turnitin

by Mela Aryani

Submission date: 25-Oct-2026 04:26PM (UTC+0800)
Submission ID: 3069685053
File name: Article_Mela.docx (113.73K)
Word count: 5414
Character count: 33596

GENDER-BASED MENTAL IMAGERY IN SPORT CLIMBING: A CONCEPTUAL STUDY ON COMPETITIVE ANXIETY AND ATHLETE PERFORMANCE

Mela Aryani[1], Nofi Marlina Siregar[2], Arisman[3], Diah Fauzi[4], Zulham[5], Amanda Fu'adah Mutmainnah[6]
Universitas Negeri Jakarta[1,2,3,4,5,6]
Mela.aryani@unj.ac.id

Abstract
Sport climbing requires physical competence, technical skills, decision-making abilities, and psychological readiness, particularly in managing competitive anxiety. Mental imagery is a potential psychological training approach to support athletes' psychological readiness and performance. This study aimed to conceptually examine the application of PETTLEP-based mental imagery in relation to competitive anxiety and performance readiness among sport climbing athletes, considering gender perspectives and individual characteristics. A structured narrative literature review with conceptual synthesis was employed to integrate literature on sport climbing psychology, mental imagery, competitive anxiety, and gender-related perspectives in sport. The literature was analyzed thematically and comparatively across four areas: the psychological characteristics of sport climbing, the PETTLEP model, the relationship between mental imagery and competitive anxiety, and gender perspectives in mental training. The synthesis indicates that mental imagery may provide a contextual approach to preparing athletes for climbing-specific demands, including route reading, movement sequencing, attentional control, and emotional regulation. The PETTLEP model offers a theoretical framework for developing imagery exercises tailored to the physical, environmental, task-related, temporal, learning, emotional, and perspective-related demands of sport climbing. However, evidence directly examining the combined relationships among mental imagery, competitive anxiety, gender, and performance in sport climbing remains limited. Gender should therefore be considered alongside individual factors rather than used to assume uniform psychological needs or intervention responses. This study proposes an integrative conceptual framework linking athlete characteristics and competition context, PETTLEP-based mental imagery, psychological readiness, and performance readiness. The framework provides a theoretical foundation for future empirical research and the development of individualized mental training programs for sport climbing athletes. Further studies are needed to test its effectiveness using validated anxiety measures and objective performance indicators.
Keywords: *Mental Imagery; Pettlep Model; Competitive Anxiety; Sport Climbing; Gender; Performance Readiness.*

INTRODUCTION

Sport climbing is a sport that requires the integration of physical ability, technical skills, decision making and psychological readiness. Athletes are not only required to have good strength, endurance, coordination and movement control, but also must be able to maintain concentration and manage psychological responses when facing the demands of climbing and competition (Aryani et al., 2023). Trail characteristics, level of movement difficulty, environmental conditions, and perception of risk can influence an athlete's psychological experience while climbing. (Mangan et al., 2025), through a systematic review of 83 studies on sport climbing psychology, showed that psychological aspects are an important part of

climber performance and safety. Thus, psychological readiness needs to be considered as part of a comprehensive approach to coaching rock climbing athletes (Padilla-crespo & Clemente-suárez, 2025).

One psychological aspect that is relevant in this context is competitive anxiety. Anxiety can arise when athletes assess the demands of a situation as something that challenges or threatens their abilities and the goals they want to achieve. In sport climbing, the anxiety response needs to be understood based on the characteristics of the activity, the athlete's experience, and the climbing situation faced. (Aşçi et al., 2006) studied pre-competition anxiety and affective conditions in 47 climbers in an indoor rock climbing competition, taking into account gender and competition categories of speed and difficulty. A more recent study by (Swinarska et al., 2026) of 100 climbers reported higher levels of anxiety on lead climbing than top-rope in the group studied. In addition, (Ionel et al., 2024) developed and conducted initial validation of the Climbing Anxiety Scale (CAS-20), an instrument designed to measure anxiety in the context of sport climbing. Overall, these findings demonstrate the importance of examining anxiety by considering sport-specific characteristics of sport climbing, although the results of observational studies cannot be used to infer cause-and-effect relationships (Giles & Mangan, 2026).

One approach that can be considered to support athletes' psychological readiness is mental imagery. Mental imagery is the process of representing experiences or actions mentally without having to carry out all physical activities at the same time. In a sports context, imagery can involve representations of movements, match environments, sequences of actions, as well as emotional responses that may arise during competition. (Morone et al., 2022), through a systematic review of motor imagery and sports performance, examines the application of the PETTLEP model which consists of seven components, namely Physical, Environment, Task, Timing, Learning, Emotion, and Perspective. This approach emphasizes the importance of matching imagery experiences with the characteristics of actual skill implementation. Therefore, in the context of sport climbing, the PETTLEP principle can be used as a conceptual basis for structuring

imagery training that includes the characteristics of the climbing environment, task demands, movement sequences, emotional aspects, and the athlete's perspective. However, its application to sport climbing still needs to be adjusted and tested based on the characteristics of the athlete and the type of climbing activity.

The relevance of mental training to competitive anxiety also finds support from the general sport psychology literature. (Ong & Chua, 2021), through a meta-analysis of psychological interventions in athletes, reported small to moderate combined effects on competitive anxiety. These findings suggest that psychological interventions have the potential to help manage anxiety in sport. However, because the analysis included multiple forms of psychological intervention, the results cannot be interpreted as a measure of the effectiveness of mental imagery specifically. Thus, the relationship between imagery and competitive anxiety in sport climbing athletes needs to be discussed by integrating general evidence from sport psychology and findings that directly examine the sport climbing context (Demir et al., 2025).

In addition to the mental training approach, individual characteristics and gender perspectives are also relevant to consider in developing imagery programs. (Aşçi et al., 2006) have included gender as a factor in research on pre-competition anxiety in climbers. Meanwhile, (Lovell et al., 2024) examined differences in the use of imagery based on gender and training and competition contexts among elite level athletes from cricket and Australian football. (Yarayan et al., 2024) also examined differences based on gender in relation to imagery and mental toughness in middle and long distance running athletes. The research provides a basis for considering variations in imagery use and athlete characteristics. However, findings from other sports cannot be directly generalized to rock climbing athletes due to differences in skill demands, environmental characteristics and competition situations.

A gender perspective in the development of mental imagery needs to be applied carefully. The differences found in groups of athletes do not mean that all female or male athletes have the same psychological needs and responses (Corrado et al., 2019). Therefore, gender is more appropriately considered along with other

individual characteristics, such as competition experience, ability to form imagery, preference for visual or kinesthetic perspectives, as well as psychological needs in competitive situations. This approach can help formulate mental training programs that are responsive to athletes' needs without assuming that gender categories automatically determine responses to imagery. Within a conceptual framework, a gender perspective thus serves as one consideration in the design and adaptation of mental training, rather than as a basis for establishing differences in effectiveness before sufficient empirical evidence is available.

Based on this literature, studies on mental imagery, competitive anxiety, and sport climbing psychology provide a complementary basis, but need to be conceptually synthesized to produce a more contextual direction for the development of mental training. The review (Mangan et al., 2025) provides an overview of the psychological factors relevant in sport climbing, while (Morone et al., 2022) provides a framework for understanding the application of PETTLEP-based imagery. The study (Ong & Chua, 2021) shows the relevance of psychological interventions for competitive anxiety in general, while research (Aşçi et al., 2006; Ionel et al., 2024; Swinarska et al., 2026) provides empirical context regarding anxiety in sport climbing. On the other hand (Lovell et al., 2024) and (Yarayan et al., 2024) provide additional perspectives regarding imagery and gender-based differences in athletes. The synthesis of these sources provides the basis for proposing a conceptual framework linking PETTLEP-based imagery, competitive anxiety, the psychological demands of sport climbing, and gender perspectives. The gap proposed in this article is a need for conceptual integration that needs to be explored further, not a claim that there has never been research that discusses the relationship between these elements.

Based on this description, this article aims to conceptually examine PETTLEP-based mental imagery in relation to competitive anxiety and performance readiness in rock climbing athletes by considering gender perspectives and individual athlete needs. The proposed contribution is a conceptual framework that can be an initial basis for the development of contextual mental training and for the preparation of subsequent empirical research. The framework is not intended

as a model that has been proven effective, but rather as a theoretical proposition that needs to be studied, developed, and tested through further research on sport climbing athletes.

METHOD

This article uses a structured narrative literature review approach with conceptual synthesis. This approach was chosen to integrate and analyze literature on mental imagery, competitive anxiety, sport climbing sport psychology, and gender perspectives in sport. The study was directed at identifying main concepts, comparing previous research findings, and formulating a relevant conceptual framework for the development of mental training in sport climbing athletes. This article was not designed as an experimental study, systematic review, or meta-analysis.

Literature search strategy

The initial search for sources was carried out on August 10 2026 through scientific search engines and journal article publisher pages. To expand and document the search before the manuscript is finalized, the databases used as search targets include Google Scholar, PubMed, Scopus if access is available, Crossref for metadata and DOI verification, and Garuda to identify relevant national publications.

Key words are arranged in English and Indonesian based on four topic groups, namely mental imagery, competitive anxiety, sport climbing, and gender. Keyword combinations used or will be used in advanced searches include:

"mental imagery" AND sport AND performance, "motor imagery" AND athlete AND performance, "mental imagery" AND "competitive anxiety" AND athlete, "sport climbing" AND anxiety AND performance, "sport climbing" AND imagery AND psychology, "sport climbing" AND "competitive anxiety" AND gender, "mental imagery" AND gender AND athlete, "imagery use" AND sex differences AND sport, "PETTLEP" AND climbing, "mental imagery" AND " sport climbing", “competitive anxiety” AND rock climbing athlete, "mental training" AND athlete AND sports performance.

These keywords are used as a basis for searches and can be adapted to the syntax of each database. The publication range 2016–2026 was prioritized to obtain relatively up-to-date literature. Older articles were still considered if they had direct relevance to pre-competition anxiety or a necessary theoretical foundation.

Source selection criteria

Literature was considered for inclusion if it met one or more of the following criteria: (1) discussed mental imagery or motor imagery in a sports context; (2) assess competitive anxiety, psychological readiness, or athlete performance; (3) specifically researching the psychology of sport climbing; (4) discussing the use of imagery based on gender or gender; or (5) is a systematic review or meta-analysis relevant to the focus of the study.

Journal articles that go through the peer review process are given priority. Sources that lack verifiable bibliographic information, are not relevant to the study question, or do not provide sufficient information to assess their contribution are not used as the basis for substantive claims. Articles with DOI are checked via publisher metadata or Crossref. Articles that are not fully accessible may still be noted as potential sources, but their results, limitations, and implications should not be interpreted beyond the available information.

Information selection and extraction process

The selection process is carried out through checking the relevance of the title and abstract, followed by checking the full text if available. Identical publications were identified to avoid double counting. Reasons for excluding articles at the full-text checking stage were recorded to maintain transparency. The number of records found, duplicates, filtered articles, fully reviewed articles, and finally synthesized sources will be reported after the entire database search and selection process is complete.

Information extracted from each article includes the name of the author and year of publication, research objectives, research design, sample characteristics, sport, variables studied, instruments or approaches used, main findings, limitations stated by the author, and their relevance to the focus of this article. The information

was organized into a literature matrix to compare evidence derived from direct rock climbing research with evidence from other sports and cross-sport reviews.

Synthesis technique

The literature was analyzed narratively and comparatively by grouping the results into four themes: (1) psychological characteristics of sport climbing; (2) mental imagery and PETTLEP models; (3) competitive anxiety and performance readiness; and (4) gender perspective and individual athlete needs. Synthesis was carried out by comparing the suitability and differences in findings, paying attention to research design and sample characteristics, and identifying parts that were not supported by direct evidence in sport climbing athletes.

The synthesis results are then used to develop a conceptual framework that links athlete characteristics and competition context, mental imagery design, psychological readiness, and performance readiness. The framework is positioned as a theoretical proposition that needs to be tested in future research, not as an intervention model that has been proven effective. Interpretations regarding gender are also limited to findings actually reported by the source and are not used to assume differences in responses across athletes based on gender.

Table 1. Evidence matrix to align the introduction

Claims In Introduction	Supporting Sources	Claim Limits
Psychology plays a role in sport climbing performance and safety.	(Mangan et al., 2025)	A review of 83 studies identified a variety of psychological factors; not an imagery intervention test. doi ScienceDirect
Emergency needs to be studied specifically in sport climbing.	(Ionel et al., 2024)	The study developed and initially validated the CAS-20 in 153 climbers; not imagery research doi ScienceDirect
The type of climbing activity is related to the level of anxiety.	(Swinarska et al., 2026)	A cross-sectional study of 100 climbers reported higher anxiety on lead climbing than top-rope; does not prove causation. PMC
PETTLEP can be the foundation of the imagery plan.	(Morone et al., 2022)	A review of 12 studies with 332 participants; its application specifically to sport climbing still needs to be studied.

		MDPI
Psychological interventions have the potential to influence competitive anxiety.	(Ong & Chua, 2021)	Combined effect\(g=-0{,}42\) comes from a variety of psychological interventions, not imagery alone.
		ScienceDirect
The use of imagery can differ according to context and gender.	(Lovell et al., 2024)	Study of 62 cricket and Australian football athletes; generalizations to climbers should be limited.
		University of the Sunshine Coast, Queensland
Imagery and mental toughness have been studied according to gender in running athletes.	(Yarayan et al., 2024)	Sample of 344 track athletes; not direct evidence in sport climbing athletes.
The combination of imagery, anxiety, and gender needs to be integrated conceptually.	Author's synthesis based on the sources above	This is an argument and candidate for novelty of the article, not a direct finding from any one source.

RESULT AND DISCUSSION

Psychological Characteristics of sport Climbing

Sport climbing has psychological characteristics that are closely related to risk management, perception of the environment, decision making, self-confidence and anxiety. (Mangan et al., 2025), through a systematic review of 83 studies, concluded that self-confidence, decision-making ability, tactile and spatial perception, and psychophysiological stress management are related to climber experience and performance. The review also shows that the relationship between psychological factors and rock climbing performance still requires further research, especially regarding optimal conditions and ways to develop athletes' psychological abilities.

Anxiety in sport climbing can also vary based on the demands of the activity. (Swinarska et al., 2026) reported differences in anxiety levels between top-rope and lead climbing activities in the sample of climbers studied. These findings suggest that anxiety needs to be understood not only as an individual characteristic, but also as a response related to climbing situations. Meanwhile, (Ionel et al., 2024)

developed the Climbing Anxiety Scale (CAS-20) instrument to measure anxiety related specifically to sport climbing activities.

In relation to mental imagery, these characteristics provide a basis for constructing mental representations that are more specific to the climbing task. Imagery can be directed at path reading, grip recognition, body position selection, movement sequences, and attention management in competitive situations. However, this conceptual relationship needs to be distinguished from evidence of intervention effectiveness: the existence of a specific psychological need does not in itself prove that particular imagery can improve performance or reduce anxiety.

Mental Imagery and the PETTLEP Model

Mental imagery is a psychological training approach used to form mental representations of sports skills or experiences. In their systematic review, (Morone et al., 2022) discusses the PETTLEP model as a framework for improving the suitability of imagery to the characteristics of skill implementation. The model consists of seven components, namely physical aspects (Physical), environment (Environment), tasks (Task), time (Timing), learning (Learning), emotions (Emotion), and perspective (Perspective).

In r sport climbing, the physical component can be considered through body position or movement readiness that is relevant to the climbing task. The environmental component relates to the representation of walls, holds, courses, and competition conditions. The task component includes movement sequences and climbing strategies, while the time component relates to the suitability of imagery duration for skill implementation. The learning component allows imagery to be adjusted to follow the development of the athlete's abilities. The emotional component includes the representation of relevant emotional responses, while the perspective relates to the viewpoint of the imagery used by the athlete.

Conceptually, PETTLEP can be used as a framework for compiling imagery that is relevant to the demands of climbing. However, the application of these seven components to sport climbing athletes should not be seen as a standard protocol that has been validated for all competition categories. Adjustments are still required

based on the type of climbing, athlete's ability level, training goals, and individual characteristics.

Mental Imagery, Competitive Anxiety, and Performance Readiness

Competitive anxiety can involve cognitive aspects, such as concerns about results and the possibility of making mistakes, as well as somatic aspects related to physiological responses to stress. These two aspects are relevant to consider in developing mental training, especially in sports activities that require attention and decision making in pressure situations.

(Ong & Chua, 2021) reported a combined effect of psychological interventions on competitive anxiety with small to moderate effect sizes. These findings support the relevance of psychological interventions in sport, but should not be interpreted as evidence that imagery is the only or always the most effective intervention.

More recent evidence was provided by (Li et al., 2026) through a systematic review and Bayesian network meta-analysis of 46 randomized controlled trials involving 2,049 participants. The analysis compared a number of psychological interventions for competitive anxiety. In the group of elite athletes, imagery showed a relatively large estimated effect of reducing anxiety, namely SMD = −0.88, but the 95% credible interval was still wide, from −1.84 to 0.14. Therefore, these results demonstrate the potential of imagery, while also demonstrating the uncertainty of effect estimates and the limitations of available evidence.

In the context of performance, (Liu et al., 2025) conducted a systematic review and multilevel meta-analysis of 86 studies involving 3,593 athletes. The study reported that imagery training generally supported athletes' performance, and the combination of imagery with one or two additional psychological skills showed better results than imagery alone in their analysis. However, these results come from a variety of sports and performance measures. Therefore, the results cannot be directly used to estimate the magnitude of performance improvements in rock climbing athletes.

Based on this synthesis, imagery can be positioned as a potential component in mental training to support psychological readiness and performance. In the

proposed conceptual framework, imagery is not viewed as a substitute for physical training, technique, or safety, but rather as a supporting approach that needs to be integrated with training requirements and climbing task characteristics.

Gender Perspective in the Development of Mental Imagery

A gender perspective is one aspect that can be considered when designing mental training for athletes. (Lovell et al., 2024) studied the use of imagery based on gender and training and competition contexts among elite athletes from cricket and Australian football. (Yarayan et al., 2024) also studied imagery and mental toughness based on gender in middle and long distance running athletes. Both studies provide a cross-sport perspective to understand possible variations in imagery use and psychological characteristics of athletes.

In rock climbing, (Aşçi et al., 2006) studied pre-competition anxiety by considering gender and competition category. However, this evidence is insufficient to conclude that gender differences directly determine athletes' responses to imagery interventions. Additionally, research that measures biological sex does not automatically provide a complete explanation of social experiences, training environments, and psychological needs related to gender.

Therefore, this article proposes a gender perspective that is not deterministic. Gender is considered along with other factors, such as competition experience, imagery ability, preference for visual or kinesthetic perspective, level of anxiety, and characteristics of the climbing task. This approach opens up space for the development of adaptive training without assuming that all athletes in the same gender category will respond identically to mental training.

Literature Synthesis and Conceptual Gaps

Based on the literature reviewed, there are four main synthesis points. First, sport climbing psychology is related to risk management, self-confidence, perception, anxiety, and decision making (Mangan et al., 2025). Second, the PETTLEP model provides a framework for designing imagery that suits the characteristics of sports tasks (Morone et al., 2022). Third, evidence across sports shows the potential of psychological and imagery interventions to support both anxiety management and performance, although the magnitude of effect and

certainty of evidence varies (Li et al., 2026; Liu et al., 2025; Ong & Chua, 2021). Fourth, cross-sport research provides a rationale for considering variations in imagery use and athlete characteristics without overgeneralizing based on gender (Lovell et al., 2024; Yarayan et al., 2024).

This synthesis underlies the need to link PETTLEP-based mental imagery, competitive anxiety, the psychological demands of sport climbing, and gender perspectives in a conceptual framework. This need is positioned as a direction for theoretical integration proposed by the article, not as evidence that this relationship has never been studied by previous research. Definitively establishing novelty requires additional exploration of studies that directly combine imagery, competitive anxiety, and gender in rock climbing athletes.

DISCUSSION

Contextual Imagery on the Demands of Rock Climbing

One of the main implications of the literature synthesis is the need to design imagery based on the specific demands of rock climbing. An approach that focuses solely on imagining success can be developed into more structured mental representations, such as reading the course, recognizing holds, choosing body position, structuring movement sequences, and maintaining focus when encountering difficult sections of the course. The design is a conceptual application of PETTLEP principles, not a protocol that has been proven effective for all categories of climbing.

The importance of specificity is in line with (Mangan et al., 2025), who emphasize that perception, decision making, self-confidence and stress management have relevance in sport climbing. Thus, imagery can be designed to represent the cognitive and motor demands that athletes actually face. At the next stage of development, the design can be reviewed by coaches, sports psychologists and rock climbing practitioners to assess the suitability of the content to training needs.

Conceptual Relationship between Imagery and Competitive Anxiety

The psychological intervention literature suggests that competitive anxiety can be a target for mental training. However, findings from meta-analyses do not

support the notion that one intervention is always most effective for all athletes and situations. (Li et al., 2026) for example, reported relatively large estimates of imagery effects in a group of elite athletes, but their credible intervals still included the possibility of no effect. This shows the importance of considering the level of competition experience, athlete characteristics, and uncertainty of evidence.

In the conceptual framework of this article, imagery is positioned as a means of preparing athletes to face competitive situations mentally. Athletes can imagine task demands, movement sequences, and appropriate responses when faced with stress. Theoretically, this process may support attentional preparation and management of emotional responses. However, these mechanisms need to be tested empirically in climbers, including through measurements of cognitive anxiety, somatic anxiety, and self-confidence before and after mental training programs.

Gender Perspective as a Basis for Adjustment, Not Generalization

A gender perspective in imagery training should be directed at understanding the needs of athletes, not at assuming that certain gender categories always have the same level of anxiety or imagery response. Research on the use of imagery across sports can provide a basis for identifying research questions, but is insufficient to determine different protocols for female and male athletes without direct testing.

In conceptual practice, program adjustments can start from an assessment of individual needs, competition experience, imagery preferences, and climbing task characteristics. If future research finds differences in responses based on gender or gender, these differences need to be interpreted in conjunction with other relevant factors. This approach supports the development of adaptive mental training programs and reduces the risk of applying stereotypes in athlete coaching.

Conceptual Framework Propositions

Based on a literature synthesis, this article proposes a conceptual relationship between athlete characteristics and competition context, imagery design, psychological readiness, and performance readiness. This framework was formulated as a basis for subsequent research.

First, the characteristics of the athlete and the climbing situation are the basis for determining imagery needs. Second, imagery exercises are designed taking into

account PETTLEP principles and the specific demands of sport climbing. Third, psychological readiness including competitive anxiety, self-confidence, and focus is positioned as an outcome that needs to be evaluated. Fourth, indicators of performance readiness such as path reading, decision making, and movement execution can be targeted for measurement in further research.

The relationship between these components is a conceptual proposition, not the result of statistical testing. Empirical research is needed to determine whether imagery designed based on this framework is truly associated with changes in anxiety or performance, and whether responses vary based on individual characteristics, gender, and climbing category.

Implications and Directions for Further Research

This conceptual framework has initial implications for sport climbing coaches, lecturers and researchers. Coaches can consider imagery as a complement to technical and physical training, while researchers can use this synthesis to design mental training programs and determine relevant evaluation indicators. However, practical implementation must take into account the competency of the trainer, climbing safety, and the individual needs of the athlete.

Future research can develop and test PETTLEP-based imagery protocols on rock climbing athletes. The research design could compare the group that received imagery with a suitable comparison group, using validated anxiety instruments and clear performance indicators. If a gender perspective is the focus, the research design needs to have an adequate number of participants as well as appropriate analyzes to test for differences or interactions, rather than simply comparing group means descriptively. Thus, this conceptual framework can be the basis for developing empirical evidence that is more specific to sport climbing.

CONCLUSION

Mental imagery is a psychological approach that has the potential to support the mental readiness and performance of rock climbing athletes, especially in facing competition demands that involve time pressure, movement accuracy, decision making, and anxiety management. Based on the literature review, the use of mental imagery needs to consider task characteristics, competition situations, athletes'

imagination abilities, and individual psychological needs. The Physical, Environment, Task, Timing, Learning, Emotion, and Perspective (PETTLEP) approach can be a basis for developing more contextual imagery exercises because it integrates elements of physical, environmental, task characteristics, time, learning, emotions, and visualization perspectives.

In the context of competitive anxiety, mental imagery has the potential to help athletes prepare for competition situations, build self-confidence, maintain focus, and anticipate challenges during climbing. However, these benefits cannot be assumed to apply uniformly to all athletes. The characteristics of match numbers, level of experience, imagery abilities, and individual responses to pressure need to be considered in designing mental training.

A gender perspective in the application of mental imagery should be used to understand possible variations in athletes' psychological needs, experiences and preferences, not to determine differences in training ability or effectiveness based on gender directly. Therefore, gender-based mental imagery programs need to prioritize individual assessment and be supported by adequate empirical evidence.

Based on this synthesis, this article proposes an integrative conceptual framework that links mental imagery, competitive anxiety, and performance readiness in rock climbing athletes by considering gender perspectives and individual characteristics. It is hoped that this framework can become an initial basis for coaches, sports psychologists and researchers in designing more contextual mental training programs. However, the proposed framework is still conceptual and has not been tested empirically. Future research is needed to test the effectiveness of the PETTLEP-based mental imagery program, evaluate changes in competitive anxiety and performance indicators, and identify whether and how gender factors relate to athletes' response to the intervention.

Research limitations

This study is narrative and conceptual in nature so it cannot confirm the effectiveness of mental imagery on competitive anxiety and the performance of sport climbing athletes. The limited empirical evidence that specifically integrates mental imagery, gender perspectives, and characteristics of the sport of rock

climbing means that some syntheses still refer to research from other sports. Additionally, the proposed conceptual framework has not been empirically tested. Therefore, future research needs to test the application of PETTLEP-based mental imagery by considering individual characteristics and gender of athletes, as well as measuring changes in competitive anxiety and performance objectively.

REFERENCES

Aryani, M., Rahely, B., Komarudin, K., & Nurjaya, D. R. (2023). *Indonesian sport climbing athlete women's career view from perspective of mental health*. *18*(5), 568–571. https://dialnet.unirioja.es/servlet/articulo?codigo=9235457

Aşçi, F. Hülya, Koca, Canan, Demirhan, Giyasettin, & Dinç, S. Cem. (2006). Precompetitive Anxiety and Affective State of Climbers in Indoor Climbing Competition. *Perceptual and Motor Skills*, *102*(2), 395–404. https://doi.org/10.2466/pms.102.2.395-404

Corrado, D. Di, Guarnera, M., & Vitali, F. (2019). *Imagery ability of elite level athletes from individual vs . team and contact vs . no- contact sports*. 1–14. https://doi.org/10.7717/peerj.6940

Demir, G. T., Namlı, S., Çakır, E., Batu, B., Ateş, F., & Yılmaz, E. (2025). *The role of mental toughness , sport imagery and anxiety in athletic performance : structural equation modelling analysis*.

Giles, D., & Mangan, K. (2026). *Climber Ability and Differences in Psychological , Physiological and Behavioral Responses to an On-sight Lead Climb*. 1–15. https://doi.org/10.1017/SJP.2026.10036

Ionel, M. S., Ion, A., Iliescu, D., & Visu-Petra, L. (2024). Climbing anxiety scale (CAS-20): Preliminary development and validation. *Psychology of Sport and Exercise*, *73*. https://doi.org/10.1016/j.psychsport.2024.102635

Li, L., Wang, J., Li, Q., & Fu, Q. (2026). The Effect of Different Psychological Interventions on Athletes' Competitive Anxiety: A Systematic Review and Bayesian Network Meta-Analysis. In *Sports Medicine - Open* (Vol. 12, Number 1). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1186/s40798-026-01007-y

Liu, Y., Zhao, S., Zhang, X., Zhang, X., Liang, T., & Ning, Z. (2025). The Effects of Imagery Practice on Athletes' Performance: A Multilevel Meta-Analysis with Systematic Review. In *Behavioral Sciences* (Vol. 15, Number 5). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/bs15050685

Lovell, G. P., Bierton, J., Gorman, A. D., Lloyd, M., Gorman, A., & Parker, J. K. (2024). *Imagery use gender differences across competition and training contexts in Australian elite level athletes*. *Journal of Imagery Research in*

Sport and Physical Activity, *19*(1). https://doi.org/doi:10.1515/jirspa-2023-0034

Mangan, K., Andrews, K., Miles, B., & Draper, N. (2025). The psychology of rock climbing: A systematic review. In *Psychology of Sport and Exercise* (Vol. 76). Elsevier Ltd. https://doi.org/10.1016/j.psychsport.2024.102763

Morone, G., Ghanbari Ghooshchy, S., Pulcini, C., Spangu, E., Zoccolotti, P., Martelli, M., Spitoni, G. F., Russo, V., Ciancarelli, I., Paolucci, S., & Iosa, M. (2022). Motor Imagery and Sport Performance: A Systematic Review on the PETTLEP Model. In *Applied Sciences (Switzerland)* (Vol. 12, Number 19). MDPI. https://doi.org/10.3390/app12199753

Ong, N. C. H., & Chua, J. H. E. (2021). Effects of psychological interventions on competitive anxiety in sport: A meta-analysis. *Psychology of Sport and Exercise*, *52*, 101836. https://doi.org/https://doi.org/10.1016/j.psychsport.2020.101836

Padilla-crespo, A., & Clemente-suárez, V. J. (2025). *Psychophysiological Response Differences Between Advanced and Beginner Climbers and Fatigue Management*. 1–15.

Swinarska, N., Krężel, P., Hapka, A., Jurczak, A., & Wieder-Huszla, S. (2026). Anxiety levels and physiological responses during top-rope and lead climbing: a cross-sectional study among sport climbers. *BMC Sports Science, Medicine and Rehabilitation*, *18*(1). https://doi.org/10.1186/s13102-025-01493-9

Yarayan, Y. E., Solmaz, S., Aslan, M., Batrakoulis, A., Al-Mhanna, S. B., & Keskin, K. (2024). Sex Differences in Athletic Performance Response to the Imagery and Mental Toughness of Elite Middle- and Long-Distance Runners. *Sports*, *12*(6). https://doi.org/10.3390/sports12060141

turnitin

ORIGINALITY REPORT

6%	4%	4%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	pmc.ncbi.nlm.nih.gov Internet Source	1%
2	ouci.dntb.gov.ua Internet Source	<1%
3	Submitted to University of Northumbria at Newcastle Student Paper	<1%
4	www.ejournal.unma.ac.id Internet Source	<1%
5	Kevin Mangan, Kathryn Andrews, Brad Miles, Nick Draper. "The Psychology of Rock Climbing: A Systematic Review", Psychology of Sport and Exercise, 2024 Publication	<1%
6	Submitted to University of Wales Institute, Cardiff Student Paper	<1%
7	Submitted to Western Colorado University (Canvas LTI 1.3) Student Paper	<1%
8	Longhui Li, Zilong Zhao, Xuewen Li, Yang Yi. "Effects of psychological interventions on competitive anxiety and athletic performance in golfers: a systematic review and meta-analysis", BMC Sports Science, Medicine and Rehabilitation, 2026 Publication	<1%
9	ejournal2.unud.ac.id Internet Source	<1%
10	hira.hope.ac.uk Internet Source	<1%
11	ijcrr.com Internet Source	<1%
12	journals.humankinetics.com Internet Source	<1%
13	Fatih Bedir, Deniz Bedir, Hasan Hüseyin Yılmaz, Fatih Ağduman et al. "Investigation of the effect of a virtual reality-based imagery training model on muscle activation in athletes", Frontiers in Psychology, 2025 Publication	<1%

14	Li Gao, Wanchun Wang. "The relationship between self-efficacy and perceived academic achievement among college students: the chain mediation roles of time management and psychological resilience", Frontiers in Psychology, 2026 Publication	<1 %
15	mdpi-res.com Internet Source	<1 %
16	roderic.uv.es Internet Source	<1 %
17	Rice, Emily. "The Lived Experience of Running Among Individuals With Anxiety.", Walden University Publication	<1 %
18	open.library.ubc.ca Internet Source	<1 %
19	research.bangor.ac.uk Internet Source	<1 %
20	rodin.uca.es Internet Source	<1 %
21	schoulid.eloracenter.org Internet Source	<1 %
22	Emilio Cruz. "El papel mediador de la autoconfianza deportiva en la relación entre la ansiedad deportiva y el rendimiento deportivo percibido de atletas universitarios SUC-3 durante la temporada", Sportis. Scientific Journal of School Sport, Physical Education and Psychomotricity, 2026 Publication	<1 %
23	Jeffrey Yu, Jui-Ti Nien, Mu-Yen Chu, Yi-Zhen Yang, Yi-Chih Ko, Yun-Han Chen, Nai-Chi Chen, Yu-Kai Chang. "The relationship between mindfulness, competitive anxiety, and self-efficacy in Taekwondo athletes with/without injury: The moderated mediation model", Psychology of Sport and Exercise, 2026 Publication	<1 %
24	Luxia Zhao, Yan Wang, Nurwina Anuar. "Mapping the use of mental imagery for stress management in athletes: a scoping review", Frontiers in Psychology, 2026 Publication	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		