct research evidence exists regarding the relationship between anxiety and MW in sports situations. However, some studies have shown that negative emotions lead the mind to wander (Smallwood et al., 2009). Anxiety, as one type of negative emotion, has been shown to have a significant correlation with MW (Seli et al., 2019). Does a high frequency of MW lead to increased levels of anxiety

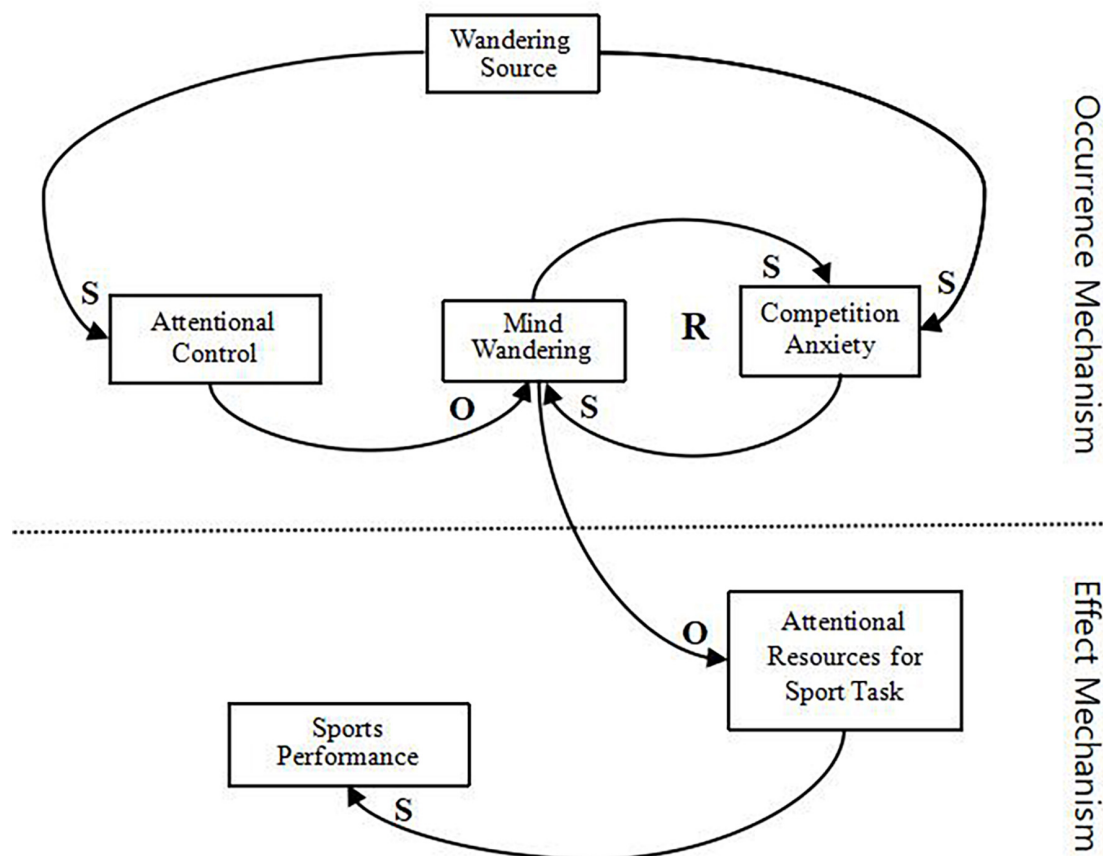


FIGURE 2

Mind wandering theory in the competition. S, S-type, the growth of one variable leads to the growth of another variable; O, O-type, the growth of one variable leads to the decline of another variable; R, an even number of O-types is an R-loop.

in athletes? The present study found that MW also can lead to competition anxiety. Some studies have confirmed that MW in daily life can lead to negative emotions (Killingsworth and Gilbert, 2010). But such a result has not emerged from any empirical study in the athlete population. Anxiety and MW are reciprocal influence relationships. Similarly, the relationship between anxiety and other internal thoughts with each other has been found in the field of athletics. For example, self-talk and MW are both internal thoughts of an individual. Research has shown that negative self-talk in sports predicted negative situational self-talk in competition and somatic and cognitive anxiety. In turn, cognitive anxiety positively predicted negative situational self-talk (Santos-Rosa et al., 2022). The second inspiration in sport practice is that the occurrence of MW can be reduced by reducing competition anxiety, ultimately minimizing its negative impact on sport performance, which is an issue worth exploring in the future.

Increased attentional control during competition will reduce the occurrence of MW. The “executive control failure hypothesis” and the “resource control hypothesis” emphasize the importance of attentional control. The executive control failure hypothesis suggests that MW is caused by a failure of executive control to maintain attention on the task (McVay and Kane, 2010). According to resource control theory, executive control weakens with the increase in the duration of performing sustained attention tasks (Thomson et al., 2015). The executive control failure

hypothesis mainly emphasizes that attentional control is the cause of MW. The resource control hypothesis further elucidates the characteristics of attention control over time when performing alertness tasks. However, the MWSP, taking into account the special nature of the competition situation, does not believe that the ability to attentional control diminishes over the course of the game. This is because resource control theory explains a single sustained attention task, and games do not always require sustained attention. Notably, all of these theories believe that attentional control has an important role in the occurrence of MW. One theory discussing the relationship between competition anxiety, attentional control, and athletic performance proposed the Athletic Attentional Control Theory: Sport (ACTS). ACTS suggests that anxiety affects sport performance, and sport performance in turn affects anxiety (Eysenck and Wilson, 2016). ACTS also suggests that anxiety interferes with attentional control. Does anxiety interfere with attentional control followed by triggering MW? From this perspective, MWSP can be considered an extension of ACTS. Future research can be done with a third way to reduce the occurrence of MW in competition: to train attentional control.

However, we need the most fundamental solution of the above three ways to reduce the occurrence of MW. The occurrence mechanism of MWSP explains that competition anxiety and attentional control have different effects on MW: competition anxiety has a “fuel” effect on MW, such that anxiety triggers a

higher frequency of MW in athletes. By contrast, attentional control reduces MW and acts as a “brake” on MW. Therefore, reducing competition anxiety and increasing attentional control can reduce MW during a competition. However, Figure 2 shows that the influence of competition anxiety and attentional control can be traced back to the MW source, which means that the root of MW occurs in the competition: the MW source. Maybe the first of these intervention methods, namely, simulation training for MW sources, is the fundamental solution, but future studies are needed to confirm it.

## Effect of MW in competition

Smallwood and Schooler (2015) have proposed that valuable topics for future research on MW include the impact of the characteristics of MW on the task. However, the prerequisite for exploring this topic is to clarify the contents in the mind when it wanders. The results of the present study showed that the contents of MW in athletes have 7 attributes and 15 dimensions. This reminds subsequent researchers of the importance of distinguishing the different contents of MW. If such distinction is neglected, erroneous conclusions may be drawn. For example, the type of intentional and unintentional MW has a different relationship with metacognition and self-awareness (Li et al., 2017; Vannucci and Chiorri, 2018), suggesting that subsequent researchers should consider them separately. The present study also showed that different contents of MW have different effects on athletes. However, athletes' perceptions of the impact of a single attribute content were not consistent. For example, some athletes perceived a negative impact of irrelevant competition, but others perceived a positive impact. We argue that the correct judgment of the impact cannot be made by considering only a single dimensional content of MW nor by ignoring the characteristic (mainly contents and temporal context) of the task. Different content of MW and task features both occupy limited attentional resources. Correct judgment depends on the attentional resources reserved for the task at the time of MW.

The occurrence of MW takes up attentional resources, which is supported by the “decoupling hypothesis.” The decoupling hypothesis explains MW in terms of the allocation of attentional resources and suggests that MW is caused by the coupling of attention with internal processing while decoupling it from task-related information (Smallwood, 2010). The present study argues that the different contents of MW during competition lead to differences in the attentional resources they occupy, in turn affecting in different ways the attentional resources required for sports. For example, athletes with longer and deeper MW may consume more attentional resources, whereas those with relatively shorter and shallower MW may consume fewer attentional resources. This will ultimately affect the attentional resources allocated to a task and then affect sporting performance. In addition, the characteristics of the task performed in MW also need to be considered. For example, when MW occurs during a cognitively dominant task or at critical moments that determine athletic performance, ensuring the successful completion of the competition at this time may require more attentional resources for this kind task. At this time, there is a dynamic process

of competing for attentional resources between MW and task. However, the exact amount of attentional resources taken up by different content of MW could not be confirmed in this study. This amount needs to be verified in future empirical studies (cognitive neuroscience approach may be the best solution), representing a research challenge that needs to be broken through. This study did find that the content of MW is a key factor affecting performance. In practice, if athletes cannot avoid MW on the field, they need to ensure that they avoid or reduce the use of attentional resources required for sport. Therefore, the method of managing MW content can change the attention resources occupied by MW, thereby reducing the negative impact and promoting the positive impact of MW on sports performance.

Additionally, in a single sporting event, the task performed by the athlete is variable, which will affect the occurrence of MW (as tennis doubles players 40 said: “they will be MW while waiting, and little or no MW will be allowed when the ball comes over”). If the more attentional resources are required for the execution of the task, the occurrence of MW at this time may result in limited attentional resources not being able to sustain the task, and then the negative effects of MW will be greater. Comparatively, skill-dominant sporting event may take up more attentional resources relative to physical-dominant. But, it is ultimately determined by the cognitive resources required for the varying tasks during the competition.

Theory of Challenge and Threat States in Athletes (TCTSA) also explores the effects of different states on athletic performance. The basic assumption of the TCTSA theory is that athletes have a dichotomous evaluation of upcoming competitions, either as a challenge or as a threat. The entire evaluation process is based on the athlete's evaluation and comparison of demands and resources. Athletes are more likely to enter a challenge state when their perceived resources are greater than their demands, and more likely to enter a threat state when their perceived resources are insufficient to meet their demands (Jones et al., 2009). However, the TCTSA explores the challenge-threat state from a more macroscopic perspective (cognitive, emotional and physiological), which is essentially a motivational state. Meanwhile, the TCTSA addresses “resources” including self-efficacy ratings, perception of control, and goal orientation; while the MWSP explores the effects of a type of thought state on performance, where “resources” refers exclusively to attentional resources. In conclusion, helping athletes to achieve ideal performance and win in competition is one of the main tasks of sport psychologists. Theories are explored from different perspectives, but with the same goal of contributing to competition.

## Limitations and future directions

This study has some that need to be improved upon in the future. This study was able to obtain general results for athletes of multiple sporting events. These findings will undoubtedly be of value to athletes in many sports, but taking the whole into account will lead to a loss of specialization. We suggest that the hypotheses of this study be tested in future research for a single sport specialization. This will not only test the theory of this study but also provide assurance that the practice of this specialization



will be correctly guided. In addition, the grounded theory that we have refined to meet the needs of our research is a risky endeavor that can create difficulties in understanding the results of the theory. The results of the study indicate that the relationships between the variables in the theory we present are directional and dynamic. This way of constructing and presenting the results of the theory is more informative and beneficial to the formation of clear research ideas for future empirical studies. Future research on grounded theory can also make methodological improvements based on research needs, contributing to qualitative methodology and yielding exciting results.

In conclusion, this study is based on the competition situation, rooted in original data, to form MWSP. The result has a theoretical dialogue with the executive control failure hypothesis, the resource control hypothesis, and the decoupling hypothesis. MWSP suggests that MW occupies attentional resources and emphasizes the role of attentional control. On this basis, we also found the important influence of MW sources, competition anxiety, and content of MW. In daily training, we can learn from the occurrence and influence mechanisms of MWSP. Coaches can apply the intervention method of simulating the MW sources to reduce the frequency of MW in competition. At the same time, the negative effects can be mitigated and positive effects can be promoted by managing the content of MW.

## Conclusion

To investigate the reasons why athletes' MW affects performance, this study followed grounded theory and combined systems thinking to propose MWSP. The theory suggests that MW affecting sporting performance is influenced by the dynamics of MW source, competition anxiety, content of MW, attentional resources, and attentional control. MWSP is able to explain MW's bidirectional effects and provides scientific guidance for the intervention of athletes' MW. The hypothesis in this theory can be empirically tested in the future to examine its explanatory power.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## References

- Blondé, P., Girardeau, J. C., Sperduti, M., and Piolino, P. (2022). A wandering mind is a forgetful mind: A systematic review on the influence of mind wandering on episodic memory encoding. *Neurosci. Biobehav. Rev.* 132, 774–792. doi: 10.1016/j.neubiorev.2021.11.015
- Bryant, A., and Charmaz, K. (2007). *The sage handbook of grounded theory*. Newbury Park, CA: Sage Publications Ltd.
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Newbury Park, CA: Sage Publications Ltd.
- Chen, X. M., and Wang, F. W. (2021). A paradox of the double-track promotion for university counselors—a study based on the grounded theory. *Educ. Res.* 42, 80–96.
- Cheyne, J. A., Solman, G. J. F., Carriere, J. S. A., and Smilek, D. (2009). Anatomy of an error: A bidirectional state model of task engagement/disengagement and attention-related errors. *Cognition* 111, 98–113. doi: 10.1016/j.cognition.2008.12.009
- China News (2008). *Emmons's last shot: Thinking too much, last moment hands or trembling*. Available online at: <https://www.chinanews.com/olympic/news/2008/08-17/1350776.shtml> (accessed January 05, 2023).
- Christoff, K., Mills, C., Andrews-Hanna, J. R., Irving, Z. C., Thompson, E., Fox, K. C. R., et al. (2018). Mind-wandering as a scientific concept: Cutting through the definitional haze. *Trends Cogn. Sci.* 22, 957–959. doi: 10.1016/j.tics.2018.07.004
- Corbin, J. M., and Strauss, A. L. (2015). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Newbury Park, CA: Sage Publications.

## Ethics statement

The studies involving humans were approved by the Ethics Committee of Hebei Normal University (2023LLSC031). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

JL: Conceptualization, Data curation, Funding acquisition, Methodology, Project administration, Supervision, Writing – original draft. YL: Data curation, Validation, Writing – original draft. SX: Data curation, Writing – review & editing. BT: Conceptualization, Methodology, Project administration, Validation, Writing – review & editing.

## Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This research was supported by the National Social Science Foundation of China (19CTY012).

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.



- Deng, Y. Q., Shi, G., Zhang, B., Zheng, X., Liu, Y., Zhou, C., et al. (2022). The effect of mind wandering on cognitive flexibility is mediated by boredom. *CTA Psychol.* 231, 103789–103789. doi: 10.1016/J.ACTPSY.2022.103789
- Eysenck, M. W., and Wilson, M. R. (2016). "Sporting performance, pressure and cognition: Introducing attentional control theory: Sport," in *The introduction to applied cognitive psychology*, eds D. Groome and M. Eysenck (London: Routledge), 329–350.
- Flick, U. (2021). *Grounded theory*. Nanjing: Gezhi Publishing House.
- Glaser, B. G. (1978). *Theoretical*. Mill Valley, CA: Sensitivity.
- Glaser, B. G. (1998). *Doing grounded theory: Issues and discussions*. Mill Valley, CA: Sociology Press.
- Glaser, B. G. (2008). *Doing quantitative grounded theory*. Mill Valley, CA: Sociology Press.
- Guang Ming Net. (2022). *Ren Ziwei was disqualified and missed out on his third gold medal at the Winter Olympics*. Available online at: <https://m.gmw.cn/baijia/2022-02/10/1302797167.html> (accessed January 05, 2023).
- Jones, M., Meijen, C., McCarthy, P. J., and Sheffield, D. (2009). A theory of challenge and threat states in athletes. *Int. Rev. Sport Exerc.* 2, 161–180. doi: 10.1080/17509840902829331
- Killingsworth, M. A., and Gilbert, D. (2010). A wandering mind is an unhappy mind. *Science* 330:932. doi: 10.1126/science.1192439
- Latinjak, A. T. (2018). Athletes' self-reports on mind wandering while practicing sports: An exploratory two-study project. *J. Clin. Sport Psychol.* 12, 432–447. doi: 10.1123/jcsp.2017-0023
- Li, J. L., Yao, J. X., and Li, X. (2017). Performance and interventions of mind wandering in sustained attention response task. *Chin. J. Rehabil. Theory Pract.* 23, 470–474. doi: 10.3969/j.issn.1006-9771.2017.04.023
- McVay, J. C., and Kane, M. J. (2010). Does mind wandering reflect executive function or executive failure? Comment on Smallwood and Schooler (2006) and Watkins (2008). *Psychol. Bull.* 136, 188–197. doi: 10.1037/a0018298
- Miś, M., and Kowalczyk, M. (2020). Mind-wandering during long-distance running and mood change. The role of working memory capacity and temporal orientation of thoughts. *Int. J. Sport Exerc. Psychol.* 19, 815–833. doi: 10.1080/1612197x.2020.1766538
- Santos-Rosa, F. J., Montero-Carretero, C., Gómez-Landero, L. A., Torregrossa, M., and Cervelló, E. (2022). Positive and negative spontaneous self-talk and performance in gymnastics: The role of contextual, personal and situational factors. *PLoS One* 17:e0265809. doi: 10.1371/journal.pone.0265809
- Seli, P., Beaty, R. E., Cheyne, J. A., Smilek, D., Oakman, J., and Schacter, D. L. (2018a). How pervasive is mind wandering, really? *Conscious. Cogn.* 66, 74–78. doi: 10.1016/j.concog.2018.10.002
- Seli, P., Kane, M. J., Metzinger, T., Smallwood, J., Schacter, D. L., Maillet, D., et al. (2018b). The family-resemblances framework for mind-wandering remains well clad. *Trends Cogn. Sci.* 22, 959–961. doi: 10.1016/j.tics.2018.07.007
- Seli, P., Beaty, R. E., Marty-Dugas, J., and Smilek, D. (2019). Depression, anxiety, and stress and the distinction between intentional and unintentional mind wandering. *Psychol. Conscious.* 6, 163–170. doi: 10.1037/cns0000182
- Sherwood, D. (2014). *System Thinking*. South Norwalk, CT: Mechanical Industry Press.
- Smallwood, J. (2010). Why the global availability of mind wandering necessitates resource competition: Reply to McVay and Kane (2010). *Psychol. Bull.* 136, 202–207. doi: 10.1037/a0018673
- Smallwood, J., and Andrews-Hanna, J. (2013). Not all minds that wander are lost: The importance of a balanced perspective on the mind-wandering state. *Front. Psychol.* 4:441. doi: 10.3389/fpsyg.2013.00441
- Smallwood, J., and Schooler, J. W. (2006). The restless mind. *Psychol. Bull.* 132, 946–958. doi: 10.1037/2326-5523.132.5.946
- Smallwood, J., and Schooler, J. W. (2015). The science of mind wandering: Empirically navigating the stream of consciousness. *Annu. Rev. Psychol.* 66, 487–518. doi: 10.1146/annurev-psych-010814-015331
- Smallwood, J., Fitzgerald, A., Miles, L. K., and Phillips, L. H. (2009). Shifting moods, wandering minds negative moods lead the mind to wander. *Emotion* 9, 271–276. doi: 10.1037/a0014855
- Soemer, A., Gericke, C., and Schiefele, U. (2023). Does mind wandering mediate the effects of habitual reading motivation on comprehension? *Learn. Instr.* 83:693. doi: 10.1016/J.Learninstruc.2022.101693
- Strauss, A., and Corbin, J. M. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications.
- Thomson, D. R., Besner, D., and Smilek, D. (2015). A resource-control account of sustained attention: Evidence from mind wandering and vigilance paradigms. *Perspect. Psychol. Sci.* 10, 82–96. doi: 10.1177/1745691614556681
- Vannucci, M., and Chiorri, C. (2018). Individual differences in self-consciousness and mind wandering: Further evidence for a dissociation between spontaneous and deliberate mind wandering. *Pers. Individ. Dif.* 121, 57–61. doi: 10.1016/j.paid.2017.09.022
- Weed, M. (2016). Capturing the essence of grounded theory: The importance of understanding commonalities and variants. *Qual. Res. Sport Exerc.* 9, 149–156. doi: 10.1080/2159676X.2016.1251701
- Yoshida, K., Sawamura, D., Yagi, M., Nakashima, Y., Saito, R., Yamamura, N., et al. (2023). Detecting inattentiveness caused by mind-wandering during a driving task: A behavioral study. *Appl. Ergon.* 106, 103892–103892. doi: 10.1016/J.APERGO.2022.103892



## OPEN ACCESS

## EDITED BY

Iván Iván-Baragaño,  
European University of Madrid, Spain

## REVIEWED BY

Alejo García-Naveira,  
Universidad Villanueva, Spain  
María Antonia Parra Rizo,  
Miguel Hernández University of Elche, Spain  
João Nunes Prudente,  
University of Madeira, Portugal

## \*CORRESPONDENCE

Jan Spielmann  
✉ janspielmann@t-online.de

RECEIVED 15 April 2024

ACCEPTED 26 June 2024

PUBLISHED 29 July 2024

## CITATION

Spielmann J, Otte F, Schumacher T, Mayer J  
and Klatt S (2024) Searching for the perfect  
goalkeeping personality. Myth or reality?  
*Front. Psychol.* 15:1418004.  
doi: 10.3389/fpsyg.2024.1418004

## COPYRIGHT

© 2024 Spielmann, Otte, Schumacher, Mayer  
and Klatt. This is an open-access article  
distributed under the terms of the [Creative  
Commons Attribution License \(CC BY\)](#). The  
use, distribution or reproduction in other  
forums is permitted, provided the original  
author(s) and the copyright owner(s) are  
credited and that the original publication in  
this journal is cited, in accordance with  
accepted academic practice. No use,  
distribution or reproduction is permitted  
which does not comply with these terms.

# Searching for the perfect goalkeeping personality. Myth or reality?

Jan Spielmann<sup>1,2\*</sup>, Fabian Otte<sup>3,4</sup>, Tom Schumacher<sup>5</sup>,  
Jan Mayer<sup>1,6</sup> and Stefanie Klatt<sup>5</sup>

<sup>1</sup>Department of Sports Sciences, Saarland University, Saarbrücken, Germany, <sup>2</sup>TSG ResearchLab, Zuzenhausen, Germany, <sup>3</sup>Borussia Mönchengladbach, Mönchengladbach, Germany, <sup>4</sup>U.S. Soccer Federation (USSF), Chicago, IL, United States, <sup>5</sup>Institute of Exercise Training and Sport Informatics, German Sport University, Cologne, Germany, <sup>6</sup>TSG Hoffenheim, Zuzenhausen, Germany

**Background:** Psychological factors such as personality characteristics are influential factors of the goalkeeping performance in football (soccer). Not only for individualized treatment in practice, also from a scientific point of view, profiling goalkeepers is a relevant part of understanding athletes. The aim of this study was to investigate personality traits of goalkeepers of different expertise, age, and sex.

**Methods:** Using the Five Factor Model of personality we assessed personality traits of 132 male and female football goalkeepers ranging from youth to senior and low to elite level. A series of analysis investigated differences between the groups focusing on expertise, age, and sex.

**Results:** Significant differences in the personality trait agreeableness between groups of different expertise and sex could be detected. Although a significant difference in neuroticism levels of males and females could be shown.

**Conclusion:** This study was a first step of profiling football goalkeepers of different expertise, age, and sex. The study calls for more replication in this specific field of football and goalkeeping in general to understand the influence of personality characteristics on sport performance.

## KEYWORDS

personality, big-five, football, soccer, athletes

## Introduction

*“Goalkeepers need an element of insanity. Who else would want to stand there and allow people to shoot balls at their face or abdomen, and still think it’s great?”—Oliver Kahn, three-time winner of the IFFHS world’s best goalkeeper award.*

[cited from [Gorris and Kubjuweit \(2008\)](#)]

The narrative around football goalkeepers (GK) is often linked to a presentation of distinct psychological profiles with “strong” personalities that also may be perceived as “outside the norm” or, more jokingly, “not quite right” ([Giertz, 2014](#)). From a scientific point of view, current research does not provide conclusive answers to the question if top-level GKs generally differ in their personality profiles from those with lower performance levels. While, to date, there have only been few studies investigating GKs’ personality traits, it remains largely unclear to what extent professional GKs embody certain personality characteristics. Empirical knowledge about potentially more dominant personality characteristics in professional GKs (compared with their rather less advanced

counterparts), across male and female GKs at varying performance levels, could largely influence talent identification and scouting processes. Due to the lack of knowledge in this field and in order to support psychological consulting, training, and personality development, the following study investigates the existence of “a perfect goalkeeping personality profile” for performance at the professional level. We aim to examine whether this idea is close to reality or, rather, a full-on myth. For one, potential results indicating existence of an “idealized personality profile” for GKs at the professional level would assist researchers, psychologist and coaching practitioners in searching for certain personality traits when identifying and developing the future likes of world-class GKs, such as Mary Earps, Merle Frohms, Alisson Becker or Yann Sommer. In contrast, potential dispersed findings could make a case for an individual-environment-centered coaching approach (Otte et al., 2021). This coaching perspective equally considers and entangles (i) individuality of and differences between each GK, independent of performance level, experience and gender; and (ii) the development and performance contexts that players are embedded into (Sullivan et al., 2021).

Finally, prior to diving into the presented research study, the following paragraphs provide deeper theoretical understanding into positional demands in football goalkeeping and current empirical knowledge about personality profiling in sports and its connections with athletic expertise and gender differences.

## Research on positional demands in football goalkeeping

Concerning the positional requirements, goalkeeping in football arguably demands different skills that go beyond those of outfield players, not only from a tactical-technical point of view (for detailed overviews see Rechner and Memmert, 2010; Otte et al., 2022). In brief, the majority of the (limited number of) studies on goalkeeping deal with topics, such as physiological performance data on GKs' body composition, jumping power, sprint values (Sporis et al., 2009; Gil et al., 2014; Rebelo-Gonçalves et al., 2015), GKs' physical training loadings (e.g., White et al., 2020), position-specific behavior (Memmert et al., 2013; van der Kamp et al., 2018; Navia et al., 2019), GK-specific skill training periodization and coaching (Otte et al., 2019, 2020a,b), and perceptual-cognitive abilities (Savelsbergh et al., 2002; Woolley et al., 2015).

From a sport psychological standpoint, GKs are confronted with exceptional and distinctive challenges (West, 2018). For instance, a GK's game performance often is rated by an extreme dichotomy of either a successful or poor performance, which can be seen nearly every weekend: One save or, contrastingly, one goalkeeping mistake potentially determining the whole GKs rating. Thus, in professional football the outside perspective of fans, spectators, media, and other external parties seemingly has little room for gray areas. This leads to increased pressures for GKs to perform or, more drastically, to avoid mistakes. Put simple, the specific role of the GK in football appears highly demanding from a mental perspective and therefore, requires a stress-resistant psychological profile (Otte et al., 2020c). The classical psychological field of personality research appears to be

relatively underrepresented, although relevance is obvious: utilizing a comprehensive approach, Hughes et al. (2012) emphasize the importance of the categories of concentration, motivation, attitude, and body language when evaluating GKs. These categories may coherently be combined with the results of a recent study on GK training and the requirement profile for professional GKs (Otte et al., 2019). In their qualitative study, the authors asked professional goalkeeping coaches to holistically reflect on the question of: “What critical skills does a top goalkeeper need?”. Among numerous physical and tactical-technical factors, the interviewed experts highlighted the area of “mentality” as an essential component in high-performance goalkeeping. Using keywords, such as “courage”, “concentration”, “work attitude and professionalism”, coaches stressed the relevance of mental skills and a distinct GK “personality”. Interestingly, it is precisely the latter term of “personality” that again bridges the gap to this research, analysis, and evaluation of personality traits of GKs. Finally, due to a lack of research on personality profiling in football (here, goalkeeping), this paper aims to investigate differences in personality traits of GKs on different performance levels (i.e., professional, semi-professional/amateur, and elite-youth GKs) and potential gender differences between male and female GKs. Current theoretical and scientific knowledge within the field of personality research in sport will be presented in the following paragraphs and later re-connected to the football goalkeeping context.

## Current scientific knowledge about personality profiling in sports

### Personality and sports

Personality can be assessed by the use of trait assessments. Differential psychology often uses the Five Factor Model of Personality (FFM; McCrae and Costa, 1999; McCrae and Costa, 2008), which can be associated with a wide acceptance throughout literature (de Moor et al., 2012; Allen et al., 2013; Bircher et al., 2017). It divides personality into five traits: openness (O; curious, creative, and imaginative), conscientiousness (C; organized, punctual, and structured), extraversion (E; sociable, outgoing, and active), agreeableness (A; good-natured, unselfish, and forgiving), and neuroticism (N; anxious, hostile, and irritable). Besides scientific interest in assessments of personality traits, practical deductions can be used for everyday work. Therefore, scientific assessments can always provide objective perspectives of somebody's needs and motives as an addition to subjective estimations. Specifically in the world of high-performance sports, latter form of subjective estimations is overrepresented when it comes to talent identification, individualized action and developing processes (Cripps et al., 2019). Applied working personnel like sport psychologists and coaches can benefit from conclusions of an athlete's personality expression in terms of individualized intervention, consulting, coaching, and training. Depending on a certain characteristic or expression, communication and course of action should be adapted to each individual to provide best fittings possible. For example, literature shows beneficial interdependences between knowledge about athletes personality characteristics and important personal and career transitions

(Laurin, 2009), integration processes (Beauchamps et al., 2007), and interpersonal relationships (Cuperman and Ickes, 2009; Jackson et al., 2011; Allen et al., 2013). Further, players can benefit from confronting themselves with their own trait-profile as an instrument of personality-development and setting-specific orientation. This could influence diverse factors of an athlete's life like training structuring (conscientiousness), risky decision making (neuroticism), diversify processes (openness), self-concentration (agreeableness), or relationship building (extraversion), which at best leads to enhanced player long-term development and improved performances, both on and off the pitch (Piedmont et al., 1999; García-Naveira et al., 2011; Ruiz-Barquín and García-Naveira, 2013).

Additionally, several hypothesis and theories have been developed over the years to better understand the relationship between sports and personality. To further analyze the findings of this study, we also give a broad overview to these theories. One crucial distinction hereby is the difference between the “development hypothesis” and the “selection hypothesis”. Proponents of the development hypothesis argue that sport activity influences the athlete's personality, while proponents of the selection hypothesis argue that the influence is the other way around—personality characteristics make athletes choose certain sports (García-Naveira and Ruiz-Barquín, 2016).

In general, both hypotheses can be combined in a mixed approach, as the selection and active participation in a sport both influence an individual's psychological profile sports (García-Naveira and Ruiz-Barquín, 2016). This lines up with the theory of “performance hypothesis”. The performance hypothesis, developed by García-Naveira and Ruiz-Barquín (2016), argue that certain personality traits are inherently linked to the heightened performance in a sporting context. As an example, could goalkeepers which personality type is considered extroverted, adapt more easily to the demands of the position compared to introverted ones and therefore play on a higher level? The performance hypothesis would agree to said question, which could theoretically allow a personality distinction between different levels of expertise in relevant sport positions.

## Personality and athletic expertise

Personality characteristics of individuals and groups representing high expertise levels in any field of interest are often in focus of research; this, simply because these individuals have something unique, special and often the ability to do things “regular” humans are not capable of. For example, researchers investigated personality profiles of Mount Everest climbers (Egan and Stelmack, 2003), Olympic athletes (Piepiora et al., 2022b), or ultra-marathon participants (Hughes et al., 2003). As mentioned above, such an exposed role can also be applied to high-level football goalkeeping. Digging deeper into this specific clientele, it is worth using a bottom up approach by reviewing findings outside the goalkeeping field: focusing on the basic levels of physical activity, meta-analysis found positive correlations with extraversion, conscientiousness (Rhodes and Smith, 2006; Wilson and Dishman, 2015) and openness (Wilson and Dishman, 2015), whereas neuroticism was associated negatively (Rhodes and Smith, 2006; Wilson and Dishman, 2015). Studies focusing on

the bidirectional associations between the constructs are also worth to be highlighted (Tolea et al., 2012; Stephan et al., 2014; Allen et al., 2015). For example, Allen et al. (2017) could show, that personality has a relevant impact for change in physical activity, whereas physical activity is relatively unimportant for changing personality characteristics. Classifying these general considerations into expertise levels, there are other contexts (e.g., occasional or academia settings), in which personality has been proven to influence on domain-specific success (Poropat, 2009; Furnham, 2018). Similar results can be reported for the setting of sports.

There is an increased number of studies focusing on the role of personality on athletic expertise and success. Examples for this field are investigations of differences in personality profiles of selected and non-selected athletes for the Paralympics (Martin et al., 2011), athletes' match statistics throughout a season (Piedmont et al., 1999), and personality characteristics as a prediction criteria for expertise (Morgan and Johnson, 1978; Aidman, 2007; Martin et al., 2011). When examining expertise levels in sports, high-level athletes show lower expressions for neuroticism (e.g., Kirkcaldy, 1982; Allen et al., 2011; Steca et al., 2018; Vaughan and Edwards, 2020), and higher expressions for extraversion (e.g., Williams and Parkin, 1980; Newcombe and Boyle, 1995; Egloff and Gruhn, 1996), conscientiousness (e.g., Allen et al., 2011; Steca et al., 2018; Vaughan and Edwards, 2020), and openness (e.g., Goddard et al., 2019; Vaughan and Edwards, 2020). Results for agreeableness remain unclear, as both higher (Allen et al., 2011) and lower (Vaughan and Edwards, 2020) expressions have been found. Another approach is operationalizing expertise by age progression, as older athletes (in comparison to younger athletes) proved their ability to perform on a specific level for a longer period of time. From a longitudinal point of view, the affiliation to a certain stage of expertise is less influenced by short term specific biases like performance peaks, over- or underrating, and luck. Those examined athletes demonstrated their ability against all possible odds throughout their career. Here, one study investigating young and senior athletes showed larger expressions for agreeableness, conscientiousness, and openness in the latter group (Trninić et al., 2016). This could support the approach of using age as a potential variable defining expertise, as at least conscientiousness and openness (as mentioned above) differentiate higher- from lower-level athletes. As specific characteristics and combinations of traits could be beneficial for different sports or expertise levels, these findings should always be interpreted considering their specific settings. As most of the current studies use samples of various disciplines representing various population sizes, profile requirements, and levels of professionalism, the mentioned findings are not generally transferable. To clarify, whether or not these trends of expertise levels are applicable to one specific discipline and playing position (i.e., football goalkeeping), this study aims to further investigate.

## Personality and gender differences

The popularity of female sport is an obvious and increasing process of modern sport development, specifically in football. For example, the European Women's Championships (Women's EURO) made a progression in global audience from 116 million



(2013) to 178 million (2017) to 365 million in the tournament of 2022 in England (UEFA, 2022). Although the popularity of female football is rising, women are still facing barriers such as lack of funding or basic concerns like finding suitable teams (O'Reilly et al., 2018). Similar circumstances can be found in the scientific world (Emmonds et al., 2019): female-specific research is dragging behind because of long-term inequality like distribution of resources which goes in line with levels of professionalism and participation. In this line, the field of goalkeeping is definitely not an exception.

Personality differences between males and females are one big field of interest for differential psychology. For norm populations, males tend to have lower levels of conscientiousness, neuroticism, agreeableness, and extraversion (Feingold, 1994; Costa et al., 2001; Schmitt et al., 2008). There is some evidence, that these findings could be transferred to the sporting context. For example, some researchers are of the opinion that physically active females display personality characteristics closer to males than inactive females (Fleming, 1934; Williams and Parkin, 1980; Allen et al., 2013). Nevertheless, Allen et al. (2011) found males scoring lower in conscientiousness, neuroticism, and agreeableness in a sample of different expertise levels and sports. Later, Gyomber et al. (2013) showed lower scores for extraversion and openness in male than in female subjects. It is suggested, that those findings could be directly transferred to expressions found in comparisons between male athletes and non-athletic populations (Allen et al., 2013). Notably, compared to research outside sports, these findings are no more than trends, as there are also contrary results published (O'Sullivan et al., 1998; Rhodes and Smith, 2006; Sutin et al., 2016). The only trait which seems in line throughout most findings is neuroticism showing higher expressions for females in general (Kirkcaldy, 1982; Colley et al., 1985; Newcombe and Boyle, 1995; Ruiz-Barquín, 2005). Like in other scientific areas, further research to investigate general gender differences in athletic populations, specifically in high-level athlete samples, is needed.

## Aims and hypotheses

This study aims to investigate personality traits of a sample of football GKs with the Five-Factor Model. In detail, differences in trait-characteristics of various expertise and age groups together with a gender separation are point of interest. It is hypothesized that GKs of higher expertise levels show larger expressions of extraversion, conscientiousness, and openness and lower values in neuroticism than GKs of lower expertise levels (hypothesis 1). Regarding gender, it is assumed that female GKs show higher values for neuroticism than male GKs (hypothesis 2). Furthermore, we hypothesize that as female GKs progress in expertise, their neuroticism values will be closer to the lower expertise male GKs (hypothesis 3).

## Methods and materials

### Participants

In total, 132 football goalkeepers (96 male; 36 female) aged 16–37 years ( $M = 20.43$  years,  $SD = 4.94$ ) participated in this study

TABLE 1 Descriptive NEO-FFI statistics ( $n = 132$ , plus gender and level separation, raw scores).

	Level		Trait				
			N	E	O	A	C
All athletes ( $n = 132$ )	Pro	M	15.79	30.28	26.34	34.86	37.28
		SD	5.75	5.09	4.79	3.99	5.81
	Elite youth	M	15.17	30.91	24.97	31.37	38.26
		SD	6.46	4.49	5.34	4.85	4.48
	Semi-pro/amateur	M	16.71	30.67	26.29	32.19	35.81
		SD	7.48	3.44	5.28	4.92	5.67
Males ( $n = 96$ )	Pro	M	13.62	29.31	25.15	33.77	40.08
		SD	4.50	6.50	4.26	4.78	4.89
	Elite youth	M	14.56	30.67	24.98	30.33	37.72
		SD	6.70	4.61	5.26	4.93	4.70
	Semi-pro/amateur	M	16.11	30.22	26.33	31.33	35.22
		SD	6.50	3.49	5.69	4.54	5.68
	Amateur youth	M	15.00	30.25	24.42	31.25	36.00
		SD	4.65	6.41	5.09	4.80	6.07
Females ( $n = 36$ )	Pro	M	17.56	31.06	27.31	35.75	35.00
		SD	6.16	3.62	5.11	3.09	5.62
	Elite youth	M	17.25	31.75	24.94	34.88	40.06
		SD	5.24	4.09	5.80	2.28	3.13
	Semi-pro/amateur	M	20.33	33.33	26.00	37.33	39.33
		SD	13.31	1.53	2.00	4.51	5.03

(Table 1). All participants were German native speakers to prevent the dataset of biases such as misunderstanding the questionnaires or test instructions. In sum, all GKs were current players of 38 different clubs all over Germany, ranging from the U17's to senior level. Altogether, 37 GKs (28.03%) have been or were part of a youth or adult national team. Regarding our hypothesis, we ran several *post-hoc* analyses with the program G\*Power (Version 3; Faul et al., 2007) to retrospectively determine the Power of our dataset. For hypothesis 1, we achieved a Power of 0.942 with a Pillai's V of 0.15. Hypothesis 2 had a Power of 0.999 with a Pillai's V of 0.255 and hypothesis 3 had a Power of 0.999 with a Pillai's V of 0.485.

### Personality assessment

The German adaptation by Borkenau and Ostendorf (2008) of McCrae and Costa's (1987) NEO-FFI questionnaire was used to determine athletes' personality traits. The questionnaire consists of 60 items rated on a five-point Likert scale (strongly disagree, disagree, neutral, agree, strongly agree). It is a self-report measure that assesses the five personality dimensions: extraversion (E), neuroticism (N), openness (O), agreeableness (A), and conscientiousness (C). The NEO-FFI is a well-established questionnaire with quality criteria reported in various populations



(McCrae and Costa, 2004), especially in elite football players (Spielmann et al., 2022). Furthermore, reliability coefficients for the NEO-FFI in the current sample were  $N = 0.81$ ,  $E = 0.66$ ,  $O = 0.67$ ,  $A = 0.69$ , and  $C = 0.81$ .

## Procedure

Prior to the commencement of this study, informed consent from all athletes (and a legal guardian for all participants under 18 years of age) was received, and the Institutional Ethics Committee approved this study (approval number: 19-19). Players answered the personality questionnaire via an online survey. The assessment had a standardized introduction and familiarization protocol, and a sport psychologist could always be consulted. Before the participants started, they were informed, that all results would stay anonymous, and they will not get any negative consequence if they do not participate. They did not get any compensation for being part of the study. The online survey was either presented during the professional clubs' standardized sport psychological diagnostics battery or sent directly in terms of personal contact. In the former case, the survey was answered in small group settings in a separate room. In the latter case, the survey was answered in an individual environment. Reading and answering the assessment took ~15 min. Finally, GKs' statements about their current and past playing levels were used to create participant groupings for statistical analysis. Using an applied approach based on football knowledge about the German senior and youth league systems and playing levels, six groups and their respective selection criteria were established (Supplementary Table 1).

## Statistical analysis

For most of the hypotheses a MANOVA with a protected F-Approach was used. The effects were subsequently controlled with the usage of a *post-hoc* Tukey Test. To analyze possible differences for effects of gender, *post-hoc* tests were conducted using a student's *t*-test. For the last hypothesis, we also used multiple pairwise comparisons to obtain specific differences between our diverse goalkeeper groups. The significance level was set at  $p < 0.05$ , and an estimate precision was provided using Wald-based 95% confidence intervals. Prior to the analysis, the data were first screened for outliers, missing data, and checked for normality using visual inspection of box plots through a Shapiro-Wilk test of normality in accordance to Tabachnick and Fidell (2014). Bonferroni correction was used to adjust  $\alpha$  with a new level of  $\alpha = 0.01$ .

## Results

### Preliminary analysis

All studies were preliminary checked for their assumptions. Due to the highly specialized sample size of elite athletes, certain outliers were noticeable and problems regarding univariate, especially in regarding the personality trait of Neuroticism. This

unusually large distribution of values may be of interest when considering future analysis but may be due to the unique sample size. A removal of the factor Neuroticism resulted in no changes regarding the significance of the analysis and therefore remained in the analysis. Due to some of the preliminary assumptions being violated, the authors opted out to use Pillai's trace in the MANOVA analysis. This is because of the high robustness regarding violations of assumptions (Pillai, 1955).

### Expertise related differences

The first objective of the study was to examine differences in personality characteristics depending on expertise level and age, respectively. The MANOVA was significant at  $F_{(5)} = 4.045$ ,  $p = 0.002$ ,  $\eta^2 = 0.138$ . As the five personality values were compared with each other, a Bonferroni correction in the singular ANOVA with a new critical  $\alpha$  of 0.01 was used. This value was only reached by agreeableness with  $F_{(3)} = 3.983$ ,  $p = 0.009$ ,  $\eta^2 = 0.085$ . This effect size indicates a medium effect. *Post-hoc* analysis using Bonferroni were done to clarify these results. As shown in Figure 1, they showed a significant difference between elite youth ( $M = 31.43$ ,  $SD = 4.91$ ) and pro GKs ( $M = 34.86$ ,  $SD = 4.06$ ). This indicates that pro GKs have a higher agreeableness score than elite youth GKs. No significant differences were found for the other personality traits or for the amateur groups and thus, hypothesis 1 is rejected.

### Gender related differences

As a second objective, differences between genders were determined. A MANOVA revealed a significant finding at  $F_{(5)} = 8.372$ ,  $p < 0.001$ ,  $\eta^2 = 0.249$ . Additional ANOVAS according to protected F-Measure were performed to find exact difference. These showed, after Bonferroni correction, a trend in gender differences for neuroticism [ $F_{(1)} = 5.550$ ,  $p = 0.02$ ,  $\eta^2 = 0.041$ ] and significant gender differences for agreeableness [ $F_{(1)} = 24.865$ ,  $p < 0.001$ ,  $\eta^2 = 0.161$ ] scores ( $\alpha = 0.01$ ). Further *t*-tests were used to clarify the differences. Significant findings could be shown for neuroticism [ $t_{(130)} = 2.328$ ,  $p = 0.023$ ,  $d = 0.04$ ] and agreeableness [ $t_{(130)} = 4.987$ ,  $p < 0.001$ ,  $d = 0.088$ ]. In detail male GKs scored lower in both agreeableness ( $M = 31.09$ ;  $SD = 4.912$  vs.  $M = 35.49$ ;  $SD = 2.86$ ; Figure 2), and neuroticism ( $M = 14-77$ ;  $SD = 6.17$  vs.  $M = 17.66$ ;  $SD = 6.32$ ; Figure 3) as female GKs. The low effect sizes in this analysis could stem from the fact that we analyzed two samples with very different sizes. To obtain a higher effect size, future studies with more female goalkeepers should be conducted to fully understand possible personality differences between male and female GKs.

### Expertise and gender related differences

Lastly, the third objective of the study was to investigate if female GKs as progressing in expertise, their personality characteristics show closer comparability to lower expertise male

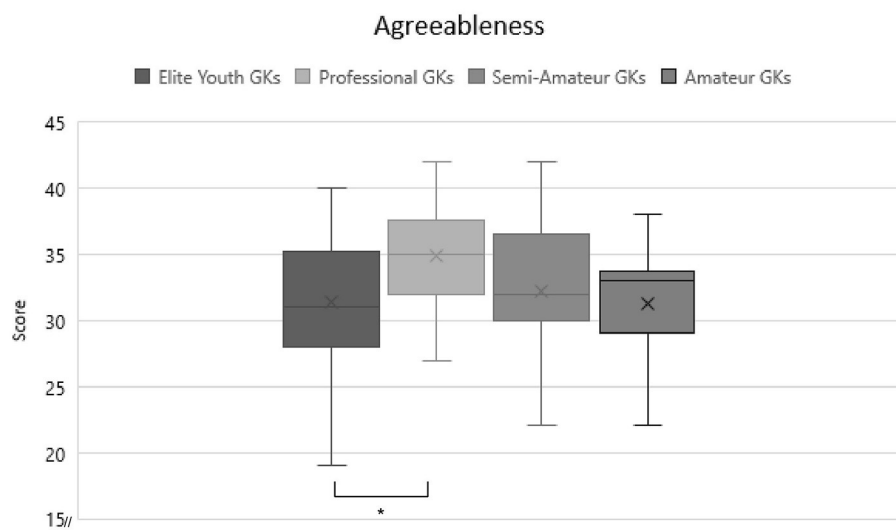


FIGURE 1

Comparison of agreeableness scores between expertise levels. Significant differences are marked with a\*.

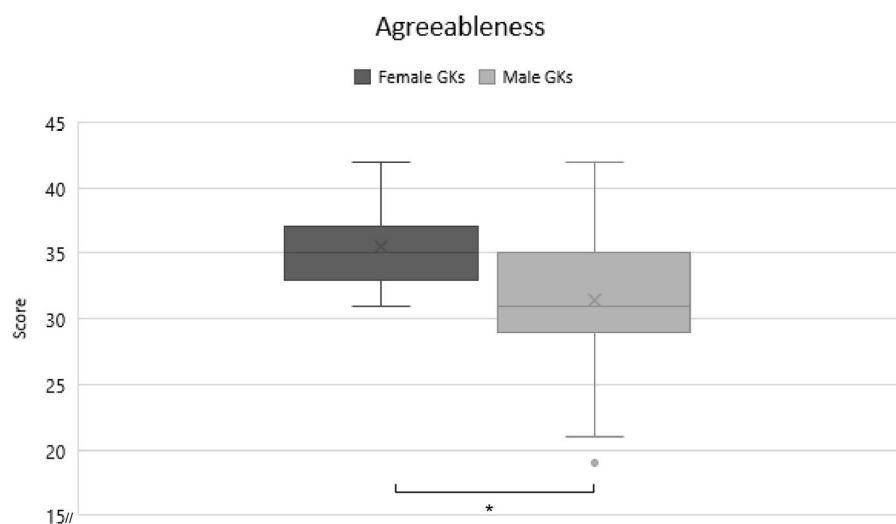


FIGURE 2

Comparison of agreeableness scores between female and male GKs. Significant differences are marked with a\*.

GKs. The MANOVA itself was significant at  $F_{(30)} = 2.229$ ,  $p < 0.001$ ,  $\eta^2 = 0.097$ . The additional ANOVAS showed significant effects for agreeableness [ $F_{(6)} = 5.082$ ,  $p < 0.001$ ,  $\eta^2 = 0.205$ ] and one less strong effect for conscientiousness [ $F_{(6)} = 2.323$ ,  $p = 0.037$ ,  $\eta^2 = 0.106$ ]. All of these effect sizes are generally deemed as medium–large. As hypothesis 3 focused on significant effects in neuroticism only, the assumption is rejected. After applying Bonferroni correction, conscientiousness is no longer significant, however this can be seen by the reason of the limiting sample size. Regardless and due to the intriguing sample, we will continue the analysis, however we must interpret conscientiousness findings with care.

Pairwise comparisons further analyzed the differences in agreeableness and conscientiousness. In agreeableness, male elite

youth GKs have significantly lower agreeableness scores than female elite youth GKs (difference =  $-4.60$ ,  $p < 0.001$ ), male pro GKs (difference =  $-3.26$ ,  $p = 0.021$ ), female pro GKs (difference =  $-5.35$ ,  $p < 0.001$ ) and female semi-pro/amateur GKs (difference =  $-6.93$ ,  $p = 0.009$ ). Furthermore, female pro GKs have higher scores than male semi-pro/amateur GKs (difference =  $3.265$ ,  $p = 0.021$ ) and male youth semi-pro/amateur GKs (difference =  $3.750$ ,  $p = 0.03$ ). For an overview of these results, refer to Figure 4. The last finding is in line with hypothesis 3 in the way that the female group of highest expertise (pro GKs) show higher agreeableness scores than male groups of lower expertise (semi-pro/amateur).

In conscientiousness, we can see that female elite youth goalkeepers have significantly higher values than female pro GKs (difference =  $5.27$ ,  $p = 0.003$ ), as well as male semi-pro/amateur

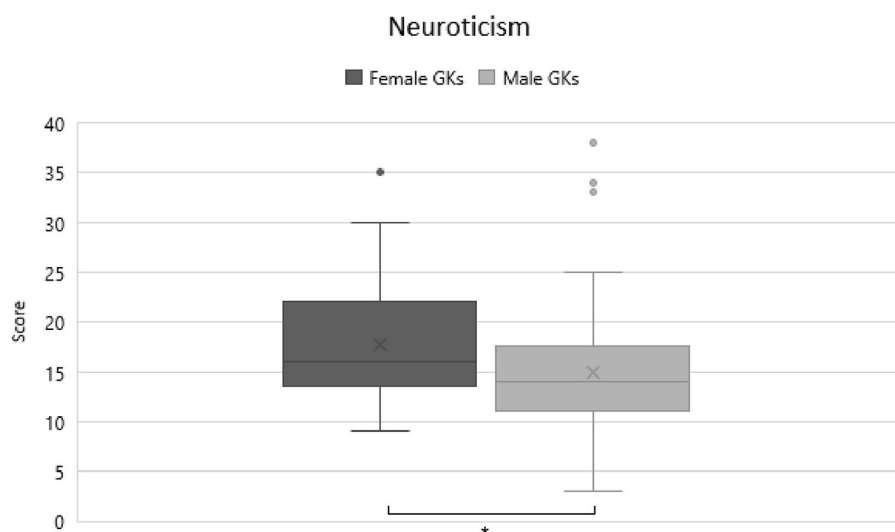


FIGURE 3

Comparison of neuroticism scores between female and male GKs. Significant differences are marked with a\*.

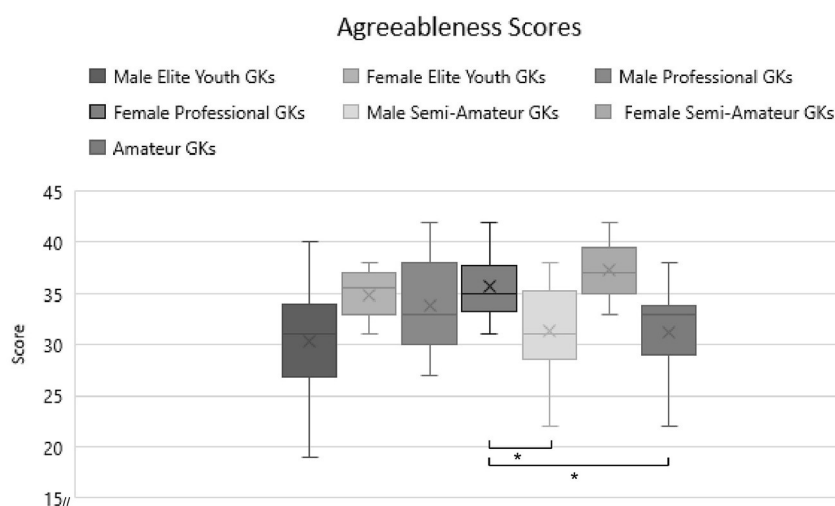


FIGURE 4

Comparison of agreeableness scores with expertise and gender separation. Significant differences are marked with a\*.

(difference = 3.77,  $p = 0.034$ ) and youth semi-pro/amateur male GKs (difference = 4.27,  $p = 0.029$ ). Additionally male pro GKs showed significantly higher scores in conscientiousness compared to female pro GKs (difference = 4.83,  $p = 0.011$ ). For an overview of these results, refer to Figure 5.

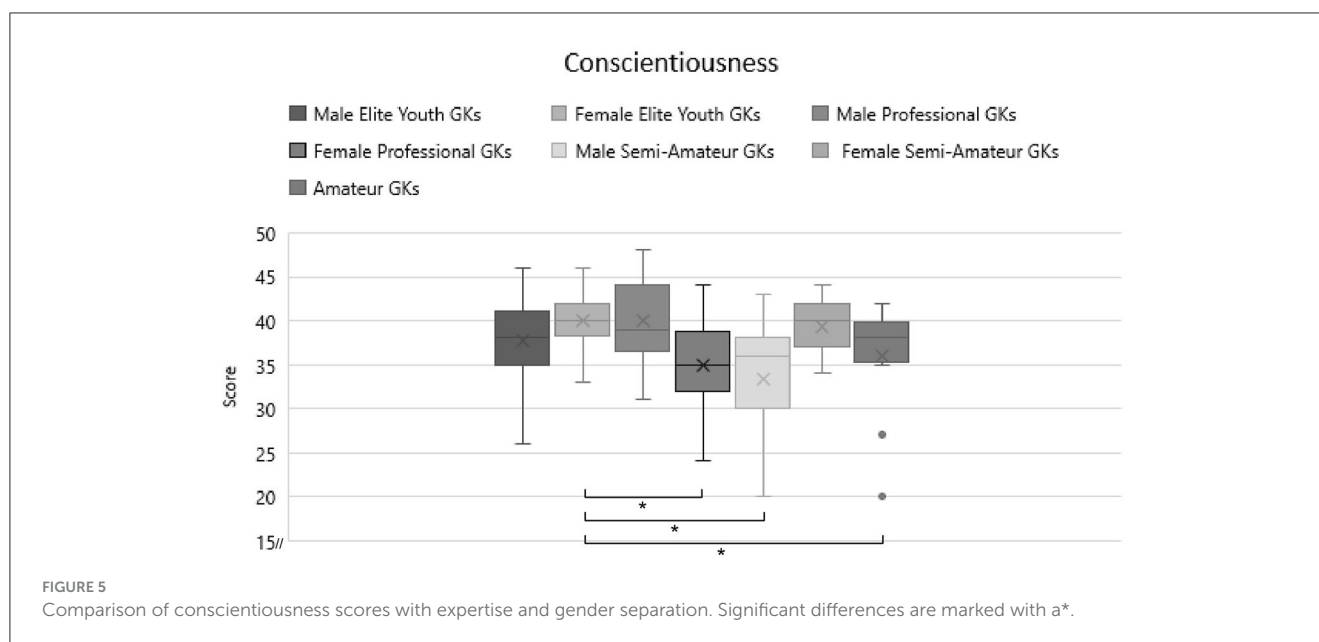
## Discussion

Using the FFM of personality, the aim of the current study was to investigate personality traits of youth and adult football goalkeepers of various expertise levels, ranging from amateur to professional level. Furthermore, it was of interest to gain a more detailed view on gender-specific differences. Findings revealed heterogeneous results for expertise levels and gender, mainly for

the personality trait agreeableness, and are discussed from an individual-environment-centered perspective.

## Expertise related differences between senior professional and elite youth GKs

Interestingly, analysis only revealed a significant difference for the personality trait agreeableness. For differences in expertise, we initially suggested the exact opposite (hypothesis 1). From an individual-environment-centered focus on player development, the non-significant findings for hypothesis 1 (i.e., the prediction that higher expertise levels show larger extraversion, conscientiousness, and openness and lower values in neuroticism) appear remarkable.



Since none of these personality traits seem to differentiate the group of professional goalkeepers from their younger or semi-pro/amateur counterparts, it could be interpreted as contrary to the performance hypothesis (García-Naveira and Ruiz-Barquín, 2016). Two main discussion points arise.

One, the often-cited notion of “context is everything” (Davids et al., 2021) for practice design and coaching transfers nicely to the domain of psychological GK profiling. Being aware of each player’s individual context, constraints and socio-cultural background appears critical in performance sport. Clearly, every player must be regarded as a unique individual that displays specific characteristics and demands; these, coaches and psychological support staff must recognize to individualize psychological development and maximize performance preparation. For example, when tasked to speak to a group of media representatives (i.e., a very common task for professional football players these days), a GK scoring high in openness and extraversion and low in neuroticism may feel and behave much differently about this scenario than a GK scoring lower/higher in these areas, respectively. In other words, only by understanding a GK’s personality profile, coaches and psychologists may be able to support this (professional) player and assist in preparing for common events, such as media interviews, press conferences or likewise, in an individualized way.

Two, due to non-significant differences when comparing experts’ personality traits with lower level or skillful GKs, it may be stated (by some) that using psychological diagnostics and profiling of individual GKs could be seen as an inefficient use of time and resources. However, we would argue the opposite: by profiling GKs’ personality traits, practitioners within high-performance player development programs will be assisted in becoming aware of and understanding each individual GK’s demands. In a recent investigation of coaches’ views on their responsibilities regarding the coaching process and practice design, Selimi et al. (2023) emphasized the importance of relationship building with players and the coaches’ initial responsibility of “developing people”. This

idea aligns closely with our findings in a way that it appears invaluable for coaching and support staff within teams, clubs and national federations to gain in-depth understanding of each individual player’s history and her personality traits. Here, use of standardized FFM of personality tests can be of instrumental help for practitioners.

Lastly, for our significant findings on agreeableness, in comparison to the other FFM traits, the status quo of current research is rather unclear. Nevertheless, our finding is in line with Allen et al. (2011) who also showed higher scores for agreeableness in higher level athletes. Thereby, we are in opposition to Vaughan and Edwards (2020). Using an approach where expertise is defined by age progression, a linkage to the studies of Trninić et al. (2016) and Piepiora et al. (2022a) is apparent and revealed similar results. From our view, different explanations could potentially underline this finding. Senior professional GKs, due to their numerous years of top-level playing and their “secure and stable” status within a club/team, may feel less under pressure to outperform competitors compared to youth elite GKs. In contrast, in an academy setting young GKs pursue the goal of signing a professional contract and hence, compete with an enlarged number of further GKs to achieve this aim; this, over time, could possibly lead to youth elite GKs displaying less agreeable behavior than their professional counterparts. Additionally, changing socio-cultural expectations, values and norms within modern-day societies have been shown to highlight stronger value-directedness toward elitism and individual competition (e.g., shown in younger generations in Swedish football; (Vaughan et al., 2022). Possibly regarding the trait of agreeableness, as much as this evolving value-directedness may shape skill development in football practice, it may also influence personality development and social behavior of aspiring elite footballers. Put simply, given the evolving socio-cultural constraints that influence and shape young adults when growing up, changes in personality traits toward less agreeable behaviors may be a consequence. Notably, this interpretation is strongly speculative and warrants further research.

## Gender related differences between male and female GKs

The primary results indicated that male GKs scored noticeably lower in agreeableness compared to their female counterparts. The disparities in neuroticism can only be considered a tendency due to the application of the Bonferroni correction. Despite this, it remains valuable to closely examine this particular insight. Our findings correspond to results from norm populations (Feingold, 1994; Costa et al., 2001; Schmitt et al., 2008). In sports, significant differences were shown for neuroticism (Kirkcaldy, 1982; Colley et al., 1985; Newcombe and Boyle, 1995; Allen et al., 2011) and agreeableness (Allen et al., 2011). The tendency for neuroticism could be explained by several reasons. First, the pure number of active athletes could lead to an increased selection effect in favor of football players with lower neuroticism, as it is associated with negative effects on athletic success (McKelvie et al., 2003; Piepiora, 2021) and mental health (De Moor et al., 2006). For example, the German Football Association (DFB) reports a number of 2.022.123 active male vs. 186.646 active female football players for the 2021/2022 season (DFB, 2023). Also, the still existing inequality of professionalism in terms of resources invested into coaching staffs and consulting (e.g., sport psychologists, psychotherapists, licensed coaches, etc.) could have an impact on neurotic behavior, like increased levels of anxiety or nervousness. Additionally, on a basis of masculine stereotypes (Chalabaev et al., 2013), neuroticism and its associations are yet interpreted as a sort of weakness (Sebbens et al., 2016). Leastwise, this bias appears with a higher quote in male football than in female settings.

The differences between male and female GKs in agreeableness are harder to explain as they are inconsistent in the sporting context. People with high levels of agreeableness tend to have higher standards in morality, sympathy, and cooperation. Like with neuroticism, the pressure in male football could favor athletes with lower levels of agreeable behavior. Also, as stated above, the professional system in football sometimes educates and forces youth athletes to show such a behavior when they need to always be the best, outperform others and be less compassionate (Beavan et al., 2022). This trend could even be stronger when it comes to special characters like GKs, where in most cases there is only one clear number one that needs to protect their status and position from potential rival candidates.

## Expertise and gender related differences

The subdivision of male and female groups showed male elite youth GKs scoring significantly lower in agreeableness. The finding could be a result of the aforementioned high pressures in this male age group, given that elite youth players play their final years in football academies with the hope of being awarded a senior professional contract, and the fear of having to transfer to semi-pro/amateur leagues or even end their ambitious careers. To showcase oneself in the best way possible, an aspiring youth elite GK may be well-aware of the situation that all manageable aspects in their last years of academy football may influence chances of becoming a professional or not. This awareness could result in a behavior which is informed by egocentricity and suspiciousness,

even if that can be interpreted negative from an ethical standpoint. One explanation, why this finding could not be detected in the female elite youth group could be that female players pass through this transition period at a younger age. This has various reasons related to the organizational structure of female pro sport (specifically in Germany), being maybe the most influential aspect. For example, the second highest league in German senior female football (i.e., 2. Frauen-Bundesliga) consists approximately one half of first division clubs' reserve/U-21s teams. These "farm teams" mainly focus on highly talented young players, which are often allowed to still play in U-17s youth leagues. As strength density in those leagues is rather weak, clubs potentially elevate young female players earlier into senior teams than they would do with male football players. As the current study implemented GKs with an age of 16 plus, future research should also implement younger age groups of the highest performance level to dig deeper into male/female differences.

## Limitations and future directions

The current study should be considered in the context of some limitations that we would like to address. We decided to investigate personality traits of both male and female goalkeepers of various ages and expertise levels. As the circumstances under which male and female GKs are identified and developed can differ from rather equal to extreme, it is hard to compare these individual GKs and groups on specific characteristics. As literature-based grouping strategies could not be transferred to the field of goalkeeping, we tried to group the participants using an applied approach (Supplementary Table 1). This grouping strategy could arguably lead to different results dependent on whether a specific GK would be classified as a "professional", "semi-professional" or "elite youth". For example, some male football players can finance their lives with an affiliation to a club in the 5th division (i.e., amateur-level football according to our grouping), whereas female players often have a second mainstay besides playing first division football (i.e., still grouped as senior professional due to playing at the highest level).

Next, the overall sample size displays a limitation of our study, which can be seen in the interpretation of the personality trait conscientiousness after Bonferroni correction (hypothesis 3). Nevertheless, as we targeted the specific football position of the GK with significantly lesser player numbers compared to outfield players and managed to recruit an enlarged number of GKs playing at the highest performance level possible (e.g., the 1st German Bundesliga), we are convinced of the high-quality insights into an often called "closed door world" of professional football.

Moreover, it is important to mention, that only European German native speakers were assessed to prevent the dataset from misunderstanding biases. As the European academy system can differ from countries outside Europe, the findings should be transferred carefully.

## Practical applications

Assessing personality profiles in athletes has several practical applications for different peer groups. Our findings could show that



there is no clear pattern that elevates an ambitious goalkeeper to a professional level. Incorporating age and gender diversity further complicates this generalized approach. Nevertheless, assessing and focusing on an athlete's personality characteristics is practically necessary to find the most suitable settings and provide a basis for sport psychological consulting. When athletes concentrate on their individual profiles, they are able to understand the interdependencies between relationships in both their personal (e.g., parents, partners, etc.) and their sporting contexts (e.g., coaches, teammates). By identifying similarities and differences, they can discover potential pathways for healthy and constructive circumstances, which could be a beneficial aspect of an athlete's life. Clubs, associations, and organizations can benefit from personality assessments for scouting purposes and to build suitable team cohesion. It is important to emphasize that such questionnaire-based instruments should not be used to identify "black sheep" in an existing team, but rather to identify missing characteristics that need to be recruited. The former approach would only lead to higher rates of social desirability and therefore miss the mark.

In the end, the strongest impact of personality profile assessments in practice is achieved when they are used as supportive instruments for all kinds of sport psychological work and not as (de)selection criteria. Their greatest benefit lies in using them to understand an athlete's characteristics in more detail and to help them find or build the most suitable setting for their individual potential development.

## Conclusion

In the current study, we aimed to investigate differences in personality traits of football goalkeepers. Compared to previous research, we used the well-established FFM to assess both male and female GKs of different age and expertise levels. Besides gender-specific differences, our findings were not in line with results of comparable studies focusing on expertise in the sporting context. From an individual-environment-centered coaching perspective, however, non-significant differences between various player groups and for some personality traits display invaluable findings. It appears critical for coaches to understand each individual player's context, constraints, and background. Hence, psychological profiling and consulting work remain highly beneficial to support individualized player development and coaching, at academy and senior levels, as well as in men's and women's football. In other words, results of this study would argue against the existence of "*an idealized goalkeeping personality profile*" for performance at the professional level. Thus, there appears to be no silver bullet and researchers, psychologists and coaching practitioners remain (positively) challenged when identifying and developing top-level GKs. Notably, as this research displays a first attempt at assessing personality traits of GKs, the interpretation and placement into the current scientific discourse has to be handled with caution. More research is encouraged and needed on whether (our first step into) studying personality traits of GKs is replicable, and to support both scientists and practitioners to generalize the current study's findings.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Universität des Saarlandes Ethikkommission der Fakultät HW Campus A1 3 66123 Saarbrücken. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

JS: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing. FO: Conceptualization, Writing – original draft. TS: Visualization, Writing – review & editing. JM: Supervision, Writing – review & editing. SK: Data curation, Formal analysis, Supervision, Writing – review & editing.

## Funding

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

## Conflict of interest

FO was employed by Borussia Mönchengladbach. JM was employed by TSG Hoffenheim.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2024.1418004/full#supplementary-material>

## References

- Aidman, E. V. (2007). Attribute-based selection for success: the role of personality attributes in long-term predictions of achievement in sport. *J. Am. Board Sport Psychol.* 3, 1–18.
- Allen, M. S., Greenlees, I., and Jones, M. V. (2011). An investigation of the five-factor model of personality and coping behaviour in sport. *J. Sports Sci.* 29, 841–850. doi: 10.1080/02640414.2011.565064
- Allen, M. S., Greenlees, I., and Jones, M. V. (2013). Personality in sport: a comprehensive review. *Int. Rev. Sport Exerc. Psychol.* 6, 184–208. doi: 10.1080/1750984X.2013.769614
- Allen, M. S., Magee, C. A., Vella, S. A., and Laborde, S. (2017). Bidirectional associations between personality and physical activity in adulthood. *Health Psychol.* 36:332. doi: 10.1037/hea0000371
- Allen, M. S., Vella, S. A., and Laborde, S. (2015). Sport participation, screen time, and personality trait development during childhood. *Br. J. Dev. Psychol.* 33, 375–390. doi: 10.1111/bjdp.12102
- Beauchamps, M. R., Jackson, B., and Laval, D. (2007). “Personality processes and intragroup dynamics in sport teams,” in *Group Dynamics in Exercise and Sport Psychology. Contemporary Themes* (Abingdon, VA: Routledge), 25–41.
- Beavan, A., Spielmann, J., Johns, P., Doty, J., and Mayer, J. (2022). Compassion and self-compassion motivation and action levels in a high-performance soccer youth academy. *Int. J. Sport Exerc. Psychol.* 21, 440–455. doi: 10.1080/1612197X.2022.2058585
- Bircher, J., Griffiths, M. D., Kasos, K., Demetrovics, Z., and Szabo, A. (2017). Exercise addiction and personality: a two-decade systematic review of the empirical literature (1995–2015). *Balt. J. Sports Health Sci.* 3, 19–33. doi: 10.33607/bjshs.v3i106.30
- Borkenau, P., and Ostendorf, F. (2008). *NEO-Fünf-Faktoren Inventar: nach Costa u. McCrae*; NEO-FFI. Hogrefe, Verlag f. Psychologie.
- Chalabaev, A., Sarrazin, P., Fontayne, P., Boiché, J., and Clément-Guillotin, C. (2013). The influence of sex stereotypes and gender roles on participation and performance in sport and exercise: review and future directions. *Psychol. Sport Exerc.* 14, 136–144. doi: 10.1016/j.psychsport.2012.10.005
- Colley, A., Roberts, N., and Chipps, A. (1985). Sex-role identity, personality and participation in team and individual sports by males and females. *Int. J. Sport Psychol.* 16, 103–112.
- Costa, P. T. Jr., Terracciano, A., and McCrae, R. R. (2001). Gender differences in personality traits across cultures: robust and surprising findings. *J. Pers. Soc. Psychol.* 81:322. doi: 10.1037/0022-3514.81.2.322
- Cripps, A. J., Hopper, L. S., and Joyce, C. (2019). Can coaches predict long-term career attainment outcomes in adolescent athletes? *Int. J. Sports Sci. Coach.* 14, 324–328. doi: 10.1177/1747954119848418
- Cuperman, R., and Ickes, W. (2009). Big Five predictors of behavior and perceptions in initial dyadic interactions: personality similarity helps extraverts and introverts, but hurts “disagreeables”. *J. Pers. Soc. Psychol.* 97:667. doi: 10.1037/a0015741
- Daids, K., Otte, F., and Rothwell, M. (2021). Adopting an ecological perspective on skill performance and learning in sport. *Eur. J. Hum. Mov.* 46:667. doi: 10.21134/eurjhm.2021.46.667
- De Moor, M., Beem, A., Stubbe, J., Boomsma, D., and De Geus, E. (2006). Regular exercise, anxiety, depression and personality: a population-based study. *Prev. Med.* 42, 273–279. doi: 10.1016/j.ypmed.2005.12.002
- de Moor, M. H. M., Costa, P. T., Terracciano, A., Krueger, R. F., de Geus, E. J. C., Toshiko, T., et al. (2012). Meta-analysis of genome-wide association studies for personality. *Mol. Psychiatry* 17, 337–349. doi: 10.1038/mp.2010.128
- DFB (2023). *DFB-Mitgliederstatistik 2021/2022*. Available online at: <https://www.dfb.de/verbandsstruktur/mitglieder/aktuelle-statistik/> (accessed July 5, 2023).
- Egan, S., and Stelmack, R. M. (2003). A personality profile of Mount Everest climbers. *Person. Ind. Differ.* 34, 1491–1494. doi: 10.1016/S0191-8869(02)00130-7
- Egloff, B., and Gruhn, A. J. (1996). Personality and endurance sports. *Pers. Individ. Dif.* 21, 223–229. doi: 10.1016/0191-8869(96)00048-7
- Emmonds, S., Heyward, O., and Jones, B. (2019). The challenge of applying and undertaking research in female sport. *Sports Med. Open* 5, 1–4. doi: 10.1186/s40798-019-0224-x
- Faul, F., Erdfelder, E., Lang, A.-G., and Buchner, A. (2007). G\* Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav. Res. Methods* 39, 175–191. doi: 10.3758/BF03193146
- Feingold, A. (1994). Gender differences in personality: a meta-analysis. *Psychol. Bull.* 116, 429. doi: 10.1037/0033-2909.116.3.429
- Fleming, E. G. (1934). Personality and the athletic girl. *Sch. Soc.* 39, 197–221.
- Furnham, A. (2018). *Personality and Occupational Success. The SAGE Handbook of Personality and Individual Differences*. 537–551.
- García-Naveira, A., Ruiz Barquín, R., and Pujals, C. (2011). Diferencias en personalidad en función de 575 la práctica o no deportiva, nivel de competición y categoría por edad en jugadores de fútbol 576 desde el modelo de Costa y McCrae. *Rev. Psicol. Deporte* 20, 29–44.
- García-Naveira, A., and Ruiz-Barquín, R. (2016). Diferencias en personalidad en función de la práctica o no deportiva y categoría por edad en jugadores de fútbol de rendimiento desde el modelo de Costa y McCrae. *Rev. Iberoamericana Psicol. Ejercicio Deporte* 11, 23–29.
- Giertz, J. (2014). *Von Helden und Einzelgängern*. Available online at: [https://www.focus.de/wissen/von-helden-und-einzelgaengern-torhueter-studie\\_id\\_1723135.html#:~:text=](https://www.focus.de/wissen/von-helden-und-einzelgaengern-torhueter-studie_id_1723135.html#:~:text= (accessed July 5, 2023).) (accessed July 5, 2023).
- Gil, S. M., Zabala-Lili, J., Bidaurragaza-Letona, I., Aduna, B., Lekue, J. A., Santos-Concejo, J., et al. (2014). Talent identification and selection process of outfield players and goalkeepers in a professional soccer club. *J. Sports Sci.* 32, 1931–1939. doi: 10.1080/02640414.2014.964290
- Goddard, K., Roberts, C.-M., Anderson, L., Woodford, L., and Byron-Daniel, J. (2019). Mental toughness and associated personality characteristics of Marathon des Sables athletes. *Front. Psychol.* 10:2259. doi: 10.3389/fpsyg.2019.02259
- Gorris, L., and Kubjuweit, D. (2008). *Spiegel interview with football legend Oliver Kahn: 'goalkeepers need an element of insanity'*. Available online at: <https://www.spiegel.de/international/germany/spiegel-interview-with-football-legend-oliver-kahn-goalkeepers-need-an-element-of-insanity-a-553495.html> (accessed March 1, 2023).
- Gyomber, N., Lenart, A., and Kovacs, K. (2013). Differences between personality characteristics and sport performance by age and gender. *Acta Facult. Educ. Univ. Comenianae* 53, 5–17.
- Hughes, M., Caudrelier, T., James, N., Redwood-Brown, A., Donnelly, I., Kirkbride, A., et al. (2012). Moneyball and soccer-an analysis of the key performance indicators of elite male soccer players by position. *J. Hum. Sport Exerc.* 7, 402–412. doi: 10.4100/jhse.2012.72.06
- Hughes, S., Case, H. S., Stuempfle, K., and Evans, D. (2003). Personality profiles of iditaspot ultra-marathon participants. *J. Appl. Sport Psychol.* 15, 256–261. doi: 10.1080/10413200305385
- Jackson, B., Dimmock, J. A., Gucciardi, D. F., and Grove, J. R. (2011). Personality traits and relationship perceptions in coach–athlete dyads: do opposites really attract? *Psychol. Sport Exerc.* 12, 222–230. doi: 10.1016/j.psychsport.2010.11.005
- Kirkcaldy, B. D. (1982). Personality profiles at various levels of athletic participation. *Pers. Individ. Dif.* 3, 321–326. doi: 10.1016/0191-8869(82)90052-6
- Laurin, R. (2009). The influence of the “Big Five” factors on the demands–abilities fit in soccer academies. *Percept. Mot. Skills* 109, 239–250. doi: 10.2466/pms.109.1.239-250
- Martin, J. J., Malone, L. A., and Hilyer, J. C. (2011). Personality and mood in women’s paralympic basketball champions. *J. Clin. Sport Psychol.* 5, 197–210. doi: 10.1123/jcsp.5.3.197
- McCrae, R. R., and Costa, P. T. (2008). “The five-factor theory of personality,” in *Handbook of Personality: Theory and Research*, eds. O. P. John, R. W. Robins, and L. A. Pervin (Guildford Press).
- McCrae, R. R., and Costa, P. T. (1987). Validation of the five factor-model of personality across instruments and observers. *J. Pers. Soc. Psychol.* 52, 81–90. doi: 10.1037/0022-3514.52.1.81
- McCrae, R. R., and Costa, P. T. (1999). “A five-factor theory of personality,” in *Handbook of Personality: Theory and Research*, eds. P. A. Lawrence, and J. P. Oliver (The Guilford Press).
- McCrae, R. R., and Costa, P. T. (2004). A contemplated revision of the NEO Five-Factor Inventory. *Pers. Individ. Dif.* 36, 587–596. doi: 10.1016/S0191-8869(03)00118-1
- McKelvie, S. J., Lemieux, P., and Stout, D. (2003). Extraversion and neuroticism in contact athletes, no contact athletes and non-athletes: a research note. *Athlet. Insight* 5, 19–27.
- Memmert, D., Hüttermann, S., Hagemann, N., Löffing, F., and Strauss, B. (2013). Dueling in the penalty box: evidence-based recommendations on how shooters and goalkeepers can win penalty shootouts in soccer. *Int. Rev. Sport Exerc. Psychol.* 6, 209–229. doi: 10.1080/1750984X.2013.811533
- Morgan, W. P., and Johnson, R. W. (1978). Personality characteristics of successful and unsuccessful oarsmen. *Int. J. Sport Psychol.* 9, 119–133.
- Navia, J. A., Van der Kamp, J., Avilés, C., and Aceituno, J. (2019). Self-control in aiming supports coping with psychological pressure in soccer penalty kicks. *Front. Psychol.* 10:1438. doi: 10.3389/fpsyg.2019.01438
- Newcombe, P. A., and Boyle, G. J. (1995). High School students’ sports personalities: variations across participation level, gender, type of sport, and success. *Int. J. Sport Psychol.* 26, 277–249.

- O'Reilly, N., Brunette, M., and Bradish, C. (2018). Lifelong female engagement in sport: a framework for advancing girls' and women's participation. *J. Appl. Sport Manag.* 10:6. doi: 10.18666/JASM-2017-V10-I2-8742
- O'Sullivan, D. M., Zuckerman, M., and Kraft, M. (1998). Personality characteristics of male and female participants in team sports. *Pers. Individ. Dif.* 25, 119–128. doi: 10.1016/S0191-8869(98)00036-1
- Otte, F., Davids, K., Millar, S., and Klatt, S. (2021). Understanding how athletes learn: integrating skill training concepts, theory and practice from an ecological perspective. *Appl. Coach. Res. J.* 7, 22–32.
- Otte, F., Dittmer, T., and West, J. (2022). Goalkeeping in modern football: current positional demands and research insights. *Int. Sport Coach. J.* 10, 112–120. doi: 10.1123/iscj.2022-0012
- Otte, F. W., Davids, K., Millar, S.-K., and Klatt, S. (2020a). When and how to provide feedback and instructions to athletes?—How sport psychology and pedagogy insights can improve coaching interventions to enhance self-regulation in training. *Front. Psychol.* 11:1444. doi: 10.3389/fpsyg.2020.01444
- Otte, F. W., Millar, S.-K., and Klatt, S. (2019). Skill training periodization in “specialist” sports coaching—an introduction of the “PoST” framework for skill development. *Front. Sports Act. Living* 1:61. doi: 10.3389/fspor.2019.00061
- Otte, F. W., Millar, S.-K., and Klatt, S. (2020b). How does the modern football goalkeeper train?—An exploration of expert goalkeeper coaches' skill training approaches. *J. Sports Sci.* 38, 1465–1473. doi: 10.1080/02640414.2019.1643202
- Otte, F. W., Millar, S.-K., and Klatt, S. (2020c). Ready to perform? A qualitative-analytic investigation into professional football goalkeepers' match warm-ups. *Int. J. Sports Sci. Coach.* 15, 324–336. doi: 10.1177/1747954120909956
- Piedmont, R. L., Hill, D. C., and Blanco, S. (1999). Predicting athletic performance using the five-factor model of personality. *Pers. Individ. Dif.* 27, 769–777. doi: 10.1016/S0191-8869(98)00280-3
- Piepora, P. (2021). Assessment of personality traits influencing the performance of men in team sports in terms of the big five. *Front. Psychol.* 12:679724. doi: 10.3389/fpsyg.2021.679724
- Piepora, P., Piepora, Z., and Bagińska, J. (2022a). Personality and sport experience of 20–29-year-old polish male professional athletes. *Front. Psychol.* 13:854804. doi: 10.3389/fpsyg.2022.854804
- Piepora, P., Reguli, Z., Witkowski, K., Maslinski, J., Dzioba, N., and Piepora, Z. (2022b). The personality traits of Polish junior and senior national team in Olympic karate and handball—comparative analysis. *Arch. Budo* 18, 37–45.
- Pillai, K. S. (1955). Some new test criteria in multivariate analysis. *Ann. Math. Stat.* 117–121. doi: 10.1214/aoms/1177728599
- Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychol. Bull.* 135:322. doi: 10.1037/a0014996
- Rebello-Gonçalves, R., Coelho-e-Silva, M. J., Severino, V., Tessitore, A., and Figueiredo, A. J. B. (2015). Anthropometric and physiological profiling of youth soccer goalkeepers. *Int. J. Sports Physiol. Perform.* 10, 224–231. doi: 10.1123/ijspp.2014-0181
- Rechner, M., and Memmert, D. (2010). Das technisch-taktische Anforderungsprofil des modernen Fußballtorwarts. *Leistungssport* 40, 32–37.
- Rhodes, R. E., and Smith, N. E. I. (2006). Personality correlates of physical activity: a review and meta analysis. *Br. J. Sports Med.* 40, 958–965. doi: 10.1136/bjsm.2006.028860
- Ruiz-Barquín, R. (2005). Análisis de las diferencias de personalidad en el deporte del judo a nivel competitivo en función de la variable sexo y categoría de edad deportiva. *Cuadernos Psicología Deporte* 5, 29–48.
- Ruiz-Barquín, R., and García-Naveira, A. (2013). Personalidad, edad y rendimiento deportivo en jugadores de fútbol desde el modelo de Costa y McCrae. *Anal. Psicol.* 29, 642–655. doi: 10.6018/analesps.29.3.175771
- Savelsbergh, G. J., Williams, A. M., Kamp, J. V. D., and Ward, P. (2002). Visual search, anticipation and expertise in soccer goalkeepers. *J. Sports Sci.* 20, 279–287. doi: 10.1080/026404102317284826
- Schmitt, D. P., Realo, A., Voracek, M., and Allik, J. (2008). Why can't a man be more like a woman? Sex differences in Big Five personality traits across 55 cultures. *J. Pers. Soc. Psychol.* 94:168. doi: 10.1037/0022-3514.94.1.168
- Sebbens, J., Hassmén, P., Crisp, D., and Wensley, K. (2016). Mental health in sport (MHS): improving the early intervention knowledge and confidence of elite sport staff. *Front. Psychol.* 7:911. doi: 10.3389/fpsyg.2016.00911
- Selimi, E., Lascu, A., Serpiello, F., and Woods, C. T. (2023). Exploring football coaches' views on coach education, role, and practice design: an Australian perspective. *PLoS ONE* 18:e0285871. doi: 10.1371/journal.pone.0285871
- Spielmann, J., Beavan, A., and Mayer, J. (2022). Personality in soccer: investigation of the five-factor model of personality in high-level athletes. *Front. Sports Act. Living* 4:896934. doi: 10.3389/fspor.2022.896934
- Sporis, G., Jukic, I., Ostojic, S. M., and Milanovic, D. (2009). Fitness profiling in soccer: physical and physiologic characteristics of elite players. *J. Strength Condit. Res.* 23, 1947–1953. doi: 10.1519/JSC.0b013e3181b3e141
- Steca, P., Baretta, D., Greco, A., D'Addario, M., and Monzani, D. (2018). Associations between personality, sports participation and athletic success. A comparison of Big Five in sporting and non-sporting adults. *Person. Ind. Differ.* 121, 176–183. doi: 10.1016/j.paid.2017.09.040
- Stephan, Y., Sutin, A. R., and Terracciano, A. (2014). Physical activity and personality development across adulthood and old age: evidence from two longitudinal studies. *J. Res. Pers.* 49, 1–7. doi: 10.1016/j.jrp.2013.12.003
- Sullivan, M. O., Woods, C. T., Vaughan, J., and Davids, K. (2021). Towards a contemporary player learning in development framework for sports practitioners. *Int. J. Sports Sci. Coach.* 16, 1214–1222. doi: 10.1177/17479541211002335
- Sutin, A. R., Stephan, Y., Luchetti, M., Artese, A., Oshio, A., and Terracciano, A. (2016). The five-factor model of personality and physical inactivity: a meta-analysis of 16 samples. *J. Res. Pers.* 63, 22–28. doi: 10.1016/j.jrp.2016.05.001
- Tabachnick, B. G., and Fidell, L. S. (2014). *Using Multivariate Statistics: Pearson New International Edition*. Boston, MA: Pearson.
- Tolea, M. I., Terracciano, A., Simonsick, E. M., Metter, E. J., Costa Jr, P. T., and Ferrucci, L. (2012). Associations between personality traits, physical activity level, and muscle strength. *J. Res. Pers.* 46, 264–270. doi: 10.1016/j.jrp.2012.02.002
- Trninić, V., Trninić, M., and Penezić, Z. (2016). Personality differences between the players regarding the type of sport and age. *Acta Kinesiol.* 10, 69–74.
- UEFA (2022). *Women's EURO Watched by Over 365 Million People Globally*. Available online at: <https://www.uefa.com/insideuefa/news/0278-15ff73f066e1-c729b5099cbb-1000--365-million-people-watch-women-s-euro-2022/> (accessed May 4, 2023).
- van der Kamp, J., Dicks, M., Navia, J. A., and Noël, B. (2018). Goalkeeping in the soccer penalty kick. *Germ. J. Exerc. Sport Res.* 48, 169–175. doi: 10.1007/s12662-018-0506-3
- Vaughan, J., Mallett, C. J., Potrac, P., Woods, C., O'Sullivan, M., and Davids, K. (2022). Social and cultural constraints on football player development in Stockholm: influencing skill, learning, and wellbeing. *Front. Sports Act. Living* 4:832111. doi: 10.3389/fspor.2022.832111
- Vaughan, R. S., and Edwards, E. J. (2020). Executive function and personality: the moderating role of athletic expertise. *Pers. Individ. Dif.* 161:109973. doi: 10.1016/j.paid.2020.109973
- West, J. (2018). A review of the key demands for a football goalkeeper. *Int. J. Sports Sci. Coach.* 13, 1215–1222. doi: 10.1177/1747954118787493
- White, A., Hills, S. P., Hobbs, M., Cooke, C. B., Kilduff, L. P., Cook, C., et al. (2020). The physical demands of professional soccer goalkeepers throughout a week-long competitive microcycle and transiently throughout match-play. *J. Sports Sci.* 38, 848–854. doi: 10.1080/02640414.2020.1736244
- Williams, L. R., and Parkin, W. A. (1980). Personality factor profiles of three hockey groups. *Int. J. Sport Psychol.* 11, 113–120. doi: 10.1037//0735-7028.11.1.113
- Wilson, K. E., and Dishman, R. K. (2015). Personality and physical activity: a systematic review and meta-analysis. *Pers. Individ. Dif.* 72, 230–242. doi: 10.1016/j.paid.2014.08.023
- Woolley, T., Crowther, R., Doma, K., and Connor, J. (2015). The use of spatial manipulation to examine goalkeepers' anticipation. *J. Sports Sci.* 33, 1766–1774. doi: 10.1080/02640414.2015.1014830



## OPEN ACCESS

## EDITED BY

Rubén Maneiro,  
Pontifical University of Salamanca, Spain

## REVIEWED BY

María Antonia Parra Rizo,  
Miguel Hernández University of Elche, Spain  
Carmen Galán Arroyo,  
University of Extremadura, Spain

## \*CORRESPONDENCE

Lu Guo  
✉ guol@bsu.edu.cn  
Junhua Dang  
✉ dangjunhua@gmail.com  
Zhi-Xiong Mao  
✉ zhxmiao@bsu.edu.cn

RECEIVED 13 May 2024

ACCEPTED 29 August 2024

PUBLISHED 10 September 2024

## CITATION

Sabri S, Zhang M-Y, Guo L, Dang J and Mao Z-X (2024) Effectiveness of school-based physical activity programs in enhancing attention, academic performance, and social relationships among children with intellectual disabilities: evidence from Pakistani schools. *Front. Psychol.* 15:1431890. doi: 10.3389/fpsyg.2024.1431890

## COPYRIGHT

© 2024 Sabri, Zhang, Guo, Dang and Mao. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Effectiveness of school-based physical activity programs in enhancing attention, academic performance, and social relationships among children with intellectual disabilities: evidence from Pakistani schools

Saima Sabri<sup>1</sup>, Mei-Yue Zhang<sup>1</sup>, Lu Guo<sup>1\*</sup>, Junhua Dang<sup>2,3\*</sup> and Zhi-Xiong Mao<sup>1\*</sup>

<sup>1</sup>School of Psychology, Beijing Sport University, Beijing, China, <sup>2</sup>Institute of Social Psychology, School of Humanities and Social Sciences, Xi'an Jiaotong University, Xi'an, China, <sup>3</sup>Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

Physical activity (PA) offers extensive benefits for all children, including those with intellectual disabilities (ID), who face significant challenges in behavioral management and psycho-social well-being. This study investigates the effects of school-based PA on attention, academic performance, and relationships with teachers and parents in children with ID. A 12-week single-blind randomized controlled trial was conducted with 102 children with ID, aged 6 to 12 years (71 boys and 31 girls) from grades 1 to 5. Participants were divided into three groups: MVPA (moderate to vigorous PA), MPA (mild PA), and NPA (no PA). Each group engaged in PA three times a week for 45 min per session, with activities planned by a fitness trainer and supervised by the researcher. Outcome measures were assessed using SNAP-IV, STRS, CPRS, and APRS scales before and after the intervention. The results indicated that MVPA had a more significant positive impact on all outcomes compared to MPA and NPA. MPA also produced notable improvements relative to NPA. These findings underscore the importance of integrating PA into educational settings as a comprehensive strategy to enhance attention, academic performance, and social interactions for children with ID. This research highlights PA as a vital tool for addressing behavioral challenges and fostering better developmental outcomes in this population.

## KEYWORDS

intellectual disability, physical activity, behavioral problems, attention, academic performance

## Background

Intellectual disability (ID) is one of the most common types of disability ([American Psychiatric Association, 2013](#)) and is defined by below-average mental ability and a lack of the analytical, social, and functional abilities required for normal living [[American Association on Intellectual and Developmental Disability \(AAIDD\), 2010](#)]. Great endeavor



has been put into designing various intervention programs promoting healthier development of children and adolescents with ID, with a special focus on enhancing parent-sensitive responsiveness and improving cognitive and social outcomes of those with ID in school settings (Guralnick, 2011; Guralnick, 2017). Given the benefits of consistent physical activity (PA) on one's physical and mental health have been firmly established (Kristen et al., 2017; Sabri et al., 2023), researchers have begun to investigate the interventional efficiency of PA for children and adolescents with ID (Jin et al., 2018; Salehpoor et al., 2015). A recently meta-analysis including 15 studies revealed that PA could dramatically improve psychological health (e.g., decreasing anxiety and depression while increasing self-esteem, with an effect size of Hedges'  $g = 0.54$ ) and cognitive functions (e.g., attention and inhibitory control, with an effect size of Hedges'  $g = 1.24$ ) of children and adolescents with ID, suggesting PA is a valuable interventional approach treating ID (Yang et al., 2022).

School-based physical activity (PA) programs, such as physical education (PE), offer a promising approach to supporting children with disabilities (Baron and Faubert, 2005; Filazoğlu-Çokluk et al., 2015; Nicholson et al., 2011; Savucu and Biçer, 2009). Research indicates that sports and motor activities in school can enhance cognitive abilities in children with intellectual disabilities (ID), including memory, attention, and executive skills (Goldstrom et al., 2010; Javan et al., 2014; Protic and Válková, 2018). Racket-sport interventions, in particular, have been shown to improve visual perception and executive functions in children with ID (Chen et al., 2015). However, whether these cognitive benefits translate into academic success remains an open question, as there are few studies directly examining the impact of PA on academic achievement. Existing evidence suggests that PA positively influences academic success in ID students, as they tend to be more engaged in classwork following PA sessions (Dandashi et al., 2015; Everhart et al., 2012). Beyond cognitive benefits, sports participation also addresses social skill deficits common among children with ID. These children often struggle with social skills, which can limit their involvement in social situations (Eriksson et al., 2007). Engaging in PA can improve social interactions and relationships for children with ID (Siperstein et al., 2009). Specifically, participation in school sports can enhance social competence and foster growth in these children (Brooks et al., 2015), and PA can lead to positive changes in their home and social environments (Savaş et al., 2016). Conversely, a lack of PA or an inactive lifestyle can diminish social cohesion and competence (Mehmet et al., 2018).

Despite evidence suggesting the positive impact of PA on mental and behavioral improvements in children with ID, existing studies exhibit several significant methodological limitations. For instance, there is a scarcity of randomized controlled trials, which hampers the ability to draw causal inferences. Additionally, many studies focus on only one type of ID, limiting the generalizability of their findings. Exercise programs in these studies often lack details regarding the types of exercises, their durations, and repetitions, making it challenging to replicate or compare outcomes. Furthermore, most research has been conducted in developed countries or territories, such as France and Hong Kong, raising questions about the applicability of these findings to developing or underdeveloped countries like Pakistan. These methodological shortcomings highlight a significant research gap and underscore the need for more

comprehensive and rigorously designed studies to better understand how PA influences the healthy development of children with ID.

Therefore, the current paper aims to fill this gap by employing a randomized controlled trial design to test 1) whether the beneficial effect PA on cognitive functions such as attention could be generalized to an ID sample from Pakistan; 2) whether such effect could transfer to academic performance; and 3) whether PA also brings positive effect for children and adolescents with ID on social interaction skills manifested as improved relationship with their teachers and parents.

## Methods

### Participants

The present study was conducted in three special schools in Rahim Yar Khan, Punjab Pakistan (Rahim Yar Khan, Sadiqabad, and Khanpur District). A total of 102 participants from grades 1 to 5, with an age range of 6–12, enrolled in the study. All individuals diagnosed with intellectual disabilities (ID) by qualified school personnel, according to DSM-5 criteria, exhibit characteristics such as an IQ score of 70 or lower, significant impairments in intellectual functioning (including reasoning, problem-solving, planning, abstract thinking, and both academic and experiential learning), and deficits in adaptive functioning that result in failure to meet socio-cultural standards (e.g., lack of judgment) associated with intellectual impairments. Initially, 353 participants were considered for the study. However, 251 were excluded for the following reasons: (1) 81 did not meet DSM-5 criteria for ID; (2) 23 had previously participated in PA or exercise programs; (3) 51 were unwilling to participate; (4) 39 were outside the required age range; (5) 48 had family-related concerns that could affect participation; and (6) 9 were using medication that could potentially impair physical performance. Ultimately, 102 participants were selected for the experiment, comprising 61 individuals with a diagnosis of Mild ID and 41 individuals with a diagnosis of Moderate ID. This sample was carefully chosen to ensure accurate representation across the specified ages and educational levels. Detailed characteristics of the study sample are provided in the [Supplementary Table S1](#).

Permission was obtained from the relevant authorities, including the local District Education Directorate, school management, and teachers. The study was approved by the ethics committee of Beijing Sport University. Additionally, informed consent was secured from the parents of all participating children. [Figure 1](#) illustrates the flow chart of the study.

### Study design and procedure

With a single-blind 12-week randomized controlled trial design, this study examined the effect of a school-based PA intervention program on behavioral improvements in attention, academic performance, and student-teacher relationship in children with ID. Participants were divided into three groups and matched by age, grade, and level of ID (i.e., mild or moderate). One group received a moderate to vigorous physical activity (MVPA) intervention; one group received a mild physical activity (MPA) intervention; and the final group, as the control group, did not receive a physical activity intervention (NPA). The exercise program was designed and executed

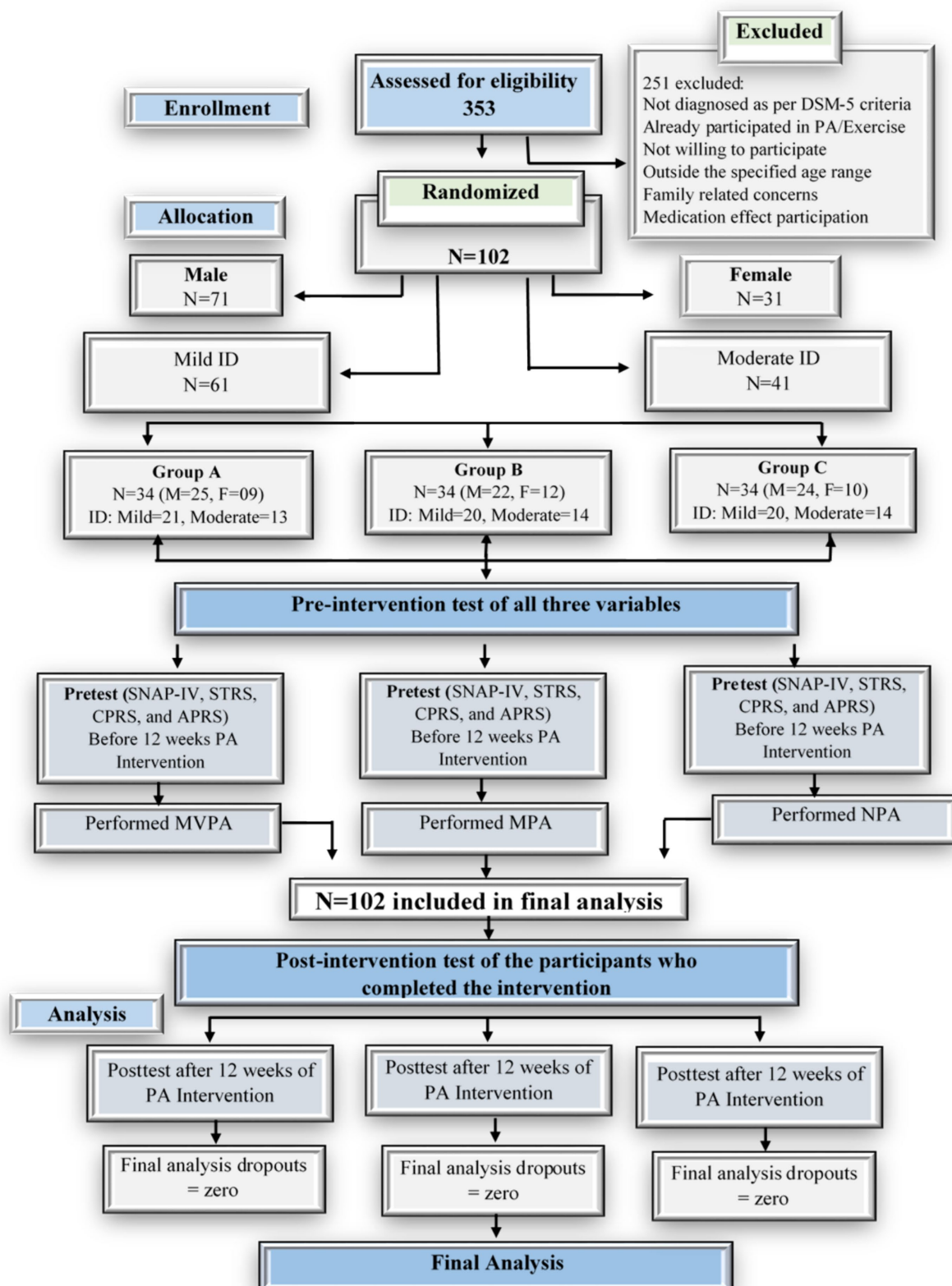


FIGURE 1

CONSORT flow diagram of research participants. ID, Intellectual Disability; PA, Physical Activity; SNAP-IV, Swanson, Nolan, and Pelham, Version IV scale; STRS, Student-Teacher Relationship Scale; CPRS, Child-Parent Relationship Scale; APRS, Academic Performance Rating Scale; MVPA, Moderate to Vigorous Physical Activity; MPA, Mild Physical Activity; NPA, No Physical Activity.

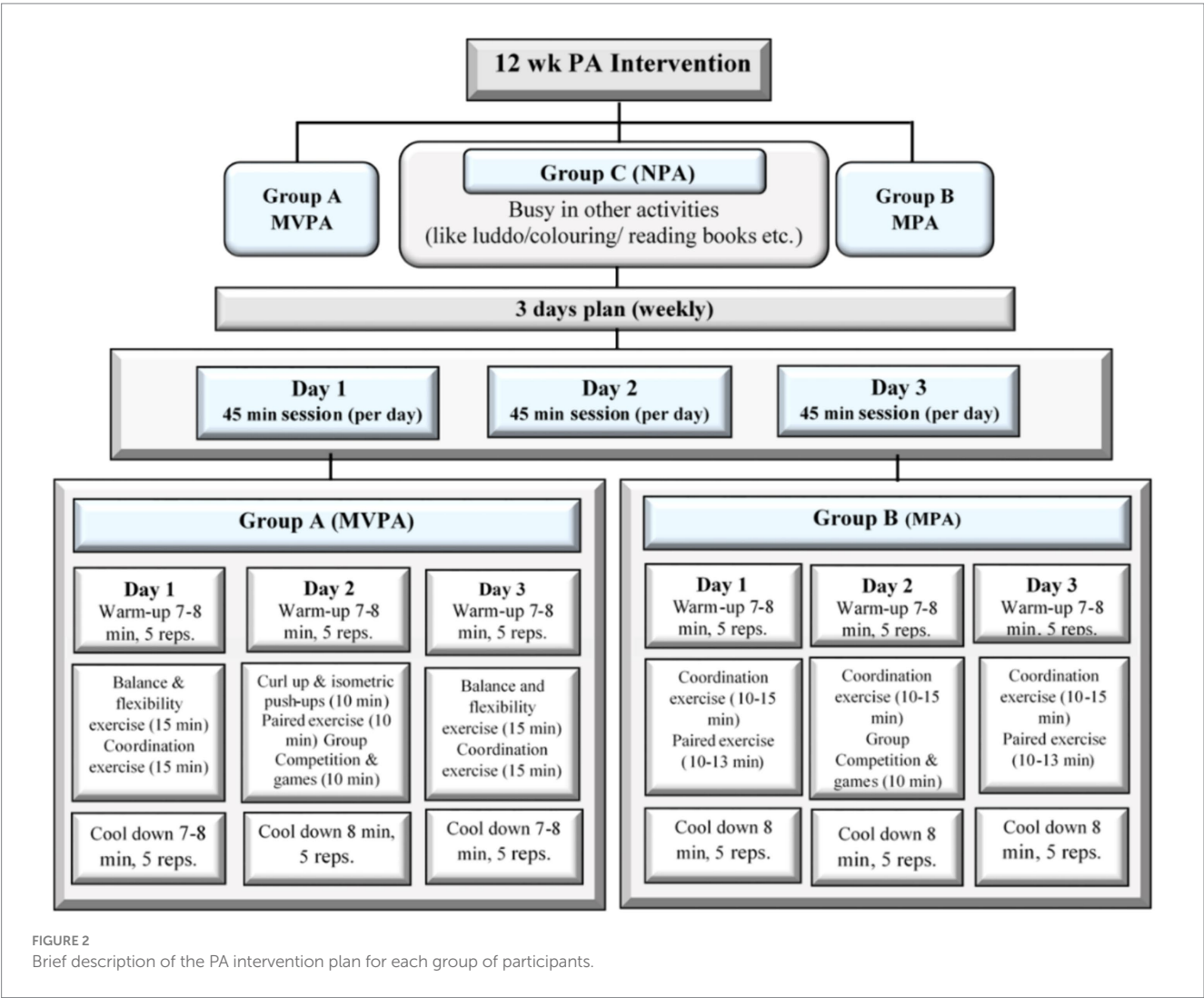
by a fitness trainer and monitored by the researcher. In particular, the 12-week PA intervention was executed 3 days per week, 45 min per day. Classification of exercise groups (MVPA & MPA) was determined on the basis of the selection, intensity, repetitions, duration and number of exercises performed each specified day. Exercise intensity was determined using the talk test, a simple method for measuring relative intensity. It is a valid, accurate, realistic, and cost-effective method for administering and tracking exercise intensity (Reed and Pipe, 2014). The intervention plan for the three groups is shown in Figure 2, which includes warm-up and cool-down exercises, balancing and flexibility exercises, modified curl-up and isometric pushups, coordination exercises, paired exercises, and group competitions and games. Details of the exercises performed by the MVPA group and the MPA group according to exercise type and intensity are given in the Supplementary material. Valid instruments were applied to parents and teachers before and after the PA program to measure dependent variables.

### Instruments

Swanson, Nolan, and Pelham, Version IV scale (SNAP-IV) was completed by both teachers and parents to determine the level of

attention of ID children. The SNAP-IV is widely used to screen for attention deficit and hyperactivity disorder (ADHD) (Swanson, 1992; Swanson et al., 1983). It consists of 26 items, and each item is scored on a four-point scale: 0 = not at all, 1 = just a little, 2 = quite a bit, and 3 = very much. The questionnaire is designed for children aged 6 to 18 years and takes approximately 10 min to complete (Costa et al., 2018; Yang et al., 2014). Although the SNAP-IV is frequently used in school-based, non-clinical settings (Bussing et al., 2008), current data also supports its validity in children with ID. Research has demonstrated strong psychometric properties, including high reliability and concurrent validity, as evidenced by positive correlations with other ADHD rating scales (Michael et al., 2004a,b). Additionally, the SNAP-IV subscales exhibit adequate internal consistency, which supports their use in this population and underscores their potential for broad applicability (Zieff et al., 2023).

Academic performance was measured by the Academic Performance Rating Scale (APRS), a teacher report scale used to measure the academic performance of a child with ID (Topor et al., 2010). The APRS consists of 19 items on which that teachers rate a child's academic abilities and behaviors in the classroom on a scale ranging from 1 (never or poor) to 5 (quite common or excellent) (e.g., "What is the quality of this child's reading skills?").



The *Student-Teacher Relationship Scale* (STRS) was used to measure the relationship between ID children and their teachers (Sanja, 2017; Seven and Ogleman, 2014). The STRS consists of 15 self-report items completed by teachers that use a 5-point Likert scale to gain an understanding of a teacher's relationship with a student, the interpersonal conduct of a student with the teacher, and the confidence of a teacher in knowing the feelings of the student toward the teacher (e.g., "This child and I always seem to be struggling with each other."). Low scores indicate less conflicts and better relationships.

The *Child-Parent Relationship Scale* (CPRS) was used to measure the relationship between ID children and their parents (Driscoll and Pianta, 2011; Dyer et al., 2017). The CPRS is a self-report instrument consisting of 15 items completed by parents who evaluate their relationship with their child on a 5-point Likert scale (e.g., "My child is uncomfortable with physical affection or touch from me."). Low scores indicate less conflicts and better relationships.

### Statistical analysis

A series of 2 (Intervention group: MVPA vs. MPA vs. NPA; Between-subject) by 2 (Time: Pretest vs. Posttest; Within-subject) ANOVAs with scores on SNAP-IV, APRS, STRS, and CPRS as dependent variables were conducted by using the SPSS. If an interaction were found, the simple effects test and post-hoc comparisons were then conducted to examine the specific pattern.

### Results

Table 1 shows the descriptive statistics of pretest and posttest scores on SNAP-IV, APRS, STRS, and CPRS total points and subscales. For SNAP-IV, a lower score indicates better attention, and a higher score indicates more attention deficiency. A decrease in scores from pretest to posttest means improvement of attention. For APRS, a higher score indicates better academic performance. For STRS and CPRS, a lower score indicates less conflict and a better relationship. A decrease in scores from pretest to posttest indicates an improvement in the relationship. A series of 2 (Intervention group: MVPA vs. MPA vs. NPA; Between-subject) by 2 (Time: Pretest vs. Posttest; Within-subject) ANOVAs with repeated measures were conducted by using the SPSS.

#### Changes in teacher-reported attention deficiency (SNAP-IV)

The ANOVA with teacher-reported scores on SNAP-IV yielded a significant main effect of time,  $F(1, 99) = 241.18, p < 0.001, \eta_p^2 = 0.71$ , a main effect of intervention group,  $F(2, 99) = 25.19, p < 0.001, \eta_p^2 = 0.34$ , and an interaction between time and intervention group,  $F(2, 99) = 63.84, p < 0.001, \eta_p^2 = 0.56$ . The simple effects test found that attention deficiency decreased significantly from pretest to posttest in the MVPA group,  $F(1, 99) = 278.53, p < 0.001, \eta_p^2 = 0.74$ , and the MPA group,  $F(1, 99) = 89.79, p < 0.001, \eta_p^2 = 0.48$ . However, attention deficiency remained unchanged in the NPA group,  $F(1, 99) = 0.54, p = 0.465, \eta_p^2 = 0.01$ . Post-hoc comparison showed that the decrease of the MVPA group was higher than the other two groups ( $ps < 0.001$ )

TABLE 1 Descriptive statistics of SNAP-IV, APRS, STRS, and CPRS.

SNAP-IV	SNAP-IV (TR)		SNAP-IV (PR)	
	Pretest	Post test	Pretest	Post test
MVPA ( $n = 34$ )	41.82 ± 2.66	33.79 ± 2.90	41.88 ± 2.99	33.88 ± 3.19
MPA ( $n = 34$ )	41.85 ± 2.60	37.29 ± 3.47	42.03 ± 2.70	37.35 ± 3.69
NPA ( $n = 34$ )	42.00 ± 2.13	41.65 ± 2.41	42.03 ± 2.33	41.82 ± 2.15

APRS	APRS	
	Pretest	Post test
MVPA ( $n = 34$ )	46.06 ± 4.59	50.41 ± 4.60
MPA ( $n = 34$ )	46.06 ± 4.80	48.09 ± 5.36
NPA ( $n = 34$ )	46.00 ± 2.09	46.38 ± 2.48

	STRS (TR) & CPRS (PR)	
	Pretest	Post test
STRS		
MVPA ( $n = 34$ )	48.82 ± 2.66	42.76 ± 3.52
MPA ( $n = 34$ )	48.20 ± 3.05	44.44 ± 3.72
NPA ( $n = 34$ )	45.79 ± 1.90	45.58 ± 2.07
CPRS		
MVPA ( $n = 34$ )	49.23 ± 2.74	42.91 ± 3.66
MPA ( $n = 34$ )	47.76 ± 2.42	44.35 ± 2.41
NPA ( $n = 34$ )	45.79 ± 2.05	45.50 ± 2.19

TR, Teachers' ratings; PR, Parents' ratings.

and the decrease of the MPA group was also higher than the NPA group ( $p < 0.001$ ), indicating both PA groups gained attention improvement and the MVPA group gained the highest.

#### Changes in parent-reported attention deficiency (SNAP-IV)

The ANOVA with parent-reported scores on SNAP-IV yielded very similar results, a significant main effect of time,  $F(1, 99) = 228.47, p < 0.001, \eta_p^2 = 0.70$ , a main effect of intervention group,  $F(2, 99) = 22.17, p < 0.001, \eta_p^2 = 0.31$ , and an interaction between time and intervention group,  $F(2, 99) = 63.18, p < 0.001, \eta_p^2 = 0.56$ . The simple effects test found that attention deficiency decreased significantly from pretest to posttest in the MVPA group,  $F(1, 99) = 264.32, p < 0.001, \eta_p^2 = 0.73$ , and the MPA group,  $F(1, 99) = 90.32, p < 0.001, \eta_p^2 = 0.48$ . However, attention deficiency remained unchanged in the NPA group,  $F(1, 99) = 0.18, p = 0.677, \eta_p^2 = 0.00$ . Post-hoc comparison showed that the decrease of the MVPA group was higher than the other two groups ( $ps < 0.001$ ) and the decrease of the MPA group was also higher than the NPA group ( $p < 0.001$ ).

#### Changes in academic performance (APRS)

The ANOVA with teacher-reported scores on APRS revealed a significant main effect of time,  $F(1, 99) = 53.05, p < 0.001, \eta_p^2 = 0.35$ . The main effect of intervention group was not significant,  $F(2, 99) = 2.37,$



$p = 0.099$ ,  $\eta_p^2 = 0.05$ . However, the interaction between time and intervention group was significant,  $F(2, 99) = 12.94$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.21$ . The simple effects test found that academic performance increased significantly from pretest to posttest in the MVPA group,  $F(1, 99) = 64.22$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.39$ , and the MPA group,  $F(1, 99) = 13.96$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.12$ . However, academic performance remained unchanged in the NPA group,  $F(1, 99) = 0.75$ ,  $p = 0.388$ ,  $\eta_p^2 = 0.01$ . Post-hoc comparison showed that the increase of the MVPA group was higher more than the MPA group ( $p = 0.003$ ) and the NPA group ( $p < 0.001$ ). The increase of the MPA group was also higher than the NPA group ( $p = 0.045$ ).

## Changes in student-teacher relationship (STRS)

The ANOVA with teacher-reported scores on STRS yielded a significant main effect of time,  $F(1, 99) = 146.66$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.60$ , and an interaction between time and intervention group,  $F(2, 99) = 38.04$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.44$ . The main effect of intervention group was not significant,  $F(2, 99) = 0.60$ ,  $p = 0.549$ ,  $\eta_p^2 = 0.01$ . The simple effects test found that STRS scores decreased significantly from pretest to posttest in the MVPA group,  $F(1, 99) = 160.56$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.62$ , and the MPA group,  $F(1, 99) = 61.99$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.39$ . However, STRS scores remained unchanged in the NPA group,  $F(1, 99) = 0.19$ ,  $p = 0.668$ ,  $\eta_p^2 = 0.00$ . Post-hoc comparison showed that the decrease of the MVPA group was higher than the other two groups ( $ps < 0.001$ ) and the decrease of the MPA group was also higher than the NPA group ( $p < 0.001$ ), indicating both PA groups gained relationship improvement and the MVPA group gained the highest.

## Changes in child–parent relationship (CPRS)

The ANOVA with parent-reported scores on CPRS yielded a significant main effect of time,  $F(1, 99) = 137.85$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.58$ , and an interaction between time and intervention group,  $F(2, 99) = 37.38$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.43$ . The main effect of intervention group was not significant,  $F(2, 99) = 0.41$ ,  $p = 0.665$ ,  $\eta_p^2 = 0.01$ . The simple effects test found that CPRS scores decreased significantly from pretest to posttest in the MVPA group,  $F(1, 99) = 164.40$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.62$ , and the MPA group,  $F(1, 99) = 47.86$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.33$ . However, CPRS scores remained unchanged in the NPA group,  $F(1, 99) = 0.36$ ,  $p = 0.552$ ,  $\eta_p^2 = 0.00$ . Post-hoc comparison showed that the decrease of the MVPA group was higher than the other two groups ( $ps < 0.001$ ) and the decrease of the MPA group was also higher than the NPA group ( $p < 0.001$ ), indicating both PA groups gained relationship improvement and the MVPA group gained the highest.

## Discussion

The current paper employed a randomized controlled trial design to test whether the PA has a positive effect on cognitive functions in children with ID living in Pakistan, whether such effect could transfer to academic performance, and whether PA also improves their social interaction skills. The results revealed significant differences between pre-and posttest scores on the SNAP-IV, APRS, STRS, and CPRS after

PA execution, indicating a significant improvement in the level of attention, academic performance, student-teacher relationship, and child–parent relationship.

Previous studies have consistently showed the beneficial effect of PA on cognitive functions (e.g., attention and inhibitory control) in developed countries/territories, with a large average effect ( $g > 1.00$  or  $\eta_p^2 > 0.20$ ) (Yang et al., 2022). In our study conducted in a Pakistani sample, the significant changes in scores on SNAP-IV in both MVPA and MPA groups compared to the NPA group showed that engaging ID children in PA produced a great positive effect on their level of attention, which replicated previous findings in the domain of cognitive functions with a comparable level of effect size. Meanwhile, a more pronounced score difference in the MVPA group suggested that the level of attention improvement was closely related to the intensity of PA. Based on these findings, it is highly encouraging to integrate PA into the lives of individuals with ID to improve their physical and cognitive well-being.

Furthermore, we found the beneficial effect of PA could also transfer from attention to academic performance. However, the mechanism of such behavioral modification is not clear and requires further investigation to fully understand the link between PA and academic performance. According to some researchers, PA lowers levels of stress and anxiety, which in turn improves attention to complete academic tasks, complete schoolwork, and learn more effectively (Ibis and Aktug, 2018; Yilmaz and Soyer, 2018). Alternatively, others also pointed out the crucial role of PA interventions in promoting the development of intelligence and self-control of school-aged children (Tomprowski et al., 2007; Farhangi and Alamdarloo, 2015).

Finally, according to the teachers and the parents of the ID children who participated in the study, there was a substantial drop between pre and posttest scores on the STRS and CPRS, with a lower score indicating a better relationship and less conflict. Higher STRS and CPRS score disparities between the MVPA and NPA groups compared to the differences between the MVPA and MPA groups also demonstrated that PA intensity had a significant impact on the degree of improvement in ID children's relationships with their teachers and parents. Although MVPA had the greatest favorable effect, the significance of MPA cannot be overlooked, therefore both therapies are useful and can improve the degree of social relationships. Taken together, these results showed that school games have a favorable impact on children with ID's quality of life as well as their physical, social, cognitive, and emotional development, which increases our confidence that participation in daily PA can be utilized as an alternate method of coping with the behavioral and emotional problems of children with ID.

Our research stands out in the field due to several distinct strengths compared to similar studies. In terms of internal validity, we implemented a rigorous participant selection process, including only children who had not participated in any PA programs in the months leading up to the study. This approach effectively controls for confounding factors related to prior PA levels (Farhangi and Alamdarloo, 2015). Our study achieved a 0% dropout rate, demonstrating exceptional participant retention and engagement, which contrasts with high dropout rates observed in previous research (Savaş et al., 2016) and ensures the consistency of our data. Additionally, unlike prior studies (Everhart et al., 2012), our PA program was led by a single fitness trainer for all participants,

minimizing variability and ensuring uniformity in training. Regarding external validity, we designed a school-based PA intervention to evaluate its impact on children with ID. By integrating PA into classroom activities, our approach aims to engage ID students during school hours, which has significant practical implications (Protic and Váľková, 2018; Everhart et al., 2012). We meticulously detailed each exercise program, including both mild and vigorous PA, to provide a comprehensive understanding of which types of exercise yield the most significant effects. This level of detail is often overlooked in similar research (Ilkım et al., 2018). These combined features enhance the reliability and validity of our study, making a substantial contribution to the field of PA interventions for children with ID.

Future research should expand the geographical scope to include all districts of Pakistan, which will help address regional differences and enhance the generalizability of the findings. Additionally, studies should involve participants from a wider age range beyond just primary school students to assess whether the effects of PA remain consistent across different developmental stages. Comparative studies are also recommended to examine the impact of PA on children with various disabilities to determine if the benefits are similar across different special needs groups.

Moreover, future studies should explore a variety of exercise modalities to identify which types of exercise produce the most significant behavioral improvements in children with ID. Longitudinal research is necessary to evaluate the long-term effects of PA on behavioral changes. Additionally, tailored PA programs should be designed and tested to determine the most effective strategies for enhancing behavioral outcomes within classroom and school settings. Addressing these areas will provide a more comprehensive understanding of how PA influences behavioral and academic achievement, ultimately leading to more effective interventions and educational methods.

Our findings also offer valuable insights for a range of professionals, including sports psychologists, physiotherapists, researchers, sports coaches, clinical psychologists, and psychiatrists. For sports psychologists and coaches, the research provides strategies to enhance student engagement and performance. Physiotherapists can adapt their therapies to support behavior modification, while clinical psychologists and psychiatrists can incorporate PA into their treatment plans. Researchers will benefit from a solid foundation for future research, promoting a multidisciplinary approach to improving outcomes for students with special needs.

## Conclusion

Our results indicate that PA can significantly enhance attention, academic performance, and social relationships among children with ID. The PA intervention yielded promising outcomes, with notable improvements observed across all measured variables. This suggests that school-based PA programs are effective in boosting the well-being of children and adolescents with ID.

However, further experimental research is needed to identify the optimal combination of exercise types and durations. It is advisable for educational institutions to incorporate PA into their curricula and provide targeted training for educators to facilitate successful implementation. Additionally, fostering multidisciplinary collaboration among parents, teachers, and healthcare professionals will enable the development of personalized PA interventions. This

approach can enhance educational outcomes and promote a more inclusive learning environment for students with ID.

## Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: [https://osf.io/es8ax/?view\\_only=1518767499c2492985d91a88b7f0d0d0](https://osf.io/es8ax/?view_only=1518767499c2492985d91a88b7f0d0d0).

## Ethics statement

The studies involving humans were approved by School of Psychology, Beijing Sport University. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

SS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. M-YZ: Validation, Writing – review & editing. LG: Supervision, Validation, Writing – review & editing. JD: Formal analysis, Supervision, Validation, Writing – review & editing. Z-XM: Conceptualization, Project administration, Supervision, Validation, Writing – review & editing.

## Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. JD is supported by National Nature Science Foundation of China (Project 31871098).

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2024.1431890/full#supplementary-material>

## References

- American Association on Intellectual and Developmental Disability (AAIDD) (2010). Intellectual disability: Definition, classification, and systems of supports. 11th Edn. Washington, DC: American Association on Intellectual and Developmental Disability (AAIDD).
- American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders. 5th Edn. Washington, DC: American Psychiatric Association.
- Baron, L. J., and Faubert, C. (2005). The role of Tai Chi Chuan in reducing state anxiety and enhancing mood of children with special needs. *J. Bodyw. Mov. Ther.* 9, 120–133. doi: 10.1016/j.jbmt.2004.03.004
- Brooks, B. A., Floyd, F., Robins, D. L., and Chan, W. Y. (2015). Extracurricular activities and the development of social skills in children with intellectual and learning disabilities. *J. Intellect. Disabil. Res.* 59, 678–687.
- Bussing, R., Fernandez, M., Harwood, M., Hou, W., Garvan, C. W., Eyberg, S. M., et al. (2008). Parent and teacher SNAP-IV ratings of attention deficit hyperactivity disorder symptoms: psychometric properties and normative ratings from a school district sample. *Assessment* 15, 317–328. doi: 10.1177/1073191107313888
- Chen, M. D., Tsai, H. Y., Wang, C. C., and Wuang, Y. P. (2015). The effectiveness of racket-sport intervention on visual perception and executive functions in children with mild intellectual disabilities and borderline intellectual functioning. *Neuropsychiatr. Dis. Treat.* 11, 2287–2297. doi: 10.2147/NDT.S89083
- Costa, D. S., de Paula, J. J., Malloy-Diniz, L. F., Romano-Silva, M. A., and Miranda, D. M. (2018). Parent SNAP-IV rating of attention-deficit/hyperactivity disorder: accuracy in a clinical sample of ADHD, validity, and reliability in a Brazilian sample. *J. Pediatr.* 95, 736–743. doi: 10.1016/j.jpeds.2018.06.014
- Dandashi, A., Karkar, A. G., Saad, S., Barhoumi, Z., Al-Jaam, J., and Saddik, A. E. (2015). Enhancing the cognitive and learning skills of children with intellectual disability through physical activity and edutainment games. *Int. J. Distrib. Sens. Netw.* 11:165165. doi: 10.1155/2015/165165
- Driscoll, K., and Pianta, R. C. (2011). Mothers' and fathers' perceptions of conflict and closeness in parent-child relationships during early childhood. *J. Early Childhood Infant Psychol.* 7, 1–24.
- Dyer, W. J., Kaufman, R., and Fagan, J. (2017). Father-child closeness and conflict: validating measures for nonresident fathers. *J. Fam. Psychol.* 31, 1074–1080. doi: 10.1037/fam0000384
- Eriksson, L., Welander, J., and Granlund, M. (2007). Participation in everyday school activities for children with and without disabilities. *J. Dev. Phys. Disabil.* 19, 485–502. doi: 10.1007/s10882-007-9065-5
- Everhart, B., Dimon, C., Stone, D., Desmond, D., and Casilio, M. (2012). The influence of daily structured physical activity on academic progress of elementary students with intellectual disabilities. *Education* 133, 298–312.
- Farhangi, F., and Alamdarloo, G. H. (2015). Effect of sports activities on behavioral-emotional problems of students with intellectual disability. *Phys. Treat.* 5, 145–152. doi: 10.15412/J.PTJ.07050304
- Filazoglu-Çokluk, G., Kirimoğlu, H., Öz, A., and İlhan, E. (2015). The effects of physical education and sports on the self-concept of the children with mild mental disabilities. *Int. J. Sci. Cult. Sport.* 3, 55–72. doi: 10.14486/IJSCS258
- Goldstrom, Y., Korman, D., Goldstrom, I., and Bendavid, J. (2010). The effect of rhythmic exercise on cognition behavior of maltreated children: a pilot study. *J. Bodyw. Mov. Ther.* 15, 326–334. doi: 10.1016/j.jbmt.2010.06.006
- Guralnick, M. J. (2011). Why early intervention works: a systems perspective. *Infants Young Child.* 24, 6–28. doi: 10.1097/IYC.0b013e3182002cfe
- Guralnick, M. J. (2017). Early intervention for children with intellectual disabilities: an update. *J. Appl. Res. Intellect. Disabil.* 30, 211–229. doi: 10.1111/jar.12233
- Ibis, S., and Aktug, Z. B. (2018). The effects of sports on the attention level and academic success in children. *Educ. Res. Rev.* 13, 106–110. doi: 10.5897/ERR2017.3455
- Ilkm, M., Tanır, H., and Özdemir, M. (2018). Socialization effect of physical activity in students who need special education. *Asian J. Educ. Train.* 4, 128–131. doi: 10.20448/journal.522.2018.42.128.131
- Javan, A. T., Framarzi, S., Abedi, A., and Nattaj, F. H. (2014). Effectiveness of rhythmic play on the attention and memory functioning in children with mild intellectual disability (MID). *Int. Let. Soc. Human. Sci.* 17, 9–21. doi: 10.18052/www.scipress.com/ILSHS.17.9
- Jin, J., Yun, J., and Agiovlasis, S. (2018). Impact of enjoyment on physical activity and health among children with disabilities in schools. *Disabil. Health J.* 11, 14–19. doi: 10.1016/j.dhjo.2017.04.004
- Kristen, E. C., Philip, J. M., Ronald, C. P., Ryan, M. H., and David, R. L. (2017). Psychological, social and physical environmental mediators of the scores intervention on physical activity among children living in low-income communities. *Psychol. Sport Exerc.* 32, 1–11. doi: 10.1016/j.psychsport.2017.05.001
- Mehmet, O., Mehmet, I., and Halil, T. (2018). The effect of physical activity on social adaptation and skills development in mentally disabled individuals. *Eur. J. Phys. Educ. Sports Sci.* 4:1146903. doi: 10.5281/zenodo.1146903
- Michael, L. M., Virginia, E. F., and Amanda, K. N. (2004a). Psychometric properties of ADHD rating scales among children with mental retardation I: reliability. *Res. Dev. Disabil.* 25, 459–476. doi: 10.1016/j.ridd.2003.11.003
- Michael, L. M., Virginia, E. F., and Christie, J. J. (2004b). Psychometric properties of ADHD rating scales among children with mental retardation. *Res. Dev. Disabil.* 25, 477–492. doi: 10.1016/j.ridd.2003.11.002
- Nicholson, H., Kehle, T. J., Bray, M. A., and Heest, J. V. (2011). The effects of antecedent physical activity on the academic engagement of children with autism spectrum disorder. *Psychol. Sch.* 48, 198–213. doi: 10.1002/pits.20537
- Protic, M., and Válková, H. (2018). The relationship between executive functions and physical activity in children with an intellectual disability. *Journal of physical education and sport*, 18(2). *Art* 125, 844–852. doi: 10.7752/jpes.2018.02125
- Reed, J. L., and Pipe, A. L. (2014). The talk test: a useful tool for prescribing and monitoring exercise intensity. *Curr. Opin. Cardiol.* 29, 475–480.
- Sabri, S., Rashid, N., and Mao, Z. X. (2023). Physical activity and exercise as a tool to cure anxiety and posttraumatic stress disorder. *Ment. Illn.* 2023:4294753. doi: 10.1155/2023/4294753
- Salehpour, M., Salesi, M., and Alamdarloo, G. (2015). The effect of exercise on anxiety of adolescents with intellectual disability. *Phys. Treat.* 5, 25–32.
- Sanja, T. V. (2017). Psychometric properties of student-teacher relationship scale-short form: Croatian validation study from preschool education context. *Proceedings of ICERI2017 conference 16th-18th November, Seville, Spain.*
- Savaş, D., Hatice, D. S., and Merve, C. (2016). The impact of physical activity on socializing mentally handicapped children. *Int. J. Human. Soc. Sci. Invent.* 5, 49–51.
- Savucu, Y., and Biçer, S. Y. (2009). Significance of the physical activities in individuals with mentally retardation: review. *Turkiye Klinikleri J. Sports Sci.* 1, 117–122.
- Seven, S., and Ogleman, H. G. (2014). The reliability-validity studies for the student-teacher relationship scale (STRS). *Eur. J. Educ. Res.* 2:179. doi: 10.15527/ejre.201426262
- Siperstein, G., Glick, G., and Parker, R. (2009). Social inclusion of children with intellectual disabilities in a recreational setting. *Intell. Dev. Disabil.* 47, 97–107. doi: 10.1352/1934-9556-47.2.97
- Swanson, J. M. (1992). School-based assessments and interventions for ADD students. Irvine, CA: K. C. Publishing.
- Swanson, J. M., Sandman, C. A., Deutsch, C., and Barren, M. (1983). Methylphenidate (Ritalin) given with or before breakfast: I. Behavioral, cognitive, and electrophysiological effects. *Pediatrics* 72, 49–55.
- Tomporowski, P. D., Davis, C. L., Miller, P. H., and Naglieri, J. A. (2007). Exercise and children's intelligence, cognition, and academic achievement. *Educ. Psychol. Rev.* 20, 111–131. doi: 10.1007/s10648-007-9057-0
- Topor, D. R., Keane, S. P., Shelton, T. L., and Calkins, S. D. (2010). Parent involvement and student academic performance: a multiple mediational analysis. *J. Prev. Interv. Community* 38, 183–197. doi: 10.1080/10852352.2010.486297
- Yang, M.-T., Lee, W.-T., Liang, J.-S., Lin, Y.-J., Fu, W.-M., and Chen, C.-C. (2014). Hyperactivity and impulsivity in children with untreated allergic rhinitis: corroborated by rating scale and continuous performance test. *Pediatrics Neonatol.* 55, 168–174. doi: 10.1016/j.pedneo.2013.09.003
- Yang, W., Liang, X., and Sit, C. H. P. (2022). Physical activity and mental health in children and adolescents with intellectual disabilities: a meta-analysis using the RE-AIM framework. *Int. J. Behav. Nutr. Phys. Act.* 19:80. doi: 10.1186/s12966-022-01312-1
- Yilmaz, A., and Soyer, F. (2018). Effect of physical education and play applications on school social behaviors of mild-level intellectually disabled children. *Educ. Sci.* 8:89. doi: 10.3390/educsci8020089
- Zieff, M. R., Hoogenhout, M., Eastman, E., Christ, B. U., Galvin, A., de Menil, V., et al. (2023). Validity of the SNAP-IV for ADHD assessment in south African children with neurodevelopmental disorders. *J. Autism Dev. Disord.* 53, 2851–2862. doi: 10.1007/s10803-022-05530-1



## OPEN ACCESS

## EDITED BY

Rubén Maneiro,  
Pontifical University of Salamanca, Spain

## REVIEWED BY

Pierluigi Diotaiuti,  
University of Cassino, Italy  
Cintia Matos,  
Federal University of Minas Gerais, Brazil

## \*CORRESPONDENCE

Yangqing Zhao  
✉ zhaoqh@qq.com

RECEIVED 23 July 2024

ACCEPTED 11 September 2024

PUBLISHED 23 September 2024

## CITATION

Li C and Zhao Y (2024) Gender differences in skilled performance under failure competitive environments: evidence from elite archers. *Front. Psychol.* 15:1468978. doi: 10.3389/fpsyg.2024.1468978

## COPYRIGHT

© 2024 Li and Zhao. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](#). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Gender differences in skilled performance under failure competitive environments: evidence from elite archers

Chunhua Li and Yangqing Zhao\*

School of Physical Education and Health, Wenzhou University, Wenzhou, Zhejiang, China

**Introduction:** Psychologists are particularly interested in how people operate in stressful settings. The sporting arena is a “natural laboratory” for studying how people behave and perform in high-pressure situations. This study explores the gender differences in archers’ ability to cope with adversity, highlighting the significant cold-hand effect observed in both male and female archers, with notable differences in the last arrow performance under pressure.

**Methods:** Our method is a Poisson general linear model -based test for the cold hand that examines how the performance of the last arrow per set depends on the performance of the previous two shots. We also interact the player’s gender with performance on the previous two arrows and game status to test for gender differences in response to past performance and intermediate game status.

**Results:** The Poisson regression analysis reveals that male and female archers’ performance dropped significantly after experiencing two consecutive missing bullseyes, which means a cold-hand effect exists. However, although there was no significant difference in the performance of male and female archers on the third arrow, female archers have significantly lower last arrow per set scores than male archers after near poor performance or being in a situation where losing can only be avoided by winning the current set.

**Discussion:** This finding suggests that female archers are more vulnerable to the potentially negative effects of adversity caused by trailing or recent failures than their male counterparts. We attempt to explain the reasons behind the results above from both psychological and physiological perspectives.

## KEYWORDS

performance under pressure, gender differences, cold hand, feedback, competition

## 1 Introduction

Psychologists are particularly interested in how people operate in stressful settings. The sporting arena is a “natural laboratory” for studying how people behave and perform in high-pressure situations. Sports have traditionally been gender segregated, with separate tournaments and opportunities for men and women. As a result, gender differences in sports have sparked much attention, allowing us to investigate the physical, mental, and social elements that influence people’s athletic performance ([Handelsman et al., 2018](#)).

Previous research findings into gender disparities in resilience have been inconsistent and contradictory. A considerable amount of literature has found gender-based differences in response to setbacks. [Weinberg and Jackson \(1989\)](#) studied gender disparities in tennis players’ ability to win a match after losing the first set. Overall, males were more likely to come from behind than



females among junior-aged players. Gill and Prowse (2014) find that women take discouraging news worse than men do. Similarly, some studies have found that women perform just as well as men in high-pressure scenarios such as teaching or professional tennis (Paserman, 2007; Lavy, 2012). However, Banko et al. (2016) analyzed tennis data to determine whether females react more negatively to setbacks than males. And they did not discover any difference in their reactions. Recent research conducted by Toma (2017) and Bucciol and Castagnetti (2020) reveals that men and women are equally prone to choking under pressure.

Some studies are dedicated to examining gender differences in competitiveness during the critical stages of competitions. Analyzing tennis data, the detailed point-by-point analysis reveals that, relative to men, women are substantially more likely to make unforced errors at crucial junctures of the match (Paserman, 2023). However, Cohen-Zada et al. (2017b) discovered that only men's performance decreases following a loss in a bronze medal fight.

Other studies on gender differences in professional sports concentrated on financial incentives and their effects on performance (Maloney and McCormick, 2000; Deaner, 2006; Gilsdorf and Sukhatme, 2008; Lallemand et al., 2008; Frick, 2011). All studies show women succumbing to the pressure that comes with significant prizes at risk. Other research discovered that men professional golfers (PGA) performed better when their financial benefits increased (Ehrenberg and Bognanno, 1990a; Ehrenberg and Bognanno, 1990b). However, another study failed to duplicate the men's results using the 1992 PGA records (Orszag, 1994), and overall results in this area of research are mixed.

On the other hand, in academic settings, other studies suggest that men outperform women under increased competition (Orszag, 1994; Azmat et al., 2016; Cai et al., 2019). Gneezy et al. (2003) find that the relative and absolute performance of males increases as competition intensifies. The performance of female students dominates that of male students in the less competitive exam, whereas the opposite holds in the more competitive exam. A similar picture emerges from the study by Morin (2015).

According to the above literature, women are less resilient to stress than men, except in the sport of tennis where this is controversial. We examine data from professional recurve archery players on the men's and women's tours to determine if women react worse to competitive failures or in the critical stage of competition. We aim to understand not only whether female and male contestants react differently to poor performance in the past but also to explore the potential psychological mechanisms, such as self-confidence and competitive anxiety, that may drive these differences. Our key findings are significant in understanding the impact of feedback on performance. Professional sports provide a fruitful setting for studying gender differences in decision-making and performance (Kahn, 2000; Paserman, 2007; Cohen-Zada et al., 2017a), as well as behavioral differences between men and women (Malueg and Yates, 2010; González-Díaz et al., 2012; Banko et al., 2016). Archery statistics contain three valuable attributes for examining gender disparities. Optimal shooting performance is typically achieved when arousal levels are low or moderate. Hence, it necessitates precise motor control, stability, and the capacity to avoid involuntary muscular contractions (Robazza et al., 1998). Such attributes of archery, which differentiate it from more intense sports such as judo or tennis, enable us to disregard the influence of physiological (testosterone) and physical factors on gender disparities. Furthermore, no bewildering impacts arise from collaborative gameplay, defensive tactics, or score-dependent strategies. Elite archers consistently prioritize attentiveness to each arrow and strive to achieve optimal accuracy by targeting the center. Ultimately, male and female athletes experience the

same competitive settings. Both male and female individual matches follow a best-of-five format. Every shot is captured from a consistent distance, with brief time intervals separating them.

Our first objective in the current study is to identify cold-hand effects in archery and whether the magnitude of the cold-hand effect is significantly different between men and women. We specifically want to find out if the last arrow in each set performs worse after the previous worse performance. The concept of "cold-hand" sheds light on the hot-hand literature.

There is a lot of research supporting the hot-hand effect, but there is less research on the cold-hand effect (Arkes, 2010; Yaari and Eisenmann, 2011; Bocskocsky et al., 2014; Miller and Sanjurjo, 2015), with only limited literature supporting it (Arkes, 2016). Cold hand effect is a negative momentum, which predicts that failure increases the probability of subsequent failure. Following this, our primary aim is to examine whether these impacts vary by the athletes' gender.

The second empirical goal of this paper is to determine whether the magnitude of the gender disparity differs according to the game's critical stage, or the final arrow's dynamic game state in a given set. For this reason, we categorize the competitive situation into four types. We speculate that under condition C1 (losing the current set will result in the loss of the entire game while winning the set will have no impact on the outcome of the game), the athletes experience the greatest pressure, and in such condition, they must win the next set to avoid elimination, encounter the adversity. We attempt to utilize the aforementioned indicators to discover the gender gap in the ability to bounce back from adversity.

## 2 Materials and methods

### 2.1 Recurve archery data

The target in recurve archery is 70 meters away. It has 10 concentric rings, with the center scoring 10 points and the outside circles scoring less (Figure 1). No points are awarded if an arrow misses the target completely.



Tournaments comprise two phases: the “ranking round” and the “elimination round.” During the ranking round, athletes shot a total of 72 arrows in order to determine their rankings. During the elimination rounds, athletes of comparable rankings compete against one another. The highest-ranked athlete competes against the lowest-ranked athlete; the second-highest-ranked athlete competes against the second-to-last competitor, and so on. Each match ends with the loser falling out and the winner advancing. This continues until just two competitors compete in the final. Semifinal losers compete for third place.

In a match, athletes compete in a best-of-five set format. Each set contains three arrows for each participant. The winner of a set receives two points, while a tie awards both competitors one point. The first player to reach six points wins. Each set begins with the higher-ranked athlete shooting first, and then the athlete with fewer points shoots first in the next set.

In current study, elite athletes are those who compete in international (London 2012, Rio 2016, Tokyo 2020 Olympics, Yankton 2021 Hyundai World Archery Championships) and continental championships (Antalya European Grand Prix 2021). Athletes who were unable to participate in the above events were excluded due to the unavailability of competition data. We have collected arrow-by-arrow data from various archery events such as the London 2012, Rio 2016, Tokyo 2020 Olympics, the Yankton 2021 Hyundai World Archery Championships, and the Antalya European Grand Prix 2021. This data was obtained from the official World Archery Federation website.<sup>1</sup> For the London 2012 Olympics archery game, we obtained the data from the archived website.<sup>2</sup> After collecting the data, we examined it thoroughly for 10 years from 2012 to 2021. We discovered 6,374 instances of three consecutive shots, totaling 19,122 shots. For each set of three shots, we recorded the player's identity, the points achieved, the shooting order, whether the player participated in the Olympics or other games, and the set points in the game when the shots were taken.

We thoroughly examined the arrow-by-arrow data spanning 10 years from 2012 to 2021. In total, we discovered 6,374 instances of three consecutive shots, totaling 19,122 shots. For each set of three shots, we recorded the points achieved, the player's identity, the shooting order, whether the player participated in the Olympics or other games, and the set points in the game when the shots were taken.

## 2.2 Variables

Our analysis is aimed at understanding whether the previous poor results or unfavorable game status affect subsequent players' performance and whether this effect is heterogeneous according to gender. Our empirical strategy is quite simple: We first analyze the respective scores of archers in their third arrow in relation to the outcome of the previous two shootings. Specifically, we compared the points scored on the third shot under four scenarios: after two consecutive 10s (Momentum A, Hit-Hit), after a first shot of 10 and a second miss of 10s (Momentum B, Hit-Miss), after a first miss of

10 and a second shot of 10 points (Momentum C, Miss-Hit), and after two consecutive missing 10s (Momentum A, Miss-Miss). If a cold-hand effect exists, we expect to observe lower scores on the third shot following two consecutive 10s than following the other combinations. If an archer's performance significantly decreases after missing 10 points compared to those hitting 10 points, we consider it to be the existence of a cold-hand effect (Table 1). To investigate whether men and women respond differently to the outcome of the first two arrows, we conducted a regression analysis. We used the performance of the third arrow as the dependent variable and the outcome of the previous two shootings (momentum type) as independent variables. The momentum type is crucial for understanding the cold-hand effect, with “Hit-Hit” scenarios potentially reinforcing performance, while “Miss-Miss” scenarios are expected to exacerbate performance declines. A deeper exploration of how these scenarios interact with gender could offer richer insights. We also included the gender of the player as an interaction term. Next, we performed the same analysis using game status as an additional independent variable. To account for differences in players' abilities and heterogeneity, we used both players' scores in ranking rounds.

### 2.2.1 Game status

The game status is separated into four categories: “C0” (winning or losing the current set has no impact on the outcome of the game), “C1” (losing the current set will result in the loss of the entire game while winning the set will have no impact on the outcome of the game), “C2” (winning the set wins the game, otherwise losing the game), “C3” (winning the set will win the game; losing the set will not impact the game's result). Status C0 occurs in a non-decisive set, hence we assume that the pressure it generates is the lowest. The other three states all occur in the decisive set, and we believe that their pressure is ranked from highest to lowest as C1, C2, C3. Similarly, losing the current set in state C1 and C2 means being eliminated, while in state C3, it does not lead to elimination. And winning the current set in state C2 means ultimate victory, while winning the current set in state C1 only means being spared from elimination.

### 2.2.2 Player heterogeneity

This is based on the apparent fact that a player's overall skill level influences their performance. Compared to bad shooters, proficient archers are more likely to shoot better on their third attempt. We used their ranking round score to estimate the strength ratio ( $\text{score ratio} = \text{player's ranking score} / \text{opponent's ranking score}$ ) between the two players in a match, accounting for variations in athlete ability.

### 2.2.3 Tournament type

We documented whether the match took place during the Olympics or the World Championship games to ascertain whether there was a competitive edge during the Olympics. The binary variable “Game Type” equals one for the Olympics (London 2012, Rio 2016, Tokyo 2020 Olympics) and zero for others (Yankton 2021 Hyundai World Archery Championships, Antalya European Grand Prix 2021).

### 2.2.4 Shooting order

Individual competitions adopt alternating shooting; the higher-ranked archer shoots first in the first set, and the archer with lower set

<sup>1</sup> <https://worldarchery.sport/events/results>

<sup>2</sup> <https://webarchive.nationalarchives.gov.uk/ukgwa/20130301124206/http://www.london2012.com/archery/event/men-individual/>

TABLE 1 Definition and descriptive statistics of dependent and independent variables ( $N = 6,374$ ).

Variable	Name	Type	Classification	Mean	Median	Std	Min	Max
Dependent variable	Arrow3	Continuous	Player's points on their third shot	8.25	9	1.468	0	10
Independent variable	Momentum	Categorical	We then classify the momentum type into four categories: "A" (Hit–Hit, $n = 827$ ), "B" (Hit–Miss, $n = 1753$ ), "C" (Miss–Hit, $n = 675$ ), and "D" (Miss–Miss, $n = 3,119$ )					
	Gender	Dummy	1 = male ( $n = 3,380$ ), 0 = female ( $n = 2,994$ )					
	Status	Categorical	C0 ( $n = 4,108$ ), C1 ( $n = 999$ ), C2 ( $n = 268$ ), C3 ( $n = 999$ )					
	Player heterogeneity	Continuous	=one archer's ranking score/opponent's ranking score	1.002	1	0.057	0.648	1.543
	Game type	Dummy	1 = Olympic games ( $n = 3,236$ ), 0 = others (3138)					
	Order	Dummy	1 = second ( $n = 3,187$ ), 0 = first (3187)					

"Hit" means hit the bullseye, "Miss" does not. "-" left is the first arrow score, right is the second arrow score. Numbers in parentheses represent sample sizes.

points shoots first in the next set. Thus, the dummy variable Order is one for shooting first and zero otherwise.

2.3 Statistical analysis

Since the dependent variable is a count of integers, we used a Poisson general linear model (GLM), which detected under-dispersion (Zuur et al., 2009). To correct for this, we used a quasi-GLM with the variance given by  $\varphi \times \mu$ , where  $\mu$  is the mean and  $\varphi$  is the dispersion parameter estimated at 0.231. This adjustment means that all standard errors were multiplied by 0.481 (the square root of 0.231). It should be mentioned that under-dispersed count data can be handled using the quasi-Poisson approach (Hostetler et al., 2012; Otterbeck et al., 2019). While a negative binomial regression model could address potential overdispersion, the quasi-Poisson model was chosen due to its better fit for the specific data characteristics observed in this study.

For all GLM analyses conducted in this paper, the "Multcomp" package was used to conduct pairwise comparisons of means. The statistical software package R (R development core team 2018) was utilized for statistical analyses and graphing. All tests were two-tailed, and a  $p$ -value below 0.05 was considered significant.

Our final method is a Poisson regression-based test for the cold hand that examines how the performance of the last arrow per set depends on the performance of the previous two shots.

We also interact the player's gender with performance on the previous two arrows and game status to test for gender differences in response to past performance and intermediate game status.

Our Poisson regression takes the following form:

$$\text{Arrow3}_i \sim \text{Poisson}(\mu_i) \text{ and } E(Y_i) = \mu_i \text{ and } \text{var}(Y_i) = \varphi \times \mu_i$$

$$\log(\mu_i) = \alpha + \beta_0 \text{Momentum}_i + \beta_1 \text{Game Status}_i + \beta_2 \text{Heterogeneity}_i + \beta_3 \text{Game Type}_i + \beta_4 \text{Order}_i + \beta_5 \text{Gender}_i + \beta_6 \text{Momentum}_i \times \text{Gender}_i + \beta_7 \text{GameStatus}_i \times \text{Gender}_i + \varepsilon_i$$

Arrow3<sub>*i*</sub>, with the number of points on the last arrow per set *i*, is Poisson distributed with a mean of  $\mu_i$ .

3 Results

3.1 Cold-hand effects

The statistically significant evidence of a cold-hand effect is presented in Table 2. This is supported by the negative and significant coefficients that are linked to previous worst performances [ $t = -12.862$   $e^{\beta} = 0.878$  (0.86–0.90),  $p < 0.001$ ], specifically missing the bullseye twice in a row. It indicates significantly lower scores (12.2%) after two missing 10-point shots compared to the case after two 10-point shots.

Moreover, the conditional score of the third shot after two missing 10-point shots is significantly higher than the average score following the other cases ( $p < 0.001$ , Figure 2A).

In conclusion, Table 2 shows that archers tend to shoot worse after missing the bullseye twice, regardless of the player's gender, general skill, game status, shooting order, or game type. The cold-hand effect, while statistically significant, also presents practical implications for coaching strategies, suggesting that interventions should focus on enhancing resilience after consecutive poor performances.

3.2 Control variables

In Poisson regression, we see that the player's general skill has a highly significant effect on their conditional score for the third shot (Figure 2F). This takes into account the size and statistical importance of heterogeneity. And this control variable is the most important thing in these regressions. Also, the "Game Type" binary variable shows a higher score on the third shot per set in Olympic games than in Championship games (Figure 2C). Both the player heterogeneity and game type effect are significant at the 0.0001 level.

Furthermore, when in game status C1 (losing the current set will result in the loss of the entire game while winning the set will have no impact on the outcome of the game), archers perform worse on the third arrow than when it is in game status C0 (winning or losing the current set has no impact on the outcome of the game, Figure 2D). However, none of these differences among statuses were statistically significant (Table 2). Similarly, the order of archery had no significant effect on the performance of the third arrow ( $t = 0.017$ ,  $p = 0.986$ ).

TABLE 2 Quasi-Poisson regressions predicting average scores in the first and second versus third shots ( $N = 6,374$ ).

Parameters	$\beta$ (95% CI)	Stand error	$t$
Intercept	1.696 (1.619, 1.774)	0.04	42.857***
Gender (male vs. female)	0.014 (−0.009, 0.037)	0.012	1.215
<b>Momentum A#</b>			
Momentum B	−0.089 (−0.11, −0.067)	0.011	−8.112***
Momentum C	−0.075 (−0.1, −0.05)	0.013	−5.79***
Momentum D	−0.131 (−0.151, −0.111)	0.01	−12.862***
Player heterogeneity	0.41 (0.337, 0.483)	0.037	11.011***
Type (olympic vs. champion)	0.151 (0.143, 0.16)	0.004	35.279***
Order (second vs. first)	0 (−0.01, 0.01)	0.005	0.017
<b>Status: C0#</b>			
Status: C1	−0.017 (−0.035, 0)	0.009	−1.944
Status: C2	−0.02 (−0.049, 0.008)	0.015	−1.377
Status: C3	0.004 (−0.014, 0.021)	0.009	0.408
Gender $\times$ Momentum B	0.025 (−0.002, 0.052)	0.014	1.828
Gender $\times$ Momentum C	0.004 (−0.028, 0.036)	0.016	0.233
Gender $\times$ Momentum D	0.035 (0.01, 0.06)	0.013	2.75**
Gender $\times$ C1	0.024 (0.001, 0.046)	0.011	2.075*
Gender $\times$ C2	0.004 (−0.036, 0.044)	0.02	0.212
Gender $\times$ C3	−0.002 (−0.024, 0.02)	0.011	−0.212
$\phi$	0.21		
pseudo- $R^2$	0.231		

\*\*\*, \*\*, and \* denotes statistical significance at the 0.1, 1, and 5% levels, respectively.  $\beta$  denotes estimated coefficients. # denotes Reference categories.  $\phi$  denotes dispersion parameters.

By including these variables in our study, we improve the reliability of our findings and reinforce the conclusion that the cold-hand phenomenon is present in repeated archery attempts.

### 3.3 Gender differences

Although male archers scored slightly higher than female archers on the last arrow of each set (Figure 2B), this difference was not significant ( $t = 1.214$ ,  $p = 0.225$ ). Table 2 shows that the coefficient (0.035) for the interaction between gender and the previous worst performance (missing bullseye twice) is positive. This information indicates that when archers get equal bad scores on the first two arrows, male athletes do much better on the third arrow than female athletes, with a 3.5% difference ( $p < 0.001$ , Figure 3A).

Another significant aspect of the interaction effect is between gender and game status. In a situation where losing can only be avoided by winning, the third arrow performance gap between male and female athletes significantly increased by 2.4% (Table 2). This suggests that the decline in the performance of female athletes on the third arrow is considerably higher than that of male athletes when on the verge of failure (game status C1, Figure 3B).

## 4 Discussion

This paper uses archery, an individual sport with an isolated single-sex structure, to verify potential gender differences in competitive behaviour. We find evidence supporting the existence of a negative momentum (cold-hand) effect—that is, a poor performance on the previous two shots leads to a worse performance on the final shot. Such supportive evidence in favour of the “failure breeds failure” indicates the presence of cold-hand effect.

Our study enables us to conclude that gender differences are more pronounced in reaction to a negative result. In a situation where losing can only be avoided by winning or facing poor previous performance, female athletes have 2.4 and 3.6% lower performance than their male counterparts. The above results indicate a gender difference in the ability to handle pressure between men and women in elite recurve archery. Similar findings on choking under pressure in archery have been discussed by Diotaiuti et al. (2021), who explored the psychological factors contributing to performance declines in high-stakes situations.

Consequently, our findings complement those of Banko et al. (2016), who found that women perform considerably worse when trailing by a substantial margin. This finding is consistent with that of De Paola and Scoppa (2017), who indicate that women can handle pressure just as well as men, as long as they are not lagging.

Regarding the gender difference in handling pressure from near setbacks, the results are inconsistent. Lackner and Weichselbaumer (2023) find that women perform considerably worse after near setbacks in tennis, while Banko et al. (2016) suggest that women are not more prone to losing due to setbacks. These findings align with recent research by Diotaiuti et al. (2021) on choking episodes in archery, which also highlight the importance of psychological resilience in maintaining performance under pressure.

We attempt to explain the reasons behind the results above from both psychological and physiological perspectives. From a psychological perspective, the following four types of gender differences can explain the above-mentioned gender differences.

### 4.1 Gender differences in self-confidence

Published reports suggest that men generally have higher self-confidence than females in competitive situations (Lirgg, 1991; O'Connor et al., 2020). Research has demonstrated that receiving negative feedback can diminish self-assurance, especially in women (Roberts and Nolen-Hoeksema, 1989), perhaps leading to decreased performance (Woodman and Hardy, 2003). Lirgg (1991) emphasized the possibility that males tend to overestimate their performance, whereas females may underestimate their performance, which can lead to differences in confidence ratings (Lirgg, 1991).

Undoubtedly, self-confidence must play a role in archers' ability to bounce back from adversity. Self-confidence will impact archers' subsequent motivation and performance after an abysmal performance or facing near failure. According to prior theory and research, males may be more resilient to such a loss due to a higher level of self-confidence. On the other hand, because females' self-confidence may be more sensitive to feedback, a setback may be more likely to reduce females' self-confidence and interfere with subsequent performance.



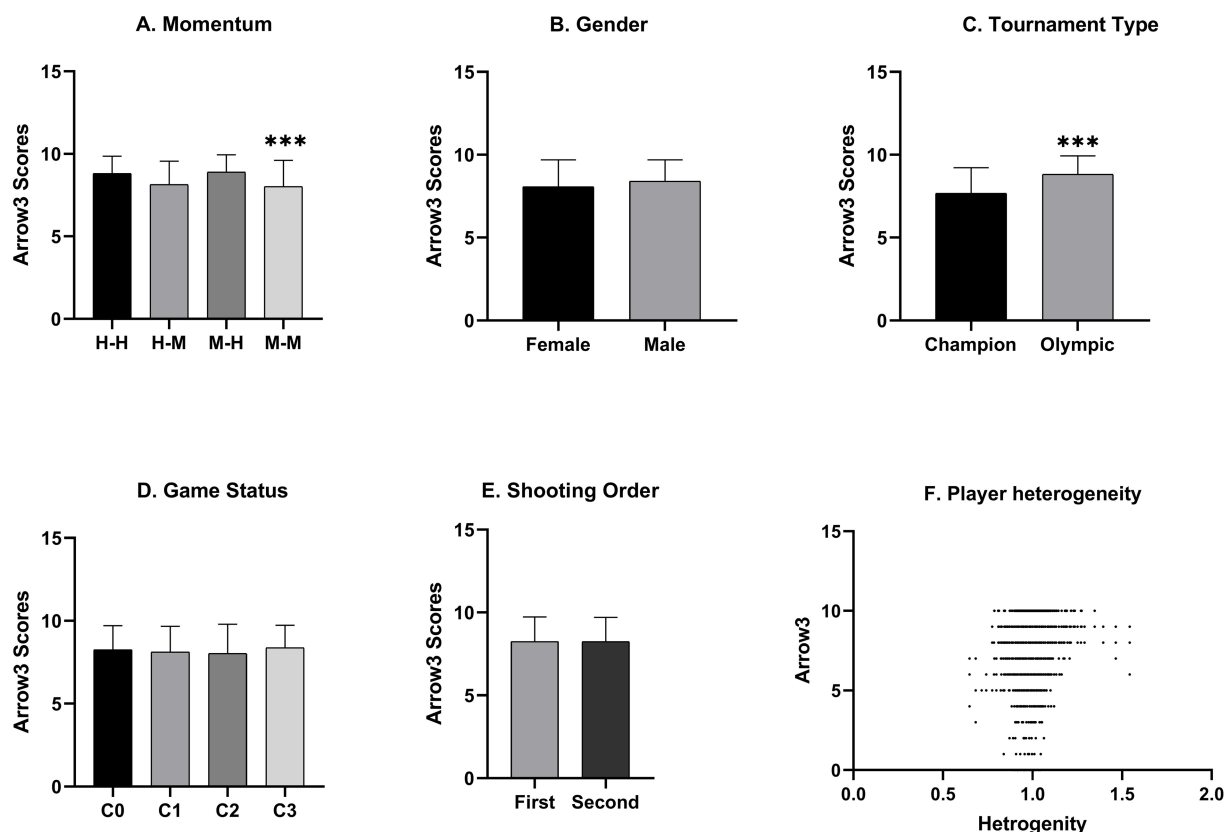


FIGURE 2

Graphical plots for simple main effects. (A) The third arrow scores versus momentum. (B) The third arrow scores versus sex. (C) The third arrow scores versus tournament. (D) The third arrow scores versus status. (E) The third arrow scores versus shooting order. (F) The third arrow scores versus player heterogeneity.

## 4.2 Gender differences in competitive anxiety

Male athletes typically display lower levels of anxiety than female athletes (Krane and Williams, 1994; Correia and Rosado, 2019). Female athletes exhibited higher levels of competitive trait anxiety (Kristjánsdóttir et al., 2018) and higher levels of worries (O'Donoghue and Neil, 2015).

The intensity and direction of competitive trait anxiety were investigated by Perry and Williams (1998) based on gender disparities (Perry and Williams, 1998). While cognitive anxiety levels were not different between males and females, females were more likely to have a debilitating interpretation of it.

Females reported that cognitive anxiety was a hindrance to tennis performance. In addition, males more often interpreted somatic and cognitive anxiety as facilitative to competitive performance. The female archers exhibited higher levels of felt arousal and cognitive anxiety than the male archers.

Gender differences in levels of competitive trait anxiety might contribute to the understanding of potential gender differences in archers' ability to overcome a disadvantageous situation.

## 4.3 Gender differences in athletic coping

Studies have shown that males tend to employ problem-focused coping strategies more frequently, while females rely more on

emotion-focused coping strategies (Tamres et al., 2002; Hammermeister and Burton, 2004; Anshel et al., 2009). Psychological factors of competitive anxiety are related to coping strategies (Hoar et al., 2010). Active coping, planning, effort, and suppression of competing activities are examples of problem-focused coping methods that have a positive correlation with positive affect (Watson et al., 1988), which is a reflection of enjoyable engagement. Positive affect was also found to be inversely correlated with behavioural disengagement and wishful thinking (Gaudreau et al., 2002).

These findings have implications for archers' responses to frustration in a match. If females are more likely to resign after a failure and males are more likely to engage in problem-focused strategies, males are more equipped to overcome a loss.

## 4.4 Gender differences in competitiveness

Extensive literature confirms the presence of a significant and enduring disparity between genders in terms of competition (Frick, 2011; Wozniak, 2012; Deaner et al., 2016; Birk et al., 2019). Trait competitiveness measures have shown that males are more competitive than females. Studies showing females as more competitive have had small samples of high-level athletes, which are not typical of females. In contrast, the male samples were more prominent and more representative. Although the results are inconsistent, there seems to be reasonable support for this gender



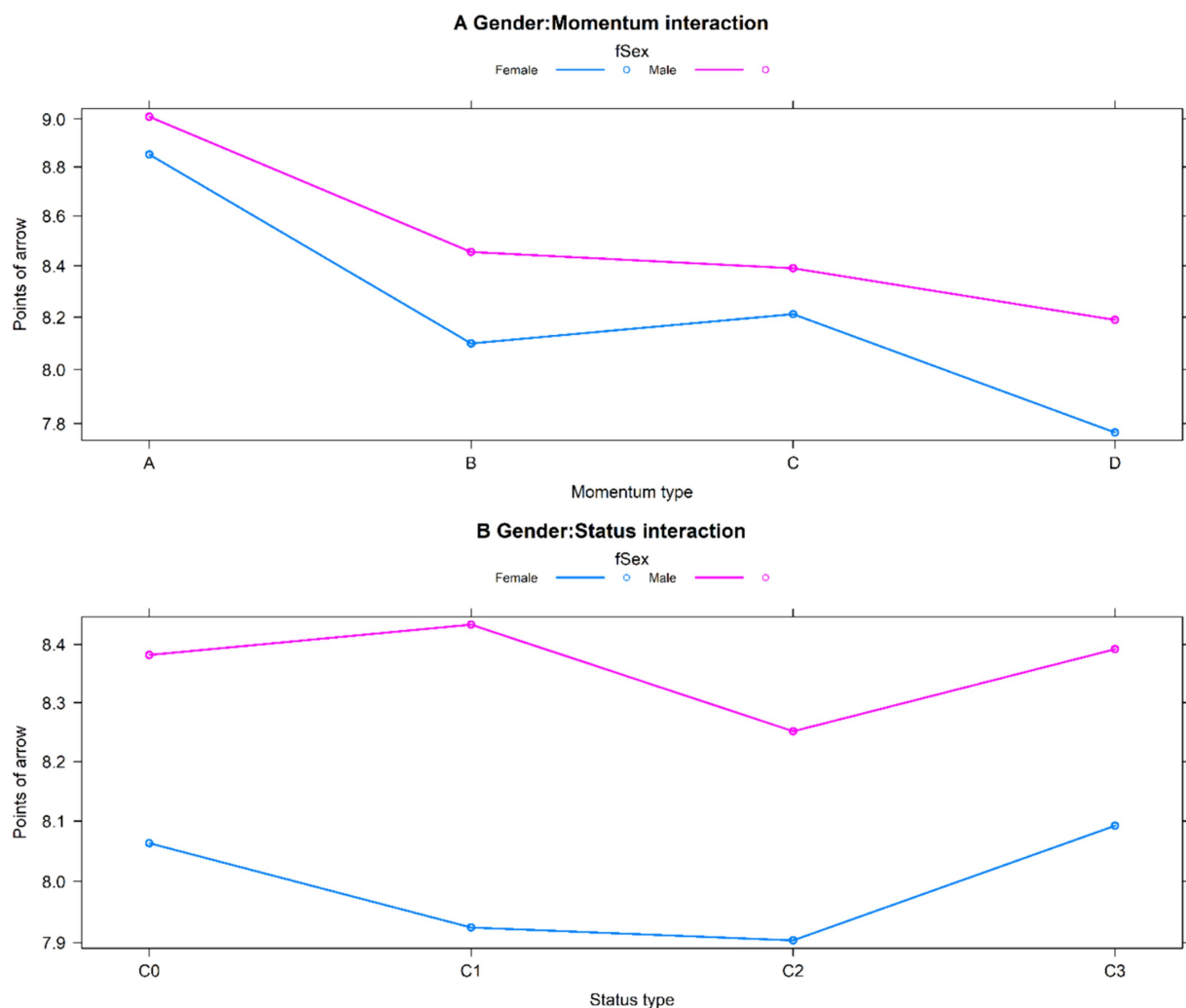


FIGURE 3

Graphical plots for interaction effects. (A) gender by momentum type interaction; (B) gender by status interaction.

difference. A high level of competitiveness would likely contribute to an archer's motivation to overcome a loss.

Summing up, differences exist between the two gender groups in a variety of fields such as confidence, anxiety, coping strategy, and competitiveness. Such variation may explain the causes of sex differences in response to failures.

From a physiological perspective, poor performance in recurve archery was correlated with high real-time heart rate (Lu and Zhong, 2023). Some heart rate variability (HRV) studies have indicated that females may exhibit a higher overall complexity of heart rate dynamics than males (Ryan et al., 1994). Women show a greater mean heart rate (Koenig and Thayer, 2016). It should be mentioned that a higher heart rate—which indicates an increase in psychological stress—is associated with lower scores. Archery is a sport that requires fine movement control, and postural stability is considered an important variable in achieving high performance (Sarro et al., 2021). An increased heart rate can accelerate the imbalance of the human body posture and reduce the ability of people to maintain body balance posture. Subsequently, it affects shooting performance.

Furthermore, the gender-specific autonomic differences may contribute to the weaker resilience to setbacks in females. For example,

during adolescence, girls are 3 times more likely to develop post-traumatic stress disorder (PTSD) than boys (McLaughlin et al., 2013). Sex or gender differences in cognitive styles contribute to resilience for post-traumatic stress disorder (PTSD) and other mood disorders.

## 4.5 Limitation

The absence of qualitative data on psychological factors and athletes' backgrounds limits the depth of the conclusions that can be drawn. Unfortunately, the constraints of our data prevent a thorough investigation into the disparities in how men and women respond to failure across various sports, the labour market, and marital outcomes. The results may not be fully applicable to other sports or competitive contexts where the dynamics of pressure and feedback differ significantly. Additionally, the dataset lacks detailed information on psychological interventions or external support factors, which could play a significant role in shaping athletes' responses to pressure. Furthermore, our analysis is limited in its capacity to elucidate the underlying causes for the observed gender differences in the archery context. The observed gender differences in response to consecutive

poor performances may be influenced by other factors such as experience level, access to psychological support, and prior exposure to high-pressure situations, which should be considered in future research. It is recommended that future studies, equipped with more extensive data, delve deeper into these issues to provide a more comprehensive understanding of high-level performance under stress.

## 5 Conclusion

We utilize large-scale data from elite recurve archery to investigate gender differences in performance feedback. The detailed arrow-by-arrow analysis reveals that, relative to men, women are substantially more likely to react negatively to negative feedback. We have found that women tend to experience a stronger discouragement effect than men when in a situation where losing can only be avoided by winning or facing recent poor performance. The insights gained from this study may be of assistance to investigate the gender gap in the ability to handle pressure.

## 6 Practical applications

Our findings can help us understand why gender differences occur in various situations where individuals compete one after another and receive feedback on their interim performance. Furthermore, future investigations should conduct more comprehensive analyses using simulations to enhance the statistical robustness of our discoveries and gain deeper insights into the presence of the hot hand or momentum phenomenon. For instance, in a professional context, training programs could be designed to enhance resilience in female employees, drawing parallels with strategies used to bolster performance in high-pressure sports like archery.

## Data availability statement

The datasets generated for this study are available on request to the corresponding author.

## Ethics statement

The studies involving humans were approved by the Ethics Committee of the Wenzhou University. The studies were conducted

in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## Author contributions

CL: Data curation, Formal analysis, Methodology, Resources, Writing – original draft. YZ: Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – review & editing.

## Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. This work was supported by grants from the Philosophy and Social Sciences Project of Zhejiang Province (No. 23YJRC12ZD-2YB).

## Acknowledgments

The authors are grateful for the support of the Olympic Governance Research Center at the School of Physical Education and Health, Wenzhou University for our work.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

- Anshel, M. H., Sutarso, T., and Jubenville, C. (2009). Racial and gender differences on sources of acute stress and coping style among competitive athletes. *J. Soc. Psychol.* 149, 159–178. doi: 10.3200/SOCP.149.2.159-178
- Arkes, J. (2010). Revisiting the hot hand theory with free throw data in a multivariate framework. *J. Quant. Anal. Sports* 6, 1–12. doi: 10.2202/1559-0410.1198
- Arkes, J. (2016). The hot hand vs. cold hand on the PGA tour. *Int. J. Sport Finance* 11, 99–113.
- Azmat, G., Calsamiglia, C., and Iriberry, N. (2016). Gender differences in response to big stakes. *J. Eur. Econ. Assoc.* 14, 1372–1400. doi: 10.1111/jeea.12180
- Banko, L., Leeds, E. M., and Leeds, M. A. (2016). Gender differences in response to setbacks: evidence from professional tennis\*. *Soc. Sci. Q.* 97, 161–176. doi: 10.1111/ssqu.12230
- Birk, E. G., Lee, L. M., and Waddell, G. R. (2019). Overlapping marathons: what happens to female pace when men catch up? *South. Econ. J.* 86, 823–838. doi: 10.1002/soej.12390
- Bocskocsky, A., Ezekowitz, J., and Stein, C. (2014). Heat check: new evidence on the hot hand in basketball. *SSRN Electron. J.* doi: 10.2139/ssrn.2481494
- Buccioli, A., and Castagnetti, A. (2020). Choking under pressure in archery. *J. Behav. Exp. Econ.* 89:101581. doi: 10.1016/j.jsocec.2020.101581
- Cai, X., Lu, Y., Pan, J., and Zhong, S. (2019). Gender gap under pressure: evidence from China's National College Entrance Examination. *Rev. Econ. Stat.* 101, 249–263. doi: 10.1162/rest\_a\_00749
- Cohen-Zada, D., Krumer, A., Rosenboim, M., and Shapir, O. M. (2017a). Choking under pressure and gender: evidence from professional tennis. *J. Econ. Psychol.* 61, 176–190. doi: 10.1016/j.joep.2017.04.005

- Cohen-Zada, D., Krumer, A., and Shtudiner, Z. (2017b). Psychological momentum and gender. *J. Econ. Behav. Organ.* 135, 66–81. doi: 10.1016/j.jebo.2017.01.009
- Correia, M., and Rosado, A. (2019). Anxiety in athletes: gender and type of sport differences. *Int. J. Psychol. Res.* 12, 9–17. doi: 10.21500/20112084.3552
- De Paola, M., and Scoppa, V. (2017). Gender differences in reaction to psychological pressure: evidence from tennis players. *Eur. J. Work. Organ. Psychol.* 26, 444–456. doi: 10.1080/1359432X.2017.1307178
- Deaner, R. O. (2006). More males run relatively fast in U.S. road races: further evidence of a sex difference in competitiveness. *Evol. Psychol.* 4, 303–314. doi: 10.1177/147470490600400126
- Deaner, R. O., Balish, S. M., and Lombardo, M. P. (2016). Sex differences in sports interest and motivation: an evolutionary perspective. *Evol. Behav. Sci.* 10, 73–97. doi: 10.1037/ebs0000049
- Diotaiuti, P., Corrado, S., Mancone, S., Falese, L., Dominski, F. H., and Andrade, A. (2021). An exploratory pilot study on choking episodes in archery. *Front. Psychol.* 12:585477. doi: 10.3389/fpsyg.2021.585477
- Ehrenberg, R. G., and Bognanno, M. L. (1990a). Do tournaments have incentive effects? *J. Polit. Econ.* 98, 1307–1324. doi: 10.1086/261736
- Ehrenberg, R. G., and Bognanno, M. L. (1990b). The incentive effects of tournaments revisited: evidence from the European PGA tour. *ILR Rev.* 43, 74–S–88–S. doi: 10.1177/001979399004300305
- Frick, B. (2011). Gender differences in competitiveness: empirical evidence from professional distance running. *Labour Econ.* 18, 389–398. doi: 10.1016/j.labeco.2010.11.004
- Gaudreau, P., Blondin, J. P., and Lapierre, A. M. (2002). Athletes' coping during a competition: relationship of coping strategies with positive affect, negative affect, and performance-goal discrepancy. *Psychol. Sport Exerc.* 3, 125–150. doi: 10.1016/S1469-0292(01)00015-2
- Gill, D., and Prowse, V. (2014). Gender differences and dynamics in competition: the role of luck. *Quant. Econ. J.* 5, 351–376. doi: 10.3982/QE309
- Gilsdorf, K. F., and Sukhatme, V. (2008). Tournament incentives and match outcomes in women's professional tennis. *Appl. Econ.* 40, 2405–2412. doi: 10.1080/00036840600949512
- Gneezy, U., Niederle, M., and Rustichini, A. (2003). Performance in competitive environments: gender differences\*. *Q. J. Econ.* 118, 1049–1074. doi: 10.1162/00335550360698496
- González-Díaz, J., Gossner, O., and Rogers, B. W. (2012). Performing best when it matters most: evidence from professional tennis. *J. Econ. Behav. Organ.* 84, 767–781. doi: 10.1016/j.jebo.2012.09.021
- Hammermeister, J., and Burton, D. (2004). Gender differences in coping with endurance sport stress: are men from Mars and women from Venus? *J. Sport Behav.* 27:148.
- Handelsman, D. J., Hirschberg, A. L., and Bermon, S. (2018). Circulating testosterone as the hormonal basis of sex differences in athletic performance. *Endocr. Rev.* 39, 803–829. doi: 10.1210/er.2018-00020
- Hoar, S. D., Crocker, P. R. E., Holt, N. L., and Tamminen, K. A. (2010). Gender differences in adolescent athletes' coping with interpersonal stressors in sport: more similarities than differences? *J. Appl. Sport Psychol.* 22, 134–149. doi: 10.1080/10413201003664640
- Hostetler, J. A., Onorato, D. P., Bolker, B. M., Johnson, W. E., O'Brien, S. J., Jansen, D., et al. (2012). Does genetic introgression improve female reproductive performance? A test on the endangered Florida panther. *Oecologia* 168, 289–300. doi: 10.1007/s00442-011-2083-0
- Kahn, L. M. (2000). The sports business as a labor market laboratory. *J. Econ. Perspect.* 14, 75–94. doi: 10.1257/jep.14.3.75
- Koenig, J., and Thayer, J. F. (2016). Sex differences in healthy human heart rate variability: a meta-analysis. *Neurosci. Biobehav. Rev.* 64, 288–310. doi: 10.1016/j.neubiorev.2016.03.007
- Krane, V., and Williams, J. M. (1994). Cognitive anxiety, somatic anxiety, and confidence in track and field athletes: the impact of gender, competitive level and task characteristics. *Int. J. Sport Psychol.* 25, 203–217.
- Kristjánsdóttir, H., Erlingsdóttir, A. V., Sveinsson, G., and Saavedra, J. M. (2018). Psychological skills, mental toughness and anxiety in elite handball players. *Pers. Individ. Differ.* 134, 125–130. doi: 10.1016/j.paid.2018.06.011
- Lackner, M., and Weichselbaumer, M. (2023). Can barely winning lead to losing? Gender and past performance. *J. Econ. Behav. Organ.* 208, 258–274. doi: 10.1016/j.jebo.2023.02.018
- Lallemand, T., Plasman, R., and Rycx, F. (2008). Women and competition in elimination tournaments: evidence from professional tennis data. *J. Sports Econ.* 9, 3–19. doi: 10.1177/1527002506296552
- Lavy, V. (2012). Gender differences in market competitiveness in a real workplace: evidence from performance-based pay tournaments among teachers. *Econ. J.* 123, 540–573. doi: 10.1111/j.1468-0297.2012.02542.x
- Lirgg, C. D. (1991). Gender differences in self-confidence in physical activity: a meta-analysis of recent studies. *J. Sport. Exerc. Psychol.* 13, 294–310. doi: 10.1123/jsep.13.3.294
- Lu, Y., and Zhong, S. (2023). Contactless real-time heart rate predicts the performance of elite athletes: evidence from Tokyo 2020 Olympic archery competition. *Psychol. Sci.* 34, 384–393. doi: 10.1177/09567976221143127
- Maloney, M. T., and McCormick, R. E. (2000). The response of workers to wages in tournaments: evidence from foot races. *J. Sports Econ.* 1, 99–123. doi: 10.1177/152700250000100201
- Malueg, D. A., and Yates, A. J. (2010). Testing contest theory: evidence from best-of-three tennis matches. *Rev. Econ. Stat.* 92, 689–692. doi: 10.1162/REST\_a\_00021
- McLaughlin, K. A., Koenen, K. C., Hill, E. D., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., et al. (2013). Trauma exposure and posttraumatic stress disorder in a national sample of adolescents. *J. Am. Acad. Child Adolesc. Psychiatry* 52, 815–830.e14. doi: 10.1016/j.jaac.2013.05.011
- Miller, J. B., and Sanjurjo, A. (2015). Surprised by the gambler's and hot hand fallacies? A truth in the law of small numbers. *SSRN Electron. J.* doi: 10.2139/ssrn.2627354
- Morin, L.-P. (2015). Do men and women respond differently to competition? Evidence from a major education reform. *J. Labor Econ.* 33, 443–491. doi: 10.1086/678519
- O'Connor, D., Gardner, L., Larkin, P., Pope, A., and Williams, A. M. (2020). Positive youth development and gender differences in high performance sport. *J. Sports Sci.* 38, 1399–1407. doi: 10.1080/02640414.2019.1698001
- O'Donoghue, P., and Neil, R. (2015). Relative age effect on behavioural regulation, burnout potential and anxiety of sports students. *Eur. J. Hum. Mov.* 35, 1–11.
- Orszag, J. M. (1994). A new look at incentive effects and golf tournaments. *Econ. Lett.* 46, 77–88. doi: 10.1016/0165-1765(94)90080-9
- Otterbeck, A., Selås, V., Tøttrup Nielsen, J., Roualet, É., and Lindén, A. (2019). The paradox of nest reuse: early breeding benefits reproduction, but nest reuse increases nest predation risk. *Oecologia* 190, 559–568. doi: 10.1007/s00442-019-04436-7
- Paserman, M. D. (2007). Gender differences in performance in competitive environments: evidence from professional tennis players. *SSRN Electron. J.* doi: 10.2139/ssrn.997269
- Paserman, M. D. (2023). Gender differences in performance in competitive environments? Evidence from professional tennis players. *J. Econ. Behav. Organ.* 212, 590–609. doi: 10.1016/j.jebo.2023.05.042
- Perry, J. D., and Williams, J. M. (1998). Relationship of intensity and direction of competitive trait anxiety to skill level and gender in tennis. *Sport. Psychol.* 12, 169–179. doi: 10.1123/tsp.12.2.169
- Robazza, C., Bortoli, L., and Nougier, V. (1998). Physiological arousal and performance in elite archers: a field study. *Eur. Psychol.* 3, 263–270. doi: 10.1027/1016-9040.3.4.263
- Roberts, T.-A., and Nolen-Hoeksema, S. (1989). Sex differences in reactions to evaluative feedback. *Sex Roles* 21, 725–747. doi: 10.1007/BF00289805
- Ryan, S. M., Goldberger, A. L., Pincus, S. M., Mietus, J., and Lipsitz, L. A. (1994). Gender- and age-related differences in heart rate dynamics: are women more complex than men? *J. Am. Coll. Cardiol.* 24, 1700–1707. doi: 10.1016/0735-1097(94)90177-5
- Sarro, K. J., Viana, T. D. C., and De Barros, R. M. L. (2021). Relationship between bow stability and postural control in recurve archery. *Eur. J. Sport Sci.* 21, 515–520. doi: 10.1080/17461391.2020.1754471
- Tamres, L. K., Janicki, D., and Helgeson, V. S. (2002). Sex differences in coping behavior: a meta-analytic review and an examination of relative coping. *Personal. Soc. Psychol. Rev.* 6, 2–30. doi: 10.1207/S15327957PSPR0601\_1
- Toma, M. (2017). Missed shots at the free-throw line: analyzing the determinants of choking under pressure. *J. Sports Econ.* 18, 539–559. doi: 10.1177/1527002515593779
- Watson, D., Clark, L. A., and Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *J. Pers. Soc. Psychol.* 54, 1063–1070. doi: 10.1037/0022-3514.54.6.1063
- Weinberg, R. S., and Jackson, A. (1989). The effects of psychological momentum on male and female tennis players revisited. *J. Sport Behav.* 12, 167–179.
- Woodman, T. I. M., and Hardy, L. E. W. (2003). The relative impact of cognitive anxiety and self-confidence upon sport performance: a meta-analysis. *J. Sports Sci.* 21, 443–457. doi: 10.1080/0264041031000101809
- Wozniak, D. (2012). Gender differences in a market with relative performance feedback: professional tennis players. *J. Econ. Behav. Organ.* 83, 158–171. doi: 10.1016/j.jebo.2011.06.020
- Yaari, G., and Eisenmann, S. (2011). The hot (invisible?) hand: can time sequence patterns of success/failure in sports be modeled as repeated random independent trials? *PLoS One* 6:e24532. doi: 10.1371/journal.pone.0024532
- Zuur, A., Ieno, E. N., Walker, N., Saveliev, A. A., and Smith, G. M. (2009). Mixed effects models and extensions in ecology with R. New York, NY: Springer.



## OPEN ACCESS

## EDITED BY

Rubén Maneiro,  
Pontifical University of Salamanca, Spain

## REVIEWED BY

Stanislav Sabaliauskas,  
Vilnius University, Lithuania  
Stuart G. Wilson,  
Queen's University, Canada

## \*CORRESPONDENCE

Gunnar Bjørnebekk  
✉ gunnar.bjornebekk@isp.uio.no

RECEIVED 13 April 2024

ACCEPTED 27 September 2024

PUBLISHED 14 October 2024

## CITATION

Hamoud M, Sæther SA and  
Bjørnebekk G (2024) Self-regulation and  
performance among elite youth soccer  
players: the role of approach-avoidance  
motivation.  
*Front. Psychol.* 15:1416931.  
doi: 10.3389/fpsyg.2024.1416931

## COPYRIGHT

© 2024 Hamoud, Sæther and Bjørnebekk.  
This is an open-access article distributed  
under the terms of the [Creative Commons  
Attribution License \(CC BY\)](#). The use,  
distribution or reproduction in other forums is  
permitted, provided the original author(s) and  
the copyright owner(s) are credited and that  
the original publication in this journal is cited,  
in accordance with accepted academic  
practice. No use, distribution or reproduction  
is permitted which does not comply with  
these terms.

# Self-regulation and performance among elite youth soccer players: the role of approach-avoidance motivation

Mounir Hamoud<sup>1</sup>, Stig Arve Sæther<sup>2</sup> and Gunnar Bjørnebekk<sup>3\*</sup>

<sup>1</sup>Department of Education, University of Oslo, Oslo, Norway, <sup>2</sup>Department of Sociology and Political Science, Norwegian University of Science and Technology, Trondheim, Norway, <sup>3</sup>Department of Special Needs Education, University of Oslo, Oslo, Norway

**Introduction and methods:** This study aimed to investigate the motivational processes behind self-regulated learning and performance among 192 soccer players (82 girls) for three age groups (14–16 years old) eligible for the Norwegian national football team. A conditional process model was proposed and tested with achievement goals as mediators between achievement motives on the one hand and coach-reported performance and self-regulated learning on the other hand. The probability of success was examined as a potential moderator in the motivational process.

**Results:** As predicted, motives to achieve success directly influenced planning and reflection/evaluation, whereas the influence of the success motive on regulation of effort was explained partly by task- and self-based approach goals. The motive to achieve success was, however, particularly crucial for maintaining these beneficial regulatory processes when the probability of success was found to be from moderate to low. Concerning the avoidance paths, the data supported only some of our original hypotheses. The motive to avoid failure predicted all three types of avoidance-based (task, self, and other) and other-based approach goals but did not contribute to explaining planning, reflection/evaluation, regulation of effort, or performance. There were no significant correlations between motivation variables and coach-reported performance. Moreover, girls were more motivated to avoid failure than boys, while both sexes achieved similar scores for football-specific self-regulated learning, probability of success, achievement goals, and motive to achieve success.

**Discussion:** The results are discussed considering a hierarchical motivation model.

## KEYWORDS

self-regulation, performance, elite youth soccer players, approach-avoidance motivation, achievement goals, fear of failure, achievement motives

## Introduction

The prioritization of talent development in soccer has contributed to increasing scientific interest in both identifying and developing soccer talents over the past 20 years (e.g., [Gledhill et al., 2017](#); [Williams et al., 2020](#)). Developing high level of soccer skills is a complex process based on multidimensional global and soccer-specific factors, including physiological, sociological, psychological, physical, and technical soccer-based factors ([Williams et al., 2020](#)). In this multifaceted spectrum, there has been increasing interest in the psychological dimension, such as motivation ([Musculus and Lobinger, 2018](#)) and expertise development



(McCardle et al., 2018), even though the significance of motivation in talent development and soccer performance is well documented (Gledhill et al., 2017).

Elliot's (1999) hierarchical motivation model has been widely used in educational and sport studies and has been shown to predict learning processes and future achievements. The hierarchical model operates with achievement goals as the construct designed to help us understand the direction of behavior by addressing the question of "what" individuals want to achieve. It also incorporates achievement motives to account for the energization of behavior, addressing the question of why individuals want to achieve ("the antecedent") (Elliot and Thrash, 2001). For young football talents to transition into elite football, not only is energy and goal direction required but also the ability to regulate their own learning processes (Larsen et al., 2012). Consequently, how motives and goals influence the way a group of talents regulates their own learning processes is likely to be crucial for the learning outcomes and performances over time, making it a compelling subject for further investigation. However, few studies include both the antecedents and the outcomes simultaneously (Lochbaum et al., 2017), and the links in the hierarchical model have not been similarly explored in soccer studies (Lochbaum and Gottardy, 2015). In the present research, we will use the hierarchical model as a framework to investigate motivational processes (both what provides energy and direction) behind self-regulated learning and performance among talented soccer players.

## A hierarchical motivation model

In Elliot's (1999) model, the achievement motives are presumed to energize behavior. However, specific guidelines for achieving what behavior has been activated have not been provided. Therefore, they are not directly related to outcomes, such as self-regulated learning or performance. Their function is a general motivating factor that produces achievement outcomes through more specific goals. Moreover, motivation is not only created by the achievement motives—situational factors must also be considered. An important message from the classical motivation tradition was precisely that individuals that are motivated by success (High Ms) and those motivated by fear of failure (High Mf) would be quite differently motivated in different achievement situation (Atkinson, 1964; Gjesme, 1981). Activated motivation is, for example, assumed to be very different when the task they must deal with is easy, moderate, or very difficult (e.g., Atkinson, 1964; Nygård, 1977).

## Achievement motives

In research on achievement motivation, two primary motives are usually applied: *desire to achieve success* and *fear of failure*. The motives are relatively stable personality characteristic in terms of a capacity to anticipate affect in achievement situations. The motive to achieve success (Ms) is defined as the capacity to expect a pleasant emotional state in challenging situations. Conversely, the motive to avoid failure (Mf) is defined as the capacity to expect unpleasant affective changes to occur when the outcome of a mastery attempt is uncertain (Gjesme and Nygård, 1970). These are situations where both success and failure are possible outcomes (i.e., the perceived probability of success/

failure = 0.50), indicating that motives consist of two closely related expectation components: cognitive and affective. The cognitive expectation component entails an assessment of the probability of success ( $P_s$ ) in solving a task and an assessment of the importance or value of the task. The affective expectation component is a type of prescient feeling that occurs when a mastery situation approaches and presumably accompanies the activation of motives through points of reference in situations that signal a challenge. The difference between scores on the motive to achieve success (Ms) and fear of failure (Mf) reveals whether arousal of an individual's achievement motive is motivated by success or fear of failure. When activated, the motives have three essential functions: choosing, orienting, and energizing behavior (McClelland, 1987). Emotional expectations will impact a person's development and regulation of plans and strategies (e.g., level of self-regulated learning) and the direction of their goals (e.g., approach and avoidance). Therefore, an expectation is presumably related to the orientation to goals in a specific mastery situation and is influenced by an emotional state (e.g., hope or fear).

Empirical studies indicate a positive association between scores on the success motive (High Ms) and soccer performance, whereas several studies have negatively related scores on the failure motive (high Mf) to soccer performance. For example, Murr et al.'s (2018) systematic review of longitudinal studies on the predictive value of Ms for future soccer performance found effect sizes between  $0.27 \leq d \leq 0.74$  and negative effect sizes between  $0.21 \leq d \leq 0.30$  of Mf and soccer performance. Moreover, based on Atkinson's risk-taking model, the achievement motives (Ms and Mf) will influence the incentive of success or failure on a specific task, while the probability of success will affect the activation of motives (Atkinson and Feather, 1966). A probability of success  $\leq 0.50$  is assumed to produce the strongest motivation to master a task (approach motivation) for success motivated individuals. On the other hand, for individuals with a high failure motive, a task of moderate difficulty is likely to motivate them to avoid the task (avoidance motivation), while a very easy task could produce relatively high positive motivation (Atkinson, 1957).

## Achievement goals

According to Elliot (1999), achievement goals are commonly recruited to serve the underlying motive-based motivation by strategically guiding it toward concrete aims that address the underlying motives. *Performance goals* are focused on the demonstration of competence relative to others, whereas *mastery goals* are focused on the development of competence through task mastery (Elliot and McGregor, 2001). In the early development phase of this tradition, theorists generally assumed that performance goals were related to negative processes and consequences, such as giving up more easily in the face of resistance (Dweck, 1986) and having lower intrinsic motivation (Nicholls, 1984). Mastery goals were assumed to be related to several positive processes and consequences, such as great endurance in the face of resistance (Dweck and Leggett, 1988), seeking optimal challenges (Dweck, 1986), and intrinsic motivation (Elliot and Harackiewicz, 1996).

An experiment conducted by Elliot and Harackiewicz (1996) showed that it might be appropriate to divide the performance goal into two goals: first, demonstrating one's *abilities compared to others' abilities*, and second, to *avoiding failure or appearing in a negative light*.



Studies have since strengthened the assumption that it is appropriate to apply performance-avoidance goals (Elliot, 2006). The trichomous achievement goal model comprised a comparable mastery goal to those from the two goal model and two performance goals; one focused on doing well relative to other (performance-approach), and one focused on not doing poorly relative to others (performance-avoidance). Several subsequent studies have indicated that mastery goals also should be differentiated. In addition to the mastery approach, a mastery avoidance goal has been described to avoid failure. It is defined in mastery terms and entails a reduction or stagnation in developing skills and competencies (the 2×2 model; Elliot and McGregor, 2001). Later, a 3×2 model was introduced, where mastery-based goals were separated in task and self-based goals (Elliot et al., 2011). In this model, task-based and self-based *mastery goals* focus on the absolute requirements to master the task or activity (i.e., the degree to which one has or has not accomplished the activity) and on learning or development (i.e., the degree to which one is or is not improving), respectively, whereas performance goals are designated as *other-based goals* intended to link the designation more closely to the standard used to define competence. The definition of competence (task/self/other) was then crossed with approach and avoidance to achieve the six goals in the model. More recently, Mascaret et al. (2015) have extended the 3×2 achievement model to the sport domain. The differentiation of whether one is (or is not) accomplishing the task *per se* (task-based mastery) or on which one is or is not improving on a task/activity assumed to be important in a soccer context.

Most research on achievement goals in soccer have applied a dichotomous model to estimate how mastery and performance orientation relate to behavior and performance. Silva et al. (2010) found regional team players to be more oriented toward performance goals than local players, with no significant differences in mastery goals. Other studies have shown that elite team players score significantly higher on mastery goals than non-elite team players, with no differences in scores for performance goals (Kavussanu et al., 2011). Some studies have shown lack of correlation between mastery goals and future performance (Figueiredo et al., 2009; Huijgen et al., 2014). Meanwhile, Höner and Feichtinger (2016) found a significant positive correlation between mastery goals and performance level, in a 4-year follow-up in young soccer players. Van Yperen and Duda (1999) found that improvements in performance during a soccer season corresponded to mastery goals. Few studies have investigated the distinction between approach and avoidance goals within a soccer context. Nonetheless, studies in sports suggest that mastery and performance-approach goals are positively related to performance, while no significant relationship has been found between avoidance goals and performance (Van Yperen et al., 2014). However, for athletes under the age of 18 years, the results of a meta-analysis showed that the correlation between performance-approach goals and performance was not significant (Lochbaum and Gottardy, 2015).

## Self-regulated learning

Self-regulated learning (SRL) refers to the process whereby learners systematically orchestrate their thoughts, feelings, and actions to achieve their learning goals (Pintrich, 2000). In SRL, the active role of learners in their own learning process is emphasized. Reflecting on

one's own knowledge and cognitive processes and using this information to regulate and control one's learning and problem-solving are central aspects. This aspect is referred to as metacognition or thinking about one's own thinking (Lai, 2011). Zimmerman's (2006) self-regulated learning model has been operationalized and studied in various contexts. The model consists of three cyclical phases: forethought, performance, and self-reflection. In the forethought phase, learners set their goals, analyze the task requirements, and develop a strategic plan to accomplish those goals. They also assess their self-efficacy and their motivation levels. In the performance phase, learners put their strategic plan into action. They utilize various cognitive and behavioral strategies to complete the task. Feedback and reflection play a crucial role during this phase. In the self-reflection phase, learners evaluate their performance and compare it with their goals. They identify areas of improvement and develop strategies to enhance their future performances. To achieve a world-class level in soccer, it requires not only extensive training, talent, high motivation, and high-quality instructions but also the ability to systematically evaluate and reflect on one's training practices, level of effort, approach and avoidance motivation, and how the surrounding environment influences one's learning and performance processes (e.g., McCardle et al., 2018; Young et al., 2023; Zimmerman and Kitsantas, 2005). The extent to which players take responsibility for their own learning in their daily practice is therefore assumed to be of great significance for achieving this type of goals.

Six sub-processes of this phases have been studied in soccer (Toering et al., 2012a) or sports in general (McCardle et al., 2018). Four of these processes are metacognitive: (1) strategic planning and preparations before sessions involves setting goals for a game or practice session, analyzing the opponent's strengths and weaknesses, and developing plans accordingly; (2) self-monitoring involves observing performance to track progress and stagnation during sessions; (3) evaluation involves comparison of performance and learning outcomes with specific standards; (4) reflection involves looking back on progress over multiple sessions and identifying strengths and weaknesses to gain insight for future learning and devising a plan to improve their skills. Two processes are motivational; (5) regulation of efforts and concentration related to endurance and propensity for mental and physical exertion during sessions, and (6) self-efficacy, the expectancy that they are able to successfully complete a task. Toering et al. (2009) compared soccer players between the ages of 11 and 17 years at an elite level in the Netherlands with regional level players. They found that players with high reflection scores were 4.9 times more likely to play for the top clubs' academy teams than players with low scores. Moreover, players with high scores on regulation of effort were seven times more likely to play in an academy team than those with low scores. Toering et al. (2012b) investigated self-regulated learning between "international players" and "national players" aged 12–17 years and found no significant differences between the groups for the reported amount of training, albeit regarding reflection. International players scored higher on reflection than national-level players did.

By nature, that type of learning processes depends on volitional processes. Therefore, it is assumed that motivation and direction are required to initiate them (Rheinberg et al., 2000; Zimmerman, 2001). Achievement motives and goals give energy and direction to practice, but how is motivation guided during practice? How a soccer player regulates his thoughts, emotions, and effort during practice will do

him/her able to provide higher quality in the practice/training situation.

## Achievement motives, probability of success, achievement goals, and self-regulated learning

Studies show that motives can predict which goals we are oriented toward (Elliot et al., 2011). Moreover, setting mastery-approach goals and performance-avoidance goals are linked to their underlying motives, while setting performance-approach goals may be linked to both the approach motive (Ms) and the avoidance motive (Mf) (Elliot et al., 2010). Setting mastery avoidance goals is associated with high motive to avoid failure (Conroy and Elliot, 2004). Some studies suggest that people with high Ms scores tend to ignore information about how they perform compared to others (performance/other-based goals). Instead, they focus on mastery (task-based approach goals) and their skills development (Self-based approach goals). This may indicate that those with high scores on the success motive tend to set mastery-approach goals for themselves. However, when the mastery goal is divided into task-based and self-based elements, only the task approach appears to be related to the motive to achieve success in a sample of undergraduate students (Diseth, 2015).

Individuals with a high motive to achieve success will activate higher approach motivation and to a greater extent seek out and thrive in challenging situations (probability of success  $\leq 50\%$ ). They exhibited a more adaptive mastery pattern than athletes with low scores. Zimmerman (2006) claimed that motivation variables (e.g., high perceived probability of success, activated approach motive, and approach goals) are essential for all self-regulated learning processes. Bandura (1997) suggests that the perceived probability of success is crucial in determining which activities we engage in and the amount of effort and learning processes invested in the activity. Empirical evidence suggests that a high expectancy for success is crucial for athletes' efforts and endurance in facing difficulties and challenges. For example, studies on endurance sports show that individuals with high success expectancy are more likely to respond with increased effort and fewer negative emotions when they experience competitions going awry than individuals with low (McCormick et al., 2019). Regarding reflection and evaluation, research suggests that athletes with a high success-expectations have a more appropriate attribution pattern for weak performance than do athletes with low (Feltz et al., 2008), that is, it presumably contributes positively to the approach to present and future goals and indirectly to self-regulated learning processes. Moreover, a consistent finding in Van Yperen and Renkema's three empirical studies from 2008 was that high-performance expectancy is associated with adoption of other-based approach goals, that is, when soccer players consider their skills to be good, it can create a desire to test out how good they are compared to others.

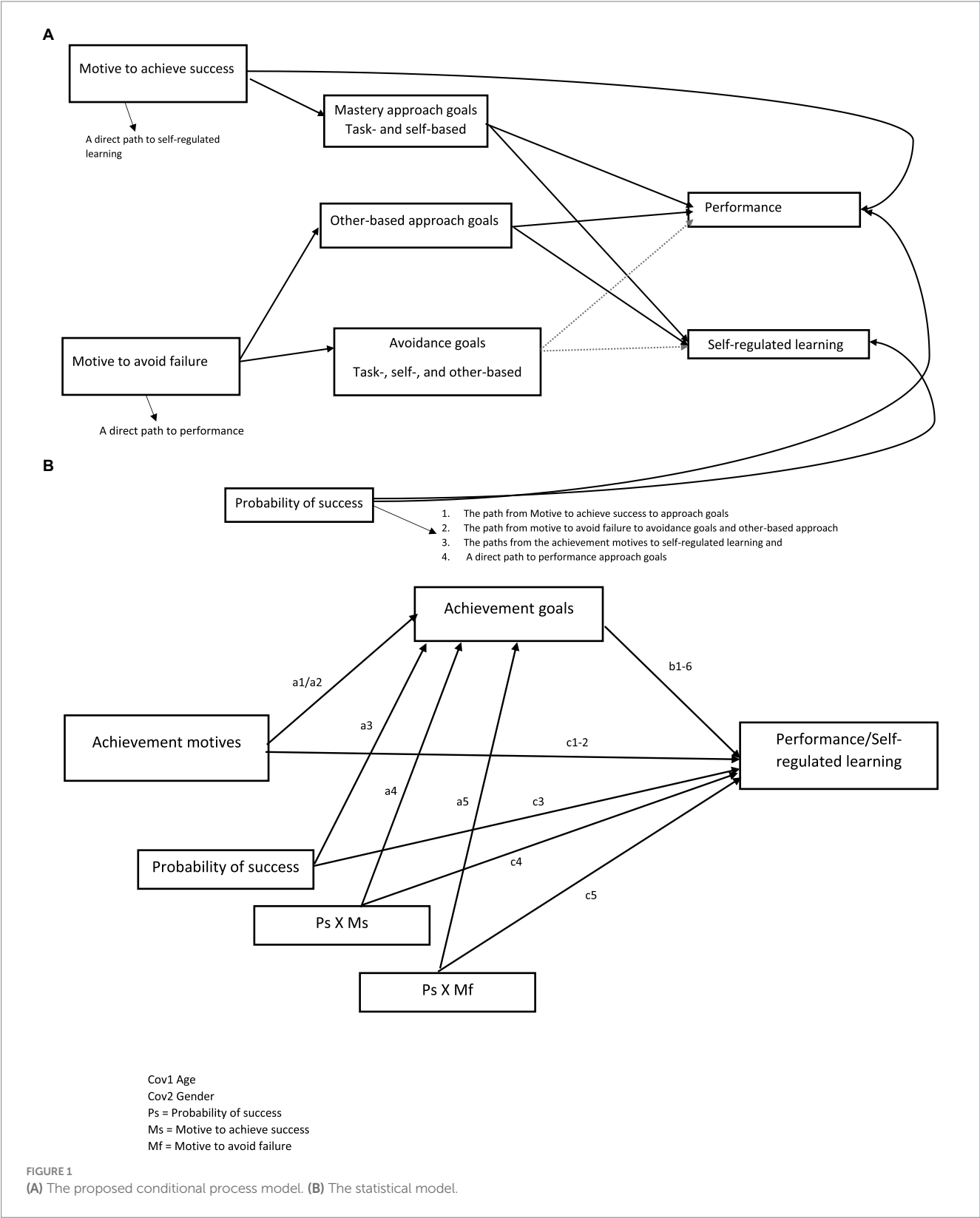
According to Atkinson, in challenging situations (i.e., a task of moderate difficulty,  $ps = 0.50$ ), motives are activated to their maximum. Therefore, it is expected that the influence of motives on motivation is moderated by the perceived likelihood of success or failure. One would thus assume that the interaction between motive

and probability of success will influence the strength and direction of goals and possibly also the degree of self-regulated learning. Concerning achievement goals, the theoretical basis suggests that approach goals and mastery (task- and self-based) are related to adaptive learning processes. This is supported by a meta-analysis that examined the relationship between three types of achievement goals: mastery, performance-approach, and performance-avoidance, and self-regulated learning processes: monitoring, evaluation, and self-reaction, across a range of contexts (Cellar et al., 2011). The results showed that mastery-approach goals were positively related to all learning processes, while performance goals (approach and avoidance) were not significantly related. Evidently, the achievement motives indirectly affect learning processes through goals. Among a sample of undergraduate student, Ms. was significantly related to metacognitive self-regulation and mastery-approach goals partially mediated this relationship (Bartels and Magun-Jackson, 2009). The relationship between the fear of failure motive/avoidance goals and self-regulated learning is more uncertain since it is possible that self-regulated learning is also motivated by fear of failure or avoidance goals. For example, performance-avoidance goals were positively related to metacognitive self-regulation ( $r = 0.31, p < 0.01$ ) in Bartels and Magun-Jackson (2009) and task-based mastery avoidance goals were positively related to adaptive strategies in Madjar et al.'s (2011) study.

## The present study

Studies on the topic of motivation in soccer have some limitations. First, the dichotomous perspective on achievement goals, whereby a distinction is made between mastery and performance, is dominant (Murr et al., 2018). This study seeks to expand the research on the impact of approach and avoidance goals. Second, there are few empirical studies on the outcomes of achievement motives among talented young footballers who are eligible for national teams. Third, it is uncertain how the probability of success affects the relationships between motives, achievement goals, and self-regulation among young elite soccer players. As far as we know, there are no studies that have examined the relationship between the  $3 \times 2$  goal structure and effective learning processes. Whether the goals predict differently when distinguishing between task and self-mastery is therefore an open question. According to Brunstein and Heckhausen (2008, p. 181), the achievement motivation researchers have, for decades, been more focused on performance and neglected to clarify the connection between motivation and learning. Therefore, we also investigated whether the observed relationship between the antecedents in the hierarchical model and self-regulated learning and performance is transferable to this population. Third, samples in most soccer studies have comprised boys. This study sought to expand the research to include girls and investigate differences in motivation between boys and girls in this population. The study partly comprises a continuation and expansion of a hierarchical motive-goal-behavior model (e.g., Elliot, 1999). Here, it is suggested that an aroused motive (i.e., affective expectation) evokes either approach or avoidance goals, which in turn regulate specific behavior. We therefore seek to answer the question, "How are achievement motives, the probability of success, and achievement goals related to self-regulated learning and coach-reported performance among the greatest young football talents in Norway?"

In that context, we hypothesize two effects as part of a conditional process model of motives, achievement goals, and soccer-related outcomes. The first is that the direct effect of achievement motives on soccer-related outcomes (achievement goals, regulation of effort, coach-reported performance, and metacognition) is moderated by the perceived probability of success. The second is that the effect of achievement motives on soccer-related outcomes is mediated by achievement goals. The proposed conditional process model is presented in Figures 1A,B.



Based on this, the following hypotheses have been proposed:

Direct effects:

*H1:* High probability of success positively predicts other-based approach goals, self-regulated learning, and performance (a3, c3).

*H2:* Motive to achieve success positively predicts mastery-approach goals (task and self), performance, and self-regulated learning (a1, c1).

*H3:* Approach goals (task, self, and others) positively predict performance (b1, b2, b3).

*H4:* Mastery-approach goals (task- and self-based) positively predict self-regulated learning (b1, b2).

*H5:* Motive to avoid failure positively relates to avoidance and other-based approach goals (a2).

*H6:* Motive to avoid failure is negatively related to performance (c2).

Moderated effects:

*H7:* Low and medium probability of success intensify the effect of the achievement motives on achievement goals/self-regulated learning (a4, a5, c4, c5).

Mediation/moderated mediation effects:

*H8:* Mastery-approach goals (task and self) mediate the relationship between motive to achieve success on the one hand and performance/self-regulated learning on the other.

*H9:* The mediation effect of achievement goals on the relationship between the motive to achieve success and self-regulated learning is moderated by the probability of success.

Studies of sex and age differences in motivation and learning in youth elite footballer are few (Wachsmuth et al., 2023). Thus, we did not forward specific hypotheses for sex or age differences.

## Methods

### Data collection procedure

Participants comprised the most promising young soccer talents in Norway. The Norwegian Football Association (NFF) holds a

national team school talent camp three times per year. The players selected for the camps are considered highly suitable for national youth teams. The selection of players for camps occurs systematically by dividing Norway into five regions with associated constituencies. Constituency officers for player development meet in their regions to nominate players from the region for the talent camp based on their observations during matches and training sessions. After the nominations, cohort managers from the football federation and national team coaches make the final selection based on the nominations and matches they have observed on video and/or live. In 2020, due to COVID-19, only one talent camp was organized for each age group. A total of 257 players were selected for the camps and were divided into 11 teams. There were two teams for boys in the age groups 14, 15, and 16. For girls, there were also two teams for the 14- and 15-year-olds, but only one team for the 16-year-old girls (28 players). Prior to the talent camps, two informational meetings were held: one for the parents of the boys and one for the girls selected for the camps. During these meetings, the research project was briefly presented to all the parents and coaches. In accordance with the guidelines from the Norwegian Centre for Research Data (NSD, registration number 753125/2020), parents of players under 15 years old received an electronic information letter and consent form for participation in the project. After parental consent was granted, players received information letters and had the opportunity to provide consent. All players received a consent form, and those who provided consent automatically received a link to an electronic questionnaire via email or SMS. Time was set aside during the beginning of the camp for the six groups of players to fill out the form, and a data collector was present to provide instructions and answer any questions.

### Participants

Data from 192 players (of the 257 selected, see Table 1) were collected during August 2020, when the Norwegian national team school talent camps was held. There were three age groups with a mean age of 14.9 years ( $SD = 0.8$ ; range = 14–16). Girls accounted for 42% of the respondents. The response rates for girls and boys selected for the talent camps were 74 and 75%, respectively. Three of the players did not participate due to not receiving permission from their club to attend the camp, for 53 we were unable to reach the parents or youth in front of the camp, and nine consented to participate but were not present when we conducted data collection (due to injuries or illness).

Data were stored with Services for Sensitive Data (TSD) at the University of Oslo. No *a priori* power analysis was conducted for the study. The sample size was determined by number of participants

TABLE 1 Descriptive data of the participants.

	Total sample		U16		U15		U14	
	<i>n</i> = 192		<i>n</i> = 53		<i>n</i> = 66		<i>n</i> = 73	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<b>Gender</b>								
Male	110	57.3%	37	69.8%	35	53%	38	52.1%
Female	82	42.7%	16	30.2%	31	47%	35	47.9%



selected for the national team camps for boys and girls in 3-year classes in 2020.

Analyses

AMOS version 26 was used for confirmatory factor analysis (CFA). There are various robust methods for analyzing the factor structure. The most appropriate available method in AMOS for non-normally distributed data with a sample size of less than 200 is the maximum likelihood with the Bollen-Stine procedure. For all CFA, we obtained  $\chi^2$  statistic based on 5,000 bootstrap samples and applied the procedure suggested by Walker and Smith (2017) to compute model fit indices adjusted in accordance with the Bollen-Stine procedure. While factors were allowed to correlate,

we did not allow for correlated errors. Descriptive statistics were calculated for all measures using SPSS version 29. Welch *t*-tests examined sex differences in achievement motives, achievement goals, perceived probability of success, self-regulated learning, and coach-reported performance (see Table 2) since it performs better than Student's *t*-test whenever sample sizes and variances are unequal between groups and gives the same result when sample sizes and variances are equal (Delacre et al., 2017). Investigating age group differences, we used a one-way ANOVA (see Table 3). The correlations between the study variables were conducted (see Table 4). As a criterion for checking whether our data satisfied a normal distribution, we used the guidelines from Byrne (2016) and Hair et al. (2010), respectively, which state that variables' skewness

TABLE 2 Sex differences in achievement motives, probability of success, achievement goals, self-regulated learning, and coach reported performance.

	N	Number of item	Response scale	Total		Boys		Girls		Welch <i>t</i> -test		
				M	SD	M	SD	M	SD	<i>t</i>	Df2	Sig.
1. Motive to achieve success	192	5	1–4	18.44	1.59	18.38	1.60	18.51	1.57	0.32	176.76	0.574
2. Motive to avoid failure	192	5	1–4	9.98	3.00	9.46	3.06	10.68	2.78	<b>8.28</b>	<b>182.77</b>	<b>0.004</b>
3. Probability of success	192	7	1–8	34.88	7.76	34.77	7.84	35.02	7.69	0.049	176.40	0.824
4. Task-based approach	192	3	1–7	20.13	1.53	20.11	1.41	20.14	1.69	0.026	155.50	0.872
5. Task-based avoidance	192	3	1–7	15.90	4.70	15.96	4.65	15.80	4.80	0.053	171.62	0.872
6. Self-based approach	192	3	1–7	19.14	2.09	18.90	2.24	19.46	1.82	3.68	188.64	0.057
7. Self-based avoidance	192	3	1–7	15.77	4.74	15.78	4.68	15.75	4.85	0.001	171.62	0.970
8. Other-based approach	192	3	1–7	16.60	4.09	17.09	3.87	15.96	4.30	3.51	163.92	0.058
9. Other-based avoidance	192	3	1–7	14.10	5.18	14.61	4.85	13.40	5.54	2.51	160.83	0.108
10. Planning	192	4	1–5	15.59	2.75	15.88	2.74	15.20	2.73	2.86	174.69	0.093
11. Reflection/evaluation	192	4	1–5	13.31	1.59	13.44	1.49	13.12	1.70	1.89	161.65	0.163
12. Effort	192	3	1–5	13.82	1.25	13.80	1.25	13.85	1.27	0.085	174.69	0.770
13. Coach reported performance	189	1	1–5	3.52	0.94	3.46	0.91	3.60	0.97	1.02	169.28	0.315

Bold values = *p* < 0.05.

TABLE 3 Age differences in achievement motives, probability of success, achievement goals, self-regulated learning, and coach reported performance.

	N	Number of item	Response scale	Total		U15		U16		U17		Welch <i>F</i> -test		
				M	SD	M	SD	M	ST	M	ST	Welch <i>F</i> -test	Df	Sig.
1. Motive to achieve success	192	5	1–4	18.44	1.59	18.59	1.57	18.38	1.64	18.30	1.55	0.58	2, 121.35	0.561
2. Motive to avoid failure	192	5	1–4	9.98	3.00	9.16	2.62	10.79	2.89	10.11	3.36	<b>6.05</b>	<b>2, 115.85</b>	<b>0.003</b>
3. Probability of success	192	7	1–8	34.88	7.76	36.33	7.16	34.14	7.97	33.81	8.11	2.20	2, 118.53	0.115
4. Task-based approach	192	3	1–7	20.13	1.53	20.18	1.33	20.03	1.80	20.17	1.46	0.16	2, 118.11	0.850
5. Task-based avoidance	192	3	1–7	15.90	4.70	16.34	4.63	15.56	4.98	15.70	4.50	0.54	2, 121.65	0.586
6. Self-based approach	192	3	1–7	19.14	2.09	19.23	1.74	19.40	1.82	18.68	2.72	1.40	2, 111.78	0.251
7. Self-based avoidance	192	3	1–7	15.77	4.74	15.78	4.94	16.02	4.73	15.45	4.54	0.22	2, 122.45	0.805
8. Other-based approach	192	3	1–7	16.60	4.09	16.16	4.37	16.62	4.36	17.21	3.24	1.20	2, 125.29	0.304
9. Other-based avoidance	192	3	1–7	14.10	5.18	13.66	5.11	14.50	5.67	14.20	4.65	0.45	2, 122.75	0.640
10. Planning	192	4	1–5	15.59	2.75	15.10	2.96	15.94	2.72	15.85	2.41	1.82	2, 124.66	0.166
11. Reflection/evaluation	192	4	1–5	13.31	1.59	13.05	1.63	13.47	1.53	13.45	1.58	1.46	2, 121.36	0.237
12. Effort	192	3	1–5	13.82	1.25	13.63	1.33	13.91	1.32	13.98	1.03	1.49	2, 124.98	0.230
13. Coach reported performance	189	1	1–5	3.52	0.94	3.41	0.98	3.56	0.96	3.61	0.84	0.84	2, 121.75	0.434

Bold values = *p* < 0.05.

TABLE 4 Descriptive statistics and Correlation between the variables (Pearson's *r*).

	$\alpha$	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Motive to achieve success	0.76	1	−0.18**	0.10	0.29**	−0.01	0.25**	−0.00	0.07	−0.02	0.31**	0.33**	0.31**	−0.07
2. Motive to avoid failure	0.69		1	−0.22**	−0.06	0.20**	0.08	0.27**	0.15*	0.28**	−0.07	−0.04	−0.15*	0.05
3. Probability of success	0.82			1	0.10	0.01	−0.02	−0.06	0.11	0.00	0.27**	0.18*	0.22**	0.26**
4. Task-based approach	0.72				1	0.22**	0.51**	0.20**	0.36**	0.25**	0.21**	0.25**	0.34**	0.08
5. Task-based avoidance	0.81					1	0.33**	0.79**	0.36**	0.70**	0.12	0.11	−0.01	−0.05
6. Self-based approach	0.67						1	0.32**	0.35**	0.31**	0.16*	0.23**	0.30**	0.07
7. Self-based avoidance	0.83							1	0.27**	0.72**	0.12	0.16*	−0.00	−0.04
8. Other-based approach	0.86								1	0.63**	0.19**	0.16*	0.16*	0.09
9. Other-based avoidance	0.90									1	0.12	0.13	−0.04	0.00
10. Planning	0.82										1	0.55**	0.46**	0.00
11. Reflection/evaluation	0.68											1	0.40**	0.07
12. Effort	0.68												1	0.06
13. Coach reported performance	–													1

$\alpha$  = Cronbach alpha; \* $p < 0.05$ , \*\* $p < 0.01$ .

and kurtosis scores should fall within a range of  $\pm 2$  and  $\pm 7$  for skewness and kurtosis.

We used PROCESS 4.0 Macro for SPSS to conduct moderation analysis testing probability of success as a moderator of the relationships of the motives with achievement goals, self-regulated learning, and coach-reported performance during the talent camp (Model 2; Hayes, 2022). To facilitate interpretability, a final set of analyses was included if only one of the interaction terms was significant (Model 1). Statistically significant interactions were probed by estimating effects at high (84th percentile), moderate (50th percentile), and low (16th percentile) levels of the achievement motives and by using the Johnson-Neyman technique to graph conditional effects. Second, a moderation mediation process model was examined (Model 10; Hayes, 2022) to estimate the direct and indirect effects of achievement motives on dimensions of self-regulated learning and performance with probability of success moderating these effects. For all models, we conducted four separate analyses—for self-regulation of effort, planning, reflection/evaluation, and for coach-rated performance. In all models, achievement motives were a focal predictor, achievement goals were treated as a mediator, and one of the dimensions of self-regulated learning and coach-related performance was the outcome variable. We included gender and age group as covariate in the final model. Third, if moderated mediation was not significant, we used a simple mediation model (Model 4) to test whether there was evidence of an indirect effect when no moderator was included in the analysis. In the last stripped model, only those mediators that showed a significant correlation with the outcome variable were included. In all models, bootstrap procedure with 5,000 iterations was used, and the significant confidence interval was 95%. A bootstrapped 95% CI that did not contain zero indicated a significant indirect effect. To interpret the magnitude of the effect sizes, we use the guidelines for personality research by Funder and Ozer (2019), with  $r = 0.05$ ,  $r = 0.10$ ,  $r = 0.20$ ,  $r = 0.30$ , and  $r = 0.40$  or greater corresponding to very small, small, medium, large, and very large effects, respectively.

## Instruments

### Achievement motives

To measure achievement motives, we used the Achievement Motives Scale-Sport, a revised sport-specific 10-item edition (AMS-S; Elbe and Wenhold, 2005; Wenhold et al., 2009), of the original 30 items AMS (Gjesme and Nygård, 1970). The instrument measures the strength of the motive to achieve success (Ms) and avoid failure (Mf). As in Höner and Feichtinger (2016), the respondents rated how well each statement matched their usual reactions in soccer-specific situations, ranging from 1 (“completely disagree”) to 4 (“completely agree”). To interpret the AMS scores, Elbe and Wenhold (2005) calculate the difference of the two scores, the net hope = Ms – Mf. A positive net hope indicates that the soccer players enjoy challenging situations during matches or training situations, whereas a negative value indicates that the players find such situations unpleasant. In this sample, the mean net hope = 8.45, and only two out of 192 had a negative value. Satisfactory internal reliability was observed for Ms ( $\alpha = 0.76$ ) and Mf ( $\alpha = 0.69$ ). A confirmatory factor analysis (CFA) produced the expected two factors of motive for success and motive to avoid failure [Bollen-Stine  $\chi^2$  ( $df = 31$ ) = 29.58 ( $p = 0.20$ ), Bs scaling factor = 1.427, CFI = 0.988, IFI = 0.987, TLI = 0.995, RMSEA = 0.035].

### Probability of success

Various methods have been used to measure probability of success (Ps) in achievement motivation research (Brunstein and Heckhausen, 2008). In our case, where there is competition among 50 other players to secure a place in a national team squad, it is most relevant to use a social comparison standard where the Ps is largely dependent on how a player rates his or her ability relatively to that of others. To contextualize the subjective probability of success, we wanted a measure where the players assessed themselves on a set of soccer skills that experts in the field assume to be central to achieving success and rank them compared against the top 50 players in their age group in Norway skills. Items from Van Yperen's performance level measure were chosen (Van Yperen, 1995; Van Yperen and Duda, 1999). The soccer skills in measure were developed by Ajax technical staff and assess players' abilities in important

areas for soccer performance. In this study, we adapted and reworked the introduction and response options to suit our purpose. The players were asked to assess their soccer skills compared to the top 50 players in Norway in their age group (corresponding number of players as in the different age groups at the national team training camp), and the item responses were as follows: (1) not among the top 50, (2) among the 50–41, (3) 40–31, (4) 30–21, (5) 20–11, (6) among the top 10, (7) among the top 5, (8) the best. The measure includes seven items: six detailed (speed; endurance/conditioning; strength, technique, tactical ability; understanding of the game, and mentality) (how mentally strong on the football field), and one global appraisal (an overall appraisal of own talent) of soccer skills. Satisfactory internal reliability was observed ( $\alpha=0.82$ ). A CFA produced the expected probability of success factor with Bollen-Stine  $\chi^2$  ( $df=14$ ) = 23.685 ( $p=0.00$ ), Bs scaling factor = 3.696, CFI = 0.980, IFI = 0.980, TLI = 0.970, and RMSEA = 0.06.

### Achievement goals

We used the soccer version of the 3×2 Achievement Goals Questionnaire (AGQ, Elliot et al., 2011). Mascaret et al. (2015) translated and validated the AGQ in the context of a specific sport. The AGQ evaluates six types of goals, each consisting of three indicators. In this study, we use a translated and validated Norwegian version of the AGQ (Diseth, 2015). The instruction in this study is, however, aimed at the types of goals you have or may not have when you play soccer. Participants rated the extent to which they agreed or disagreed that the different goals were suitable for them regarding playing soccer, ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). Satisfactory to high levels of internal reliability were observed for the achievement goals (0.67–0.90, see Table 4). Consistent with the 3×2 model, the six-factor model showed satisfactory fit to our data (Bollen-Stine  $\chi^2$  ( $df=120$ ) = 156.053,  $p=0.015$ , Bs scaling factor = 1.673, CFI = 0.982, IFI = 0.982, TLI = 0.977, RMSEA = 0.06).

### Soccer-specific self-regulated learning

We created a custom soccer-specific measure of self-regulated learning based on items from two established questionnaires (McCardle et al., 2018; Toering et al., 2013). The extended SRL-SP measures four sub-processes related to self-regulated learning: planning, reflection/evaluation, effort, and self-efficacy. The relationship between self-efficacy, motivation, and goals has already been examined in several studies (see e.g., Bjørnebekk et al., 2013). To keep questionnaires short and informative, we only used the scales to measure planning, evaluation/reflection, and regulation of effort. The items were reformulated from sports to a soccer context consisting of four items for planning, four for reflection/evaluation, and three for effort. The effort and planning items were chosen based on how high they loaded on the factor in McCardle et al.’s measure models (2018). Evaluation/reflection items were selected based on their high loadings in the extended model and their satisfactory performance in Toering et al.’s football study (2013) as this was the factor that characterized top players. For all three, they also covered the breadth of the concepts that were measured (for items and factor loadings, see Appendix Table 1). Participants rated how well the various statements suited them, ranging from 1 (“does not fit at all”) to 5 (“fits very well”). The results showed that the specified model fit the data well [Bollen-Stine  $\chi^2$  ( $df=41$ ) = 29.582 ( $p=0.06$ ), Bs scaling factor = 1.427, CFI = 0.988, IFI = 0.987, TLI = 0.995, RMSEA = 0.035]. Satisfactory internal reliability was observed for planning ( $\alpha=0.82$ ), evaluation/reflection ( $\alpha=0.68$ ), and effort ( $\alpha=0.68$ ).

### Coach-reported performance

At the talent camp, all participants were classified based on their performance during their stay. The classification is well incorporated into the national school team and undertaken over a long period. Constituency managers for player development and national team coaches operate as coaches during their stays. There are two to four coaches for each player group, comprising 20–25 players. During the talent camp, which lasted 5 days, all groups played two matches and participated in two to three training sessions. After the talent camp, coaches in each group classified their players based on the following scale: 1—“highly relevant for a national team eleven,” 2—“highly relevant for a national team squad,” 3—“highly relevant for a shadow national team eleven,” 4—“highly relevant for a shadow national team squad,” and 5—“worth following.”

## Results

Regarding the motive to achieve success, the task- and self-based approaches, skewness, and kurtosis suggest that the variables deviated from a normal distribution. The motive to achieve success (skewness = −2.92, Kurtosis = 13.02) and task-based approach (skewness = −2.84, Kurtosis = 11.88) had skewness and kurtosis over the recommended rule of thumb. The other variables were within the acceptable range. Both mirrored logarithmic and inverse transformations were attempted to improve the distribution as it approached normal. After the transformation, skewness and kurtosis were re-examined, and the correlation between the transformed and original scales was considered. The results showed that the mirrored inverse transformation  $1/(K - x)$  produced the most satisfactory results (For MS skewness = −0.52 and kurtosis = −0.25/task-based performance skewness = −1.03 and kurtosis = −0.26). This transformation was performed and used in the moderation and mediation analysis. A variance inflation factor (VIF) analysis was performed to check for multicollinearity. This analysis showed that the VIF ranged from 1.17 and 3.90, which is below the recommended limit (VIF > 5, Chatterjee and Simonoff, 2013).

### Sex and age differences, descriptive statistics, and correlations between variables

First, Welch *t*-tests were presented to illustrate the overall relationships and investigate whether there were differences between boys and girls. F-tests were presented for differences for age groups.

The independent sample *t*-tests found one significant sex difference (see Table 2): girls reported higher scores on the motive to avoid failure ( $M=2.14$ ,  $SD=0.56$ ) than boys ( $M=1.89$ ,  $SD=0.61$ ,  $t(190)=-2.88$ ,  $p<0.01$ ). The boys had higher score than the girls on other-based goals, respectively,  $M=14.61$  vs.  $M=13.40$ , for avoidance and,  $M=17.09$  vs.  $M=15.96$ , for approach, and in terms of planning training and match situations in advance ( $M=15.88$  vs.  $M=15.20$ ), while the girls scored higher on self-based approach goals ( $M=18.90$  vs.  $M=19.46$ ). However, these latter differences were only marginally significant. In addition, the youngest players scored lower on the motive to avoid failure than older players did (see Table 3). The

analyses showed no significant mean differences in scores by sex or age group regarding the other variables.

In sum, among talented footballers, the findings suggest that girls' scores on the motive to avoid failure were higher than those of boys. However, girls' and boys' scores were relatively similar for football-specific self-regulated learning, perceived probability of success, achievement goals, and the motive to achieve success.

The results, presented in Table 4, showed several significant correlations between the predictors and mediators that supported our assumptions; The motive to achieve success was moderately positively correlated with task- and self-based approach goals ( $r=0.29$  and  $0.25$ ) but not significantly related to other approach goals. The motive to avoid failure was moderately positively associated with all three avoidance goals (task-based  $r=0.20$ , self-based  $r=0.27$ , other-based  $r=0.28$ ) and weakly to other-based approach goals ( $r=0.15$ ). When it comes to the relationship between the predictors and the outcomes variables, the motive to achieve success was positively related to planning ( $r=0.31$ ), reflection/evaluation ( $r=0.33$ ), and regulation of effort ( $r=0.31$ ) and the relationships were large. The motive to avoid failure, however, was only significantly related to effort, and the association was small ( $r=-0.15$ ). Moreover, all the approach goals were moderately positively associated with self-regulation of planning, effort, and reflection/evaluation. For the avoidance goals, the only significant relationship was between self-based avoidance goals and reflection/evaluation. However, except for the association to probability to success ( $r=0.26$ ), non-significant correlations were observed between coach-reported performance and of the predictors or mediators.

## The achievement goals

The moderation mediation analyses (Model 10) showed that in the first part of the model (i.e., the paths from the predictors to the mediators, see Table 5a), the motive to achieve success was positively related to task-based ( $b=0.288$ ,  $SE=0.07$ ,  $p=0.000$ , 95% CI  $[0.148-0.428]$ ) and self-based approach goals ( $b=0.241$ ,  $SE=0.07$ ,  $p<0.001$ , 95% CI  $[0.098-0.384]$ ). However, the association between the motive to achieve success and other-based approach goals was not significant ( $b=0.106$ ,  $SE=0.07$ ,  $p=0.14$ , 95% CI  $[-0.036-0.250]$ ). Similarly, the motive to avoid failure was significantly related to the avoidance goals: task-based ( $b=0.24$ ,  $SE=0.08$ ,  $p<0.002$ , 95% CI  $[0.089-0.392]$ ), self-based ( $b=0.296$ ,  $SE=0.08$ ,  $p<0.000$ , 95% CI  $[0.148-0.445]$ ), and other-based avoidance goals ( $b=0.338$ ,  $SE=0.07$ ,  $p<0.000$ , 95% CI  $[0.192-0.483]$ ). Conversely to Ms, Mf was positively related to other-based approach goals ( $b=0.223$ ,  $SE=0.08$ ,  $p<0.004$ , 95% CI  $[0.075-0.372]$ ). The probability for success was only significantly related to other-based approach goals ( $b=0.184$ ,  $SE=0.07$ ,  $p=0.013$ , 95% CI  $[0.040-0.327]$ ).

## Regulation of effort

Concerning regulation of effort, the results showed significant direct effects (c1, see Table 5b) of the motive to achieve success ( $b=0.233$ ,  $SE=0.08$ ,  $p<0.005$ , 95% CI  $[0.066-0.398]$ ) and of the probability of success ( $b=0.247$ ,  $SE=0.08$ ,  $p<0.005$ , 95% CI  $[0.082-0.412]$ ). The test of the highest order unconditional interactions indicated that the interactions between the motives and probability of

success were not significant. The mediation process was therefore not significantly dependent of the probability of success. For the individual mediators' contributions, the results showed the following: a significant effect of adoption of task-based approach ( $b=0.211$ , 95% CI  $[0.006-0.133]$ ) and self-based approach goals ( $b=0.297$ , 95% CI  $[0.100-0.494]$ ). Approximately 32% of the variance in regulation of effort and concentration was accounted for by the moderated mediation model ( $F(13, 178)=6.37$ ,  $p=0.000$ ). In the stripped model, the total indirect effect was significant (ie=0.131 BootSE 0.05, 0.055–0.233). Two of the three approach goals were found to contribute significantly to the overall indirect effect: task-based approach ( $b=0.068$ , BootSE=0.035; 95% CI  $[0.011-0.153]$ ) and self-based approach goals ( $b=0.065$ , BootSE=0.033, 95% CI  $[0.012-0.140]$ ).

## Evaluation/reflection

The results showed a significant direct effect of the motive to achieve success ( $b=0.490$ ,  $SE=0.11$ ,  $p=0.000$ , 95% CI  $[0.267-0.713]$ ) and of the probability of success ( $b=0.287$ ,  $SE=0.11$ ,  $p=0.011$ , 95% CI  $[0.066-0.509]$ ) concerning use of the metacognitive strategies of reflection and evaluation. However, the moderated mediator contributions were not significant. Approximately 23% of the variance in reflection/evaluation was accounted for by the model [ $F(13, 178)=4.15$ ,  $p<0.000$ ]. The indirect effect in the stripped model was also non-significant (ie=0.081, BootSE 0.05; [95% CI  $-0.006-0.200]$ ).

## Planning

The results showed a significant direct effect of the motive to achieve success concerning evaluation ( $b=0.809$ ,  $SE=0.19$ ,  $p=0.000$ , 95% CI  $[0.429-1.189]$ ) and of the probability of success ( $b=0.737$ ,  $SE=0.19$ ,  $p=0.000$ , 95% CI  $[0.360-1.114]$ ). The moderated mediation was not significant.

Approximately 26% of the variance in planning was accounted for by the model [ $F(13, 178)=4.77$ ,  $p=0.000$ ]. In the striped model, the total indirect effect was significant (ie=0.122, Boot SE 0.07, 0.004–0.285). However, none of the individual mediator contributions were significant.

## Coach-reported performance

The probability of success was the only significant contributions ( $b=0.276$ ,  $SE=0.07$ ,  $p=0.000$ , 95% CI  $[0.135-0.417]$ ). Approximately 13% of the variance in coach-rated performance was accounted for by the model ( $F(13, 175)=2.00$ ,  $p=0.23$ ) (Tables 6, 7).

## Probability of success as a moderator of the achievement motives effect on achievement goals and self-regulated learning

The moderation analysis revealed that the motive to achieve success effect on task-based approach goals ( $b=-0.147$ ,  $\Delta R^2=0.025$ ,  $p=0.022$ ), regulation of effort and concentration ( $b=-0.167$ ,  $\Delta R^2=0.021$ ,  $p=0.022$ ), and evaluation/reflection ( $b=-0.167$ ,  $\Delta R^2=0.015$ ,  $p=0.07$ ) were dependent of the probability of success. The Johnson-Neyman technique indicated that for soccer players with probability of success above 0.77 for task-based approach (21.4% of the players), 1.04 for regulation of effort (16.2% of the players), and 1.23 for evaluation/reflection



TABLE 5a Path coefficients, standard errors, and confidence intervals – the mediators (Hayes Model 10).

	Task-based approach goal			Self-based approach goal			Other-based approach goal			Task-based avoidance goal			Self-based avoidance goal			Other-based avoidance goal		
Predictors	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.
a1 Ms	<b>0.288***</b>	0.07	0.148–0.428	<b>0.241***</b>	0.07	0.098–0.384	0.106	0.07	−0.036–0.250	0.024	0.07	−0.120 to 0.168	0.062	0.07	−0.079–0.203	0.056	0.07	−0.082–0.196
a2 Mf	0.002	0.08	−0.146–0.150	0.091	0.08	−0.059 to 0.242	<b>0.223**</b>	0.08	0.075 to 0.372	<b>0.240***</b>	0.08	0.089 to 0.392	<b>0.296***</b>	0.08	0.148–0.445	<b>0.338***</b>	0.07	0.192–0.483
a3 Ps	0.089	0.07	−0.054 to 0.232	−0.027	0.07	−0.172 to 0.119	<b>0.184*</b>	0.07	0.040–0.328	0.055	0.07	−0.091 to 0.202	0.017	0.07	−0.127–0.160	0.100	0.07	−0.041–0.241
a4 Ms x Ps	<b>−0.148*</b>	0.06	−0.269 to −0.028	−0.096	0.06	−0.219 to 0.026	−0.008	0.06	−0.129 to 0.114	<b>−0.131*</b>	0.06	−0.254 to −0.008	−0.109	0.06	−0.230–0.012	−0.072	0.06	−0.190–0.047
a5 Mf x Ps	−0.094	0.06	−0.219 to 0.032	−0.070	0.06	−0.198 to 0.057	<b>−0.130*</b>	0.06	−0.256 to −0.004	−0.082	0.06	−0.210 to 0.046	<b>−0.146*</b>	0.06	−0.272– −0.021	<b>−0.155*</b>	0.06	−0.278– −0.031
Gender	0.089	0.15	−0.198 to 0.375	0.220	0.15	−0.072 to 0.511	<b>−0.347*</b>	0.15	−0.635 to −0.059	−0.146	0.15	−0.439 to 0.147	−0.131	0.15	−0.418–0.156	<b>−0.364*</b>	0.14	−0.646– −0.082
Age	0.009	0.09	−0.167 to 0.185	−0.068	0.09	−0.247 to 0.111	0.087	0.09	−0.090 to 0.264	−0.146	0.09	−0.325 to 0.034	−0.115	0.09	−0.291–0.061	−0.034	0.09	−0.207–0.139
Constant	−0.060	0.20	−0.448 to 0.338	0.030	0.21	−0.375 to 0.435	−0.044	0.20	−0.445 to 0.357	0.334	0.21	−0.074 to 0.741	0.253	0.20	−0.146–0.652	0.194	0.20	−0.198–0.686
		R <sup>2</sup> = 0.124			R <sup>2</sup> = 0.091			R <sup>2</sup> = 0.110		R <sup>2</sup> = 0.081			R <sup>2</sup> = 0.118				R <sup>2</sup> = 0.148	
	F (7, 184) = 3.71, p = 0.001			F (7, 184) = 2.63, p = 0.013			F (7, 184) = 3.27, p = 0.003			F (7, 184) = 2.32, p = 0.027			F (7, 184) = 3.51, p = 0.002			F (7, 184) = 4.58, p = 0.000		

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ , two-tailed.  $N = 192$ ; SE, standard error; CI, 95% confidence interval. Gender: 0 = Male; 1 = Female. Bold values =  $p < 0.05$ .

TABLE 5b Path coefficients, standard errors, and confidence intervals – the outcome variables (Hayes Model 10).

		Effort		Evaluation/reflection				Planning		Coach rated performance		
Predictors	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.
c1 Ms	0.233**	0.08	0.066 to 398	0.490***	0.11	0.267 to 0.713	0.809***	0.19	0.429 to 1.189	−0.130	0.07	−0.271 to 0.012
c2 Mf	−0.085	0.09	−0.262 to 0.092	0.054	0.12	−0.184 to 0.292	0.086	0.21	−0.320 to 0.491	0.073	0.08	−0.078 to 0.223
c3 Ps	0.247**	0.08	0.082 to 0.412	0.287*	0.11	0.066 to 0.509	0.737***	0.19	0.360 to 1.114	0.276***	0.07	0.135 to 0.417
c4 Ms x Ps	−0.105	0.07	−0.244 to 0.034	−0.154	0.09	−0.341 to 0.032	−0.103	0.16	−0.421 to 0.214	−0.009	0.06	−0.127 to 0.109
c5 Mf x Ps	−0.035	0.07	−0.179 to 0.110	−0.206*	0.09	−0.400 to −0.012	0.021	0.16	−0.309 to 0.351	−0.024	0.06	−0.146 to 0.099
b1 Task-appr	0.211*	0.10	0.016 to 0.406	0.028	0.13	−0.234 to 0.286	0.078	0.23	−0.368 to 0.524	0.072	0.08	−0.094 to 0.239
b2 Self-appr	0.297**	0.10	0.100 to 0.494	0.189	0.13	−0.076 to 0.453	0.304	0.23	−0.147 to 0.755	0.058	0.09	−0.112 to 0.228
b3 Other-appr	0.143	0.12	−0.089 to 0.374	0.048	0.16	−0.262 to 0.359	0.216	0.27	−0.313 to 0.745	0.056	0.10	−0.147 to 0.259
b4 Task-avoid	−0.106	0.14	−0.377 to 0.165	−0.101	0.18	−0.460 to 0.267	0.033	0.31	−0.586 to 0.652	−0.108	0.12	−0.339 to 0.123
b5 Self-avoid	0.149	0.15	−0.142 to 0.440	0.269	0.20	−0.122 to 0.660	0.382	0.34	−0.284 to 1.048	−0.012	0.12	−0.259 to 0.234
b6 Other-avoid	−0.295	0.15	−0.599 to 0.009	−0.084	0.21	−0.495 to 0.321	−0.290	0.35	−0.985 to 0.406	0.002	0.13	−0.260 to 0.256
Cov1 Gender	−0.000	0.17	−0.335 to 0.335	−0.367	0.23	−0.817 to 0.083	−0.766*	0.39	−1.532 to −0.001	0.139	0.15	−0.148 to 0.426
Cov2 Age	0.261*	0.10	0.061 to 0.462	0.240	0.14	−0.029 to 0.510	0.541*	0.23	0.082 to 1.000	0.123	0.09	−0.048 to 0.294
Constant	13.33***	0.23	12.878 to 13.781	12.98***	0.31	12.373 to 13.586	14.910***	0.52	13.878 to 15.943	3.218***	0.20	2.831 to 3.605
		R <sup>2</sup> = 0.318			R <sup>2</sup> = 0.233			R <sup>2</sup> = 0.258			R <sup>2</sup> = 0.129	
	F (13, 178) = 6.37 <i>p</i> = 0.000			F (13, 178) = 4.15 <i>p</i> = 0.000			F (13, 178) = 4.77, <i>p</i> = 0.000			F (13, 175) = 2.00, <i>p</i> = 0.023		

\* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ , two-tailed.  $N = 192$ ; SE, standard error; CI, 95% confidence interval. Gender: 0 = Male; 1 = Female.

(7.29%), the probability of success was not related to Ms effect on task-based approach goals (Figure 2A), regulation of effort (Figure 2B), and evaluation/reflection (Figure 2C). In short, it appears that regulation of effort and concentration and use metacognitive strategies to evaluate and reflect during training and competition is only dependent on high probability of success when the motive for success is from moderate to low. Regarding adaption of task-based approach goals, low probability of success seems to increase the tendency for those with a high motive for success but decreases it for those with low.

The motive to avoid failure influences adaption of all the achievement goals apart from the task-based approach goal. However, the influence of the fear of failure motive on self- and

other-based goals (both approach and avoidance) depends on the probability of success: self-based approach ( $b = -0.133$ ,  $\Delta R^2 = 0.018$ ,  $p = 0.059$ ) and avoidance goals ( $b = -0.146$ ,  $\Delta R^2 = 0.020$ ,  $p = 0.044$ ), other-based approach ( $b = -0.143$ ,  $\Delta R^2 = 0.024$ ,  $p = 0.030$ ) and avoidance goals ( $b = -0.164$ ,  $\Delta R^2 = 0.028$ ,  $p = 0.017$ ). The difference between high and low Mf is greatest when the probability of success is low for adaption of all four types of achievement goals. Those with low fear of failure increases their adoption of self- and other-based goals when the probability of success is high. However, those with high fear of failure reduce their adoption of self-based goals when the probability of success is high, whereas their adoption of other-based goals remains high despite the probability of success.

TABLE 6 Testing the moderating effect of probability of success on the relationship between the achievement motives (Ms and Mf) and the six subtypes of achievement goals.

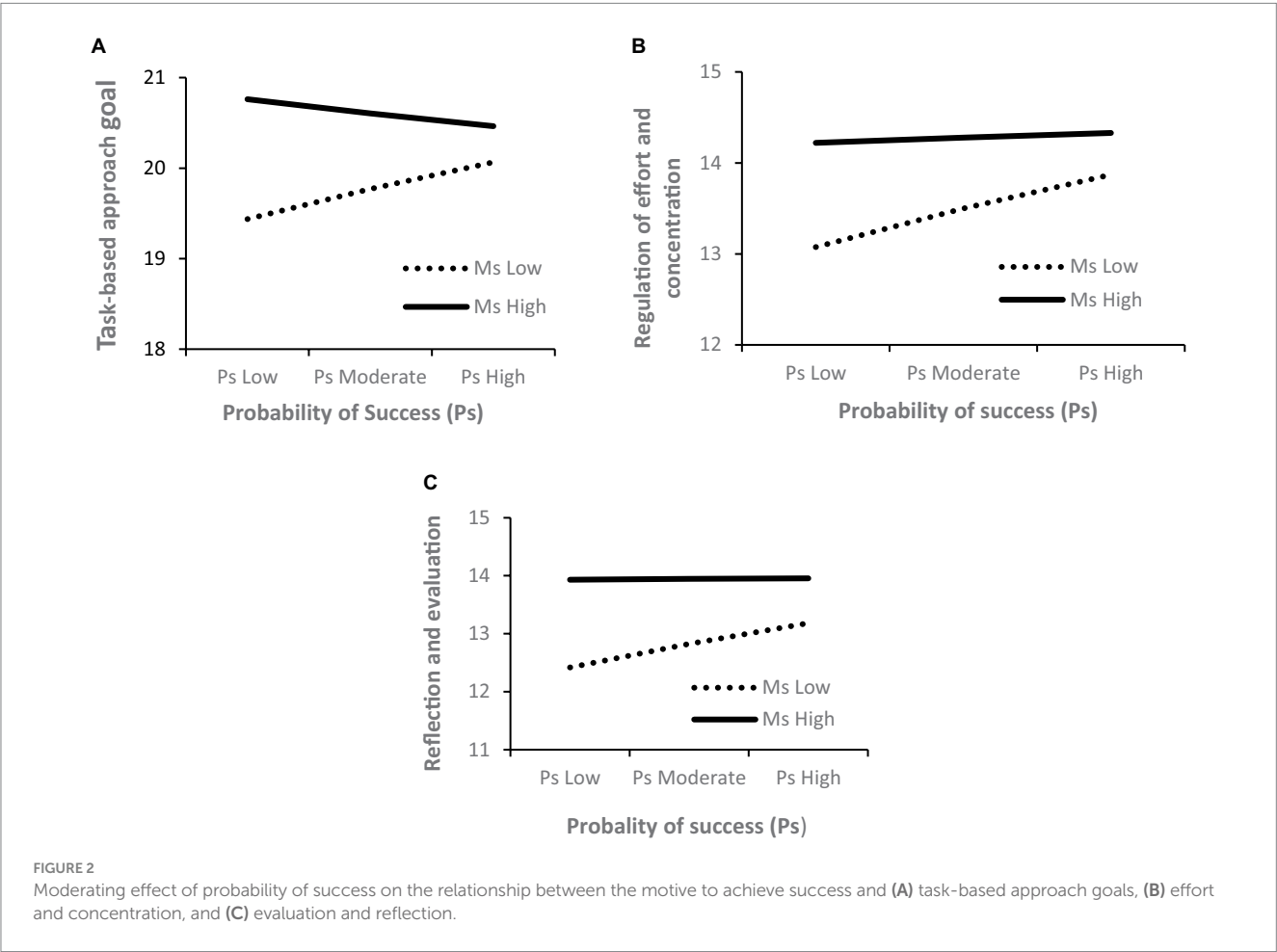
	Task-based approach goal			Self-based approach goal			Other-based approach goal			Task-based avoidance goal			Self-based avoidance goal			Other-based avoidance goal		
Predictors	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.
a1 Ms	0.290***	0.07	0.152 to 0.430	0.262***	0.07	0.121 to 0.404	0.089	0.07	−0.054 to 0.231	0.023	0.07	−0.120 to 0.167	0.061	0.07	−0.080 to 0.201	0.043	0.07	−0.097 to 0.182
a2 Mf	0.013	0.07	−0.129–0.155	0.127	0.07	−0.017 to 0.271	0.191**	0.07	0.045 to 0.336	0.211**	0.07	0.064 to 0.357	0.271***	0.07	0.128 to 0.414	0.292***	0.07	0.150 to 0.434
a3 Ps	0.091	0.07	−0.051 to 0.232	0.040	0.07	−0.104 to 0.183	0.168*	0.07	0.023 to 0.314	0.064	0.07	−0.082 to 0.210	0.023	0.07	−0.120 to 0.165	0.094	0.07	−0.048 to 0.236
a4 Ms x Ps	−0.147*	0.06	−0.266 to −0.028	−0.076	0.06	−0.196 to 0.045	−0.022	0.06	−0.144 to 0.100	−0.122	0.06	−0.244 to 0.001	−0.102	0.06	−0.221 to 0.018	−0.076	0.06	−0.195 to 0.043
a5 Mf x Ps	−0.091	0.06	−0.129 to 0.155	−0.133*	0.06	−0.259 to −0.007	−0.143*	0.06	−0.271 to −0.016	−0.081	0.06	−0.209 to 0.047	−0.146*	0.09	−0.271 to −0.020	−0.164**	0.06	−0.289 to −0.040
Constant	−0.005	0.07	−0.143 to 0.133	−0.022	0.07	−0.162 to 0.119	−0.029	0.07	−0.171 to 0.113	−0.005	0.07	−0.148 to 0.137	−0.022	0.07	−0.161 to 0.118	−0.028	0.07	−0.167 to 0.110
		R <sup>2</sup> = 0.122			R <sup>2</sup> = 0.096			R <sup>2</sup> = 0.074			R <sup>2</sup> = 0.066			R <sup>2</sup> = 0.108			R <sup>2</sup> = 0.118	
	F (5, 186) = 5.17, <i>p</i> = 0.000			F (5, 185) = 3.95, <i>p</i> = 0.002			F (5, 186) = 2.99, <i>p</i> = 0.013			F (5, 186) = 2.62, <i>p</i> = 0.026			F (5, 186) = 4.48, <i>p</i> = 0.001			F (5, 186) = 5.00, <i>p</i> = 0.000		

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .  $N = 192$ ; SE, standard error. Sex: 0 = Boys; 1 = Girls.

TABLE 7 Testing the moderating effect of probability of success on the relationship between the achievement motives (Ms and Mf) and three types of soccer-specific self-regulated learning as well as coach rated performance.

Regulation of effort				Planning			Evaluation/reflection			Coach reported performance		
Predictors	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.	Coeff	SE	95% C. I.
a1 Ms	0.367***	0.08	0.196 to 0.537	0.890***	0.19	0.520 to 10.259	0.538***	0.11	0.324 to -0.751	-0.090	0.07	-0.224 to 0.044
a2 Mf	-0.067	0.09	-0.241 to 0.107	0.146	0.19	-0.231 to 0.523	0.090	0.11	-0.128 to 0.308	0.088	0.06	-0.048 to 0.224
a3 Ps	0.233***	0.09	0.060 to 0.407	0.697***	0.19	0.321 to 10.073	0.256*	0.11	0.041 to 476	0.276***	0.07	0.140 to 0.413
a4 Ms x Ps	-0.167*	0.07	-0.312 to -0.021	-0.228	0.16	-0.543 to 0.088	-0.212*	0.09	-0.395 to -0.030	-0.021	0.06	-0.135 to 0.093
a5 Mf x Ps	-0.067	0.08	-0.219 to 0.085	-0.089	0.17	-0.259 to -0.007	-0.264**	0.10	-0.454 to -0.073	-0.031	0.06	-0.150 to 0.088
Constant	13.852***	.09	-13.656 to 16.994	15.597***	0.19	15.231 to 15.963	13.271***	0.11	13.059 to -13.483	3.514***	0.07	3.381 to -3.657
			R <sup>2</sup> = 0.162				R <sup>2</sup> = 0.180				R <sup>2</sup> = 0.177	R <sup>2</sup> = 0.089
			F (5, 186) = 7.17, p = 0.000				F (5, 185) = 8.15, p = 0.000				F (5, 186) = 8.02, p = 0.000	F (5, 186) = 3.59, p = 0.004

\**p* < 0.05. \*\**p* < 0.01. \*\*\**p* < 0.001. *N* = 192; SE = standard error. Sex: 0 = Boys; 1 = Girls.





Furthermore, it appears that when the motive to avoid failure is low, it is only at a high probability of success that regulation of effort and concentration is high ( $b = -0.264$   $\Delta R^2 = 0.025$ ,  $p = 0.020$ ). The Johnson-Neyman technique indicated that for soccer players with probability of success above 0.75 for self-based avoidance (21.4% of the players),  $-0.15$  for self-based approach

(61.5%),  $0.28$  for other-based approach (38.5%),  $0.77$  for other-based avoidance (21.4%), and  $-0.74$  for reflection/evaluation (77.6%), the probability of success was not related to the motive to avoid failures effect on self-based avoidance (Figure 3A), self-based approach (Figure 3B), other-based approach (Figure 3C), other-based avoidance (Figure 3D), and evaluation/reflection (Figure 3E).

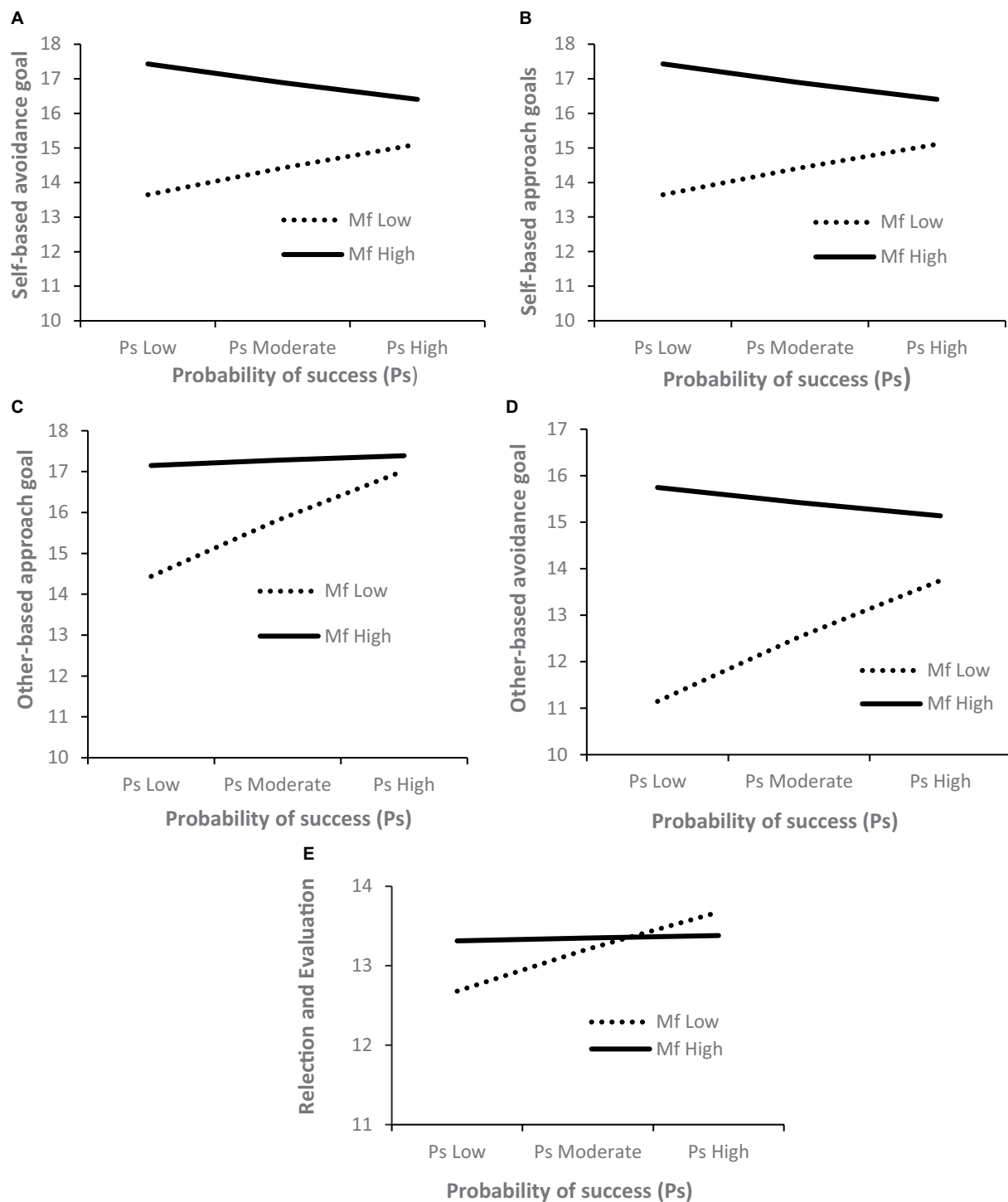


FIGURE 3

Moderating effect of probability of success on the relationship between the motive to avoid failure and (A) self-based avoidance goals, (B) self-based approach goals, (C) other-based approach goals, (D) other-based avoidance goals, and (E) evaluation and reflection.

## Discussion

In this study, we investigated how achievement motives, probability of success, and achievement goals are related to coach-rated performance and self-regulated learning of 13- to 16-year-old players eligible for the Norwegian national football team. A quantitative methodology with a cross-sectional design was used to investigate these issues. The sample differed from previous studies by including both boys and girls. We therefore also aimed to investigate sex differences in motivation. The *t*-test showed a significant difference between the sexes regarding motive to avoid failure. Girls reported significantly higher scores than boys, while there were no differences between sexes in scores on the motive to achieve success, which supports previous studies on Norwegian youth athletes (Halvari and Thomassen, 1997). There were no significant differences between boys and girls in this sample regarding probability for success, which deviates from findings involving general samples of youth and young adults in both sexes (Lirgg, 1991; Lochbaum et al., 2019). This discrepancy may be due to cultural differences or the fact that this group was particularly homogeneous and therefore is expected to explain only minor proportions of performance (Baker et al., 2018). It is also possible that we did not find differences by sex because a specific type of motivation is required in this group of preselected players, and it is independent of sex (Sarmiento et al., 2018).

Correlation analyses showed no significant correlations between the motivation variables and coach-reported performance. However, the relationship between probability of success and coach-reported performance was significantly as expected (partly confirming hypothesis 1). Due to the homogeneous population, it is conceivable that members of this population have similar motivations, even though it remains uncertain whether slight differences in motivation to achieve success or to avoid failure can explain variances in the performance of a high-performing young soccer population (Murr et al., 2018). Here, small margins and complex processes may be more important than individual variables for distinguishing between performances (Williams et al., 2020).

Similarly, to Elliot's hierarchical model of motivation, the success motive predicts task-based and self-based approach goals and the motive to avoid failure predicted all three types of avoidance-based (task, self, and other) and other-based approach goals (confirming hypothesis 5). There is, however, no significant relationship between the success motive and other-based approach goals among the top soccer talents. Moreover, it appears that when players have a high probability of achieving success, they more frequently set other-based approach goals. This is in line with the results from the study by Van Yperen and Renkema (2008). It appears that the goal of outperforming others can arise from both a motive to avoid failure and a perception of having a high probability of success. In contrast, a high motive for success seems to contribute to players setting goals related to personal growth/learning (self-based approach) or to focusing on the task at hand (task-based approach). It further appears that a low probability of success contributes to high self- and other-based avoidance goals in players with a high motivation to avoid failure but higher task-based approach goals in those with a high motivation to seek success. However, a combination of low probability of success and high fear motivation can also lead to the adoption of more appropriate goals in the form of self- and other-based approach goals (confirming hypothesis 7).

Concerning self-regulated learning, the results from the process model indicated that the motive to achieve success and the probability of success were important predictors of planning, reflection/evaluation, and regulation of effort (confirming hypotheses 1 and 2). Toering et al. (2009) found that players with high reflection scores were 4.9 times more likely to play for the top clubs' academy teams, and players with high effort scores were seven times more likely to play in an academy team, than those with low scores. Furthermore, Toering et al. (2012b) found in another study international players to score higher on reflection than national-level players did. The current study found that task-based and self-based approach goals predicted regulation of effort but not reflection and planning (partly confirming hypothesis 4). In addition, the mastery-approach goals mediated some of the correlation the motive to achieve success on the one hand and regulation of effort on the other hand (partly confirming hypothesis 8).

Some studies have shown no correlation between mastery goals and future performance (Figueiredo et al., 2009; Huijgen et al., 2014). Silva et al. (2010) found regional team players to be more oriented toward performance goals than local players, with no significant differences in mastery goals, and Kavussanu et al. (2011) found that elite team players score significantly higher on mastery goals than non-elite team players, with no differences in scores for performance goals. Meanwhile, Höner and Feichtinger (2016) found a significant positive correlation between mastery goals and performance level 4 years later in young soccer players. Van Yperen and Duda (1999) found that improvements in performance during the soccer season corresponded to mastery goals. There is also a positive trend in our results for the relationship between approach goals and coach-reported performance,  $r = 0.7, 0.8$ , and  $0.9$ , for self-, task-, and other-based approach goals, respectively (partly confirming hypothesis 3). It will be interesting to see whether the relationship between approach goals and performance will become stronger over time.

For avoidance paths, the data supported some of our original hypotheses. The motive to avoid failure predicted avoidance- and other-based approach goals (confirming hypothesis 5) but did not contribute to explaining self-regulation and performance (not confirming hypothesis 6). As noted, few studies have investigated the distinction between approach and avoidance goals within a soccer context. Nonetheless, studies in sports suggest that mastery and performance-approach goals are positively related to performance, while no significant relationship has been found between avoidance goals and performance (Van Yperen et al., 2014). However, for athletes under the age of 18 years, the results of a meta-analysis showed that the correlation between performance-approach goals and performance was not significant (Lochbaum and Gottard, 2015). The discrepancy in results from earlier studies may be because performance goals in the Task and Ego Orientation in Sport Questionnaire (TEOSQ) do not distinguish between performance-approach and performance-avoidance. It is also possible that anxious players were already selected out in this preselected group.

The results from the moderation analysis showed that players with a high motive for success regulate effort, using metacognitive strategies (planning and reflection/evaluation) even when the likelihood of success is low (confirming hypothesis 7). However, players who score low on the motive for success rely on experiencing a relatively high probability of success to make optimal use of metacognitive strategies

and regulate their effort. This is likely one of the reasons why the motive to achieve success has been shown to predict performance (Murr et al., 2018; Wachsmuth et al., 2023). However, high fear motivation also seems to predict regulation of effort when the likelihood of success is low. Perhaps this is caused by anxiety-driven form of perfectionism (Haraldsen et al., 2020). To examine whether this form of fear-driven regulation is effective over time, longitudinal studies are needed.

## Limitations and future studies

The sample size was large for a study of young national soccer team players. There are few studies on talented soccer girls' motivation and self-regulated learning. In the present study, the sample included many girls, and we used well-tested instruments. Nevertheless, there are several possible limitations. The design limits the ability to confirm a causal relationship between the variables. Performance was only obtained from national team coaches. In future studies, we will collect register data on dropouts, playing time, and the level at which participants play as performance outcomes.

## Conclusion

In summary, this study aimed to investigate the motivational processes behind self-regulated learning and performance among soccer players eligible for the Norwegian national football team. The process models which examined achievement goals as mediators between probability of success and achievement motives on the one hand and performance and self-regulated learning on the other hand showed that task- and self-based approach goals mediated the relationship between the motive to achieve success and effort. However, that was the only outcome mediated by achievement goals. The results suggest that the direct effect of the motivation to seek success and the probability of success are more crucial for regulating effort and concentration and utilizing metacognitive strategies among potential national team talents in football. Scoring high on the motive to success appears to be of crucial importance for self-regulated learning in those who perceive a low probability of success. The data supported only some of our original hypotheses concerning avoidance paths, where the motive to avoid failure predicted avoidance- and other-based approach goals but did not contribute to explaining self-regulation and performance. In addition, a negative correlation was found between the motive to avoid failure and effort. Related to sex, girls were more motivated to avoid failure than boys, while both sexes achieved similar scores for football-specific self-regulated learning, probability of success, achievement goals, and motivation to achieve success. Future research should continue to expand the research on the impact of approach and avoidance goals and add on to the few empirical studies on the outcomes of the probability of success and achievement motives among talented young footballers who are eligible for national teams, and especially include girls.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by the Norwegian Centre for Research Data (NSD, registration number 753125/2020). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

MH: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. SS: Conceptualization, Writing – original draft, Writing – review & editing. GB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing.

## Funding

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

## Acknowledgments

We would like to acknowledge our dear friend and colleague, Mounir Hamoud, who sadly passed away during the writing of this paper. The work on this data material began when Mounir wrote his master's thesis which he was undertaking at the University of Oslo, and our good collaboration continued into his new job as regional Manager of player development in the Norwegian Football Federation (NFF), Buskerud. We dedicate this paper to the memory of Mounir Hamoud.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2024.1416931/full#supplementary-material>

## References

- Atkinson, J. W. (1957). Motivational determinants of risk-taking behavior. *Psychol. Rev.* 64, 359–372. doi: 10.1037/h0043445
- Atkinson, J. W. (1964). An introduction to motivation. Princeton, NJ: Van Nostrand.
- Atkinson, J. W., and Feather, N. T. (1966). A theory of achievement motivation. New York, NY: Wiley and Sons.
- Baker, J., Schorer, J., and Wattie, N. (2018). Compromising talent: issues in identifying and selecting talent in sport. *Quest* 70, 48–63. doi: 10.1080/00336297.2017.1333438
- Bandura, A. (1997). Self-efficacy: the exercise of control. New York: Freeman and Company.
- Bartels, J. M., and Magun-Jackson, S. (2009). Approach–avoidance motivation and metacognitive self-regulation: the role of need for achievement and fear of failure. *Learn. Individ. Differ.* 19, 459–463. doi: 10.1016/j.lindif.2009.03.008
- Bjørnebekk, G., Diseth, Å., and Ulriksen, R. (2013). Achievement motives, self-efficacy, achievement goals, and academic achievement at multiple stages of education: a longitudinal analysis. *Psychol. Rep.* 112, 771–787. doi: 10.2466/14.09.PR0.112.3.771-787
- Brunstein, J. C., and Heckhausen, H. (2008). “Achievement motivation” in *Motivation and action*. eds. J. Heckhausen and H. Heckhausen (Cambridge: Cambridge University Press), 137–183.
- Byrne, B. M. (2016). Structural equation modeling with AMOS: basic concepts, applications, and programming. 3rd Edn: Routledge.
- Cellar, D. F., Stuhlmacher, A. F., Young, S. K., Fisher, D. M., Adair, C. K., Haynes, S., et al. (2011). Trait goal orientation, self-regulation, and performance: a meta-analysis. *J. Bus. Psychol.* 26, 467–483. doi: 10.1007/s10869-010-9201-6
- Chatterjee, S., and Simonoff, J. S. (2013). Handbook of regression analysis. New Jersey: John Wiley & Sons.
- Conroy, D. E., and Elliot, A. J. (2004). Fear of failure and achievement goals in sport: addressing the issue of the chicken and the egg. *Anxiety Stress Coping* 17, 271–285. doi: 10.1080/1061580042000191642
- Delacre, M., Lakens, D., and Leys, C. (2017). Why psychologists should by default use Welch’s t-test instead of student’s t-test. *Int. Rev. Soc. Psychol.* 30, 92–101. doi: 10.5334/irsp.82
- Diseth, Å. (2015). The advantages of task-based and other-based achievement goals as standards of competence. *Int. J. Educ. Res.* 72, 59–69. doi: 10.1016/j.ijer.2015.04.011
- Dweck, C. S. (1986). Motivational processes affecting learning. *Am. Psychol.* 41, 1040–1048. doi: 10.1037/0003-066X.41.10.1040
- Dweck, C. S., and Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychol. Rev.* 95, 256–273. doi: 10.1037/0033-295X.95.2.256
- Elbe, A. M., and Wenhold, F. (2005). Cross-cultural test-control criteria for the achievement motives scale-sport. *Int. J. Sport Exerc. Psychol.* 3, 163–177. doi: 10.1080/1612197X.2005.9671765
- Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educ. Psychol.* 34, 169–189. doi: 10.1207/s15326985ep3403\_3
- Elliot, A. J., and Thrash, T. M. (2001). Achievement goals and the hierarchical model of achievement motivation. *Educ. Psychol.* 13, 139–156. doi: 10.1023/A:1009057102306
- Elliot, A. J. (2006). The hierarchical model of approach-avoidance motivation. *Motiv. Emot.* 30, 111–116. doi: 10.1007/s11031-006-9028-7
- Elliot, A. J., Conroy, D. E., Barron, K. E., and Murayama, K. (2010). “Achievement motives and goals: a developmental analysis” in *Handbook on life-span human development*. eds. M. E. Lamb and A. M. Freund (New York, NY: Wiley).
- Elliot, A. J., and Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: a mediational analysis. *J. Pers. Soc. Psychol.* 70, 461–475. doi: 10.1037/0022-3514.70.3.461
- Elliot, A. J., and McGregor, H. A. (2001). A 2 X 2 achievement goal framework. *J. Pers. Soc. Psychol.* 80, 501–519. doi: 10.1037/0022-3514.80.3.501
- Elliot, A. J., Murayama, K., and Pekrun, R. (2011). A 3 x 2 achievement goal model. *J. Educ. Psychol.* 103, 632–648. doi: 10.1037/a0023952
- Feltz, D. L., Short, S. E., and Sullivan, P. J. (2008). Self-efficacy in sport. Champaign, IL: Human Kinetics.
- Figueiredo, A. J., Gonçalves, C. E., Coelho e Silva, M. J., and Malina, R. M. (2009). Characteristics of youth soccer players who drop out, persist or move up. *J. Sports Sci.* 27, 883–891. doi: 10.1080/02640410902946469
- Funder, D. C., and Ozer, D. J. (2019). Evaluating effect size in psychological research: sense and nonsense. *Adv. Methods Pract. Psychol. Sci.* 2, 156–168. doi: 10.1177/2515245919847202
- Gjesme, T. (1981). Is there any future in achievement motivation? *Motiv. Emot.* 5, 115–138. doi: 10.1007/BF00993892
- Gjesme, T., and Nygård, R. (1970). Achievement-related motives: theoretical considerations and constructions of a measuring instrument [Unpublished report]. University of Oslo.
- Gledhill, A., Harwood, C., and Forsdyke, D. (2017). Psychosocial factors associated with talent development in football: a systematic review. *Psychol. Sport Exerc.* 31, 93–112. doi: 10.1016/j.psychsport.2017.04.002
- Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2010). Multivariate data analysis. 7th Edn. Essex: Pearson Education Limited.
- Halvari, H., and Thomassen, T. O. (1997). Achievement motivation, sports-related future orientation, and sporting career. *Genet. Soc. Gen. Psychol. Monogr.* 123:343.
- Haraldsen, H. M., Solstad, B. E., Ivarsson, A., Halvari, H., and Abrahamsen, F. E. (2020). Change in basic need frustration in relation to perfectionism, anxiety, and performance in elite junior performers. *Scand. J. Med. Sci. Sports* 30, 754–765. doi: 10.1111/sms.13614
- Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis (3rd ed): a regression-based approach. New York: The Guilford Press.
- Höner, O., and Feichtinger, P. (2016). Psychological talent predictors in early adolescence and their empirical relationship with current and future performance in soccer. *Psychol. Sport Exerc.* 25, 17–26. doi: 10.1016/j.psychsport.2016.03.004
- Huijgen, B. C., Elferink-Gemser, M. T., Lemmink, K. A., and Visscher, C. (2014). Multidimensional performance characteristics in selected and deselected talented soccer players. *Eur. J. Sport Sci.* 14, 2–10. doi: 10.1080/17461391.2012.725102
- Kavussanu, M., White, S. A., Jowett, S., and England, S. (2011). Elite and non-elite male footballers differ in goal orientation and perceptions of parental climate. *Int. J. Sport Exerc. Psychol.* 9, 284–290. doi: 10.1080/1612197X.2011.614854
- Lai, E. R. (2011). “Metacognition: a literature review,” in *Always learning: pearson research report*. 24, 1–40.
- Larsen, C., Alfermann, D., and Christensen, M. (2012). Psychosocial skills in a youth soccer academy: a holistic ecological perspective. *Sport Sci. Rev.* 21, 51–74. doi: 10.2478/v10237-012-0010-x
- Lirgg, C. D. (1991). Gender differences in self-confidence in physical activity: a meta-analysis of recent studies. *J. Sport Exerc. Psychol.* 13, 294–310. doi: 10.1123/jsep.13.3.294
- Lochbaum, M., and Gottard, J. (2015). A meta-analytic review of the approach–avoidance achievement goals and performance relationships in the sport psychology literature. *J. Sport Health Sci.* 4, 164–173. doi: 10.1016/j.jshs.2013.12.004
- Lochbaum, M., Jean-Noel, J., Pinar, C., and Gilson, T. (2017). A meta-analytic review of Elliot’s (1999) hierarchical model of approach and avoidance motivation in the sport, physical activity, and physical education literature. *J. Sport Health Sci.* 6, 68–80. doi: 10.1016/j.jshs.2015.07.008
- Lochbaum, M., Zanatta, T., and Kazak, Z. (2019). The 2 x 2 achievement goals in sport and physical activity contexts: a meta-analytic test of context, gender, culture, and socioeconomic status differences and analysis of motivations, regulations, affect, effort, and physical activity correlates. *Eur. J. Invest. Health Psychol. Educ.* 10, 173–205. doi: 10.3390/ejihpe10010015
- Madjar, N., Kaplan, A., and Weinstock, M. (2011). Clarifying mastery-avoidance goals in high school: distinguishing between intrapersonal and task-based standards of competence. *Contemp. Educ. Psychol.* 36, 268–279. doi: 10.1016/j.cedpsych.2011.03.003
- Mascaret, N., Elliot, A. J., and Cury, F. (2015). Extending the 3 x 2 achievement goal model to the sport domain: the 3 x 2 achievement goal questionnaire for sport. *Psychol. Sport Exerc.* 17, 7–14. doi: 10.1016/j.psychsport.2014.11.001
- McCardle, L., Young, B. W., and Baker, J. (2018). Two-phase evaluation of the validity of a measure for self-regulated learning in sport practice. *Front. Psychol.* 9:2641. doi: 10.3389/fpsyg.2018.02641
- McClelland, D. C. (1987). Human motivation. Cambridge: Cambridge University Press.
- McCormick, A., Meijen, C., Anstiss, P. A., and Jones, H. S. (2019). Self-regulation in endurance sports: theory, research, and practice. *Int. Rev. Sport Exerc. Psychol.* 12, 235–264. doi: 10.1080/1750984X.2018.1469161
- Murr, D., Feichtinger, P., Larkin, P., O’Connor, D., and Höner, O. (2018). Psychological talent predictors in youth soccer: a systematic review of the prognostic relevance of psychomotor, perceptual-cognitive and personality-related factors. *PLoS One* 13:e0205337. doi: 10.1371/journal.pone.0205337
- Musculus, L., and Lobinger, B. H. (2018). Psychological characteristics in talented soccer players – recommendations on how to improve coaches’ assessment. *Front. Psychol.* 9:41. doi: 10.3389/fpsyg.2018.00041
- Nicholls, J. G. (1984). Achievement motivation: conceptions of ability, subjective experience, task choice, and performance. *Psychol. Rev.* 91, 328–346. doi: 10.1037/0033-295X.91.3.328
- Nygård, R. (1977). Personality, situation, and persistence: a study with emphasis on achievement motivation. Oslo: Universitetsforlaget.
- Pintrich, P. R. (2000). “The role of goal orientation in self-regulated learning” in *Handbook of self-regulation*. eds. M. Boekaerts, P. R. Pintrich and M. Zeidner (San Diego, CA: Academic Press), 451–502.
- Rheinberg, F., Vollmeyer, R., and Rollett, W. (2000). “Motivation and action in self-regulated learning” in *Handbook of self-regulation* eds. M. Boekaerts, P. R. Pintrich and M. Zeidner (New York, London: Academic Press), 503–529.



- Sarmiento, H., Anguera, M., Pereira, A., and Araújo, D. (2018). Talent identification and development in male football: a systematic review. *Sports Med.* 48, 907–931. doi: 10.1007/s40279-017-0851-7
- Silva, C. E. M. J., Figueiredo, A. J., Simões, F., Seabra, A., Natal, A., Vaeyens, R., et al. (2010). Discrimination of u-14 soccer players by level and position. *Int. J. Sports Med.* 31, 790–796. doi: 10.1055/s-0030-1263139
- Toering, T., Elferink-Gemser, M. T., Jonker, L., van Heuvelen, M. J. G., and Visscher, C. (2012a). Measuring self-regulation in a learning context: reliability and validity of the self-regulation of learning self-report scale (SRL-SRS). *Int. J. Sport Exerc. Psychol.* 10, 24–38. doi: 10.1080/1612197X.2012.645132
- Toering, T., Elferink-Gemser, M. T., Jordet, G., Pepping, G.-J., and Visscher, C. (2012b). Self-regulation of learning and performance level of elite youth soccer players. *Int. J. Sport Psychol.* 43, 312–325.
- Toering, T. T., Elferink-Gemser, M. T., Jordet, G., and Visscher, C. (2009). Self-regulation and performance level of elite and non-elite youth soccer players. *J. Sports Sci.* 27, 1509–1517. doi: 10.1080/02640410903369919
- Toering, T., Jordet, G., and Ripegut, A. (2013). Effective learning among elite football players: the development of a football-specific self-regulated learning questionnaire. *J. Sports Sci.* 31, 1412–1420. doi: 10.1080/02640414.2013.792949
- Van Yperen, N. W., Blaga, M., and Postmes, T. (2014). A meta-analysis of self-reported achievement goals and nonself-report performance across three achievement domains (work, sports, and education). *PLoS One* 9:e93594. doi: 10.1371/journal.pone.0093594
- Van Yperen, N. W., and Renkema, L. J. (2008). Performing great and the purpose of performing better than others: on the recursiveness of the achievement goal adoption process. *Eur. J. Soc. Psychol.* 38, 260–271. doi: 10.1002/ejsp.425
- Van Yperen, N. W. (1995). Interpersonal stress, performance level, and parental support: a longitudinal study among highly skilled young soccer players. *Sport Psychol.* 9, 225–241. doi: 10.1123/tsp.9.2.225
- Van Yperen, N. W., and Duda, J. L. (1999). Goal orientations, beliefs about success, and performance improvement among young elite Dutch soccer players. *Scand. J. Med. Sci. Sports* 9, 358–364. doi: 10.1111/j.1600-0838.1999.tb00257.x
- Wachsmuth, S., Feichtinger, P., Bartley, J., and Höner, O. (2023). Psychological characteristics and future success: a prospective study examining youth soccer players at different stages within the German talent development pathway. *J. Appl. Sport Psychol.* 36, 276–300. doi: 10.1080/10413200.2023.2224868
- Walker, D. A., and Smith, T. J. (2017). Computing robust, bootstrap-adjusted fit indices for use with nonnormal data. *Meas. Eval. Couns. Dev.* 50, 131–137. doi: 10.1080/07481756.2017.1326748
- Wenhold, F., Elbe, A. M., and Beckmann, J. (2009). Achievement Motives Scale-Sport (AMS-Sport). Fragebogen zum Leistungsmotiv im Sport. Manual [Achievement Motives Scale—Sport (AMS—Sport). Questionnaire on the achievement motive in sports: manual]. Köln: Sportverlag Strauss.
- Williams, A. M., Ford, P. R., and Drust, B. (2020). Talent identification and development in soccer since the millennium. *J. Sports Sci.* 38, 1199–1210. doi: 10.1080/02640414.2020.1766647
- Young, B. W., Wilson, S. G., Hoar, S., Bain, L., Siekańska, M., and Baker, J. (2023). On the self-regulation of sport practice: moving the narrative from theory and assessment toward practice. *Front. Psychol.* 14:1089110. doi: 10.3389/fpsyg.2023.1089110
- Zimmerman, B. J. (2001). “Theories of self-regulated learning and academic achievement: an overview and analysis” in *Self-regulated learning and academic achievement: theoretical perspectives*. eds. B. J. Zimmerman and D. H. Schunk. 2nd ed (Lawrence Erlbaum Associates Publishers, Routledge).
- Zimmerman, B. (2006). “Development and adaptation of expertise: the role of self-regulatory processes and beliefs” in *The Cambridge handbook of expertise and expert performance* (Cambridge handbooks in psychology). eds. K. Ericsson, N. Charness, P. Feltovich and R. Hoffman (Cambridge: Cambridge University Press), 705–722.
- Zimmerman, B. J., and Kitsantas, A. (2005). “The hidden dimension of personal competence: self-regulated learning and practice” in *Handbook of Competence and Motivation*, eds. A. J. Elliot and C. S. Dweck. (New York, NY: Guilford Press), 509–526.



# Frontiers in Psychology

Paving the way for a greater understanding of human behavior

The most cited journal in its field, exploring psychological sciences - from clinical research to cognitive science, from imaging studies to human factors, and from animal cognition to social psychology.

## Discover the latest Research Topics

[See more →](#)

### Frontiers

Avenue du Tribunal-Fédéral 34  
1005 Lausanne, Switzerland  
[frontiersin.org](https://frontiersin.org)

### Contact us

+41 (0)21 510 17 00  
[frontiersin.org/about/contact](https://frontiersin.org/about/contact)

