

Explore the Emerging Themes of Metacognition on Academic Performances in Physical Education and Physical Activity—A Systematic Literature Review with Meta-Synthesis of Qualitative Findings

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ADMINISTRATIVE INFORMATION

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INTRODUCTION

Review question / Objective Purpose: To explore the emerging themes of metacognition on academic performances in physical PE and PA settings by conducting a systematic literature review with a meta-synthesis of qualitative findings.

Method: Systematic searches identified articles reporting the results of qualitative or mixed-methods studies of the emerging themes were searched from five databases until June 2023.

Rationale Metacognition refers to an individual's cognition of their abilities and ongoing cognitive activities (Flavell, 1976). Flavell operationalized metacognition into four essential components: metacognitive knowledge, metacognitive experience, goal-setting, and the activation of strategies. Metacognitive knowledge entails being

aware of one's cognitive processes and understanding the factors that impact learning, such as attention, memory, and motivation (Stephanou & Karamountzos, 2020). Metacognitive regulation involves the capacity to plan, monitor, and evaluate one's learning activities. Metacognitive experiences encompass the subjective aspects of learning, such as feelings of confidence, frustration, and enjoyment (Jackman et al., 2021). Examples of metacognitive skills could include the ability to monitor, regulate, and control one's thinking and learning processes (Güner & Erbay, 2021; Jassim et al., 2022). Different models and frameworks have been developed to understand metacognition, such as the self-regulated learning model proposed by Zimmerman (Zimmerman, 2000) and Pintrich's four-phase self-regulation learning model (Pintrich, 2004).

Previous reviews and studies have extensively discussed the themes and underlying mechanisms involved in metacognition and its ability to enhance aspects of human performance in PE and PA (Álvarez-Bueno et al., 2016; Marques et al., 2017). Indeed, the study of metacognition has expanded to cover various topics and domains. These themes include the degree of cognitive processing (Pintrich, 2004; Pintrich et al., 1993), meta-cognitive knowledge (Elhamifar et al., 2019; Worley & Worley, 2019), meta-cognitive strategies (Atman Uslu, 2022; Liu et al., 2019), problem-solving, cognitive flexibility (Breed & Bailey, 2018; Dawati et al., 2020; Kumar et al., 2022; Tachie, 2019); metacognitive behavior (Chatzipanteli et al., 2015); metacognitive feelings (Nasser Al Rawahi, 2015); decision-making and execution of skill (Kent et al., 2022); meta-cognitive awareness (Gündoğdu & Celebi, 2017; Sudirtha et al., 2022); meta-cognitive judgments (Palmer et al., 2019); metacognitive feelings (Goudas et al., 2017a); and self-regulating skills (Kolovelonis et al., 2011, 2022; Kolovelonis A et al., 2013; Goudas et al., 2017; Lakes & Hoyt, 2004; Šteh & Šarić, 2020). All of these studies show that metacognition-related themes are highly correlated with technical skill performance, academic achievement, and learning performance in PE and PA.

To the best of the authors' knowledge, only three systematic reviews published in the literature focus solely on metacognition impact on academic performance. Malambo et al conducted a systematic review to explore the evidence on the association between fundamental movement skills (FMSs), physical fitness (PF), motor competency (MC), PA, physical fitness (PF), and executive functions (EF) in pre-school age children (Malambo et al., 2022). Álvarez-Bueno et al conducted a protocol for systematic review and meta-analysis to examine the effects of chronic physical exercise on children's and adolescents' cognitive and metacognitive functions, cognitive life skills, academic behaviours, and achievement (Álvarez-Bueno et al., 2016). Marques et al conducted a systematic review to explore the association between physical education, school-based physical activity, and academic performance (Marques et al., 2017). However, most of the literature they included was quantitative research design, focusing on outcomes of academic achievement. Indeed, a rich qualitative literature is available relating variously to metacognitive concepts such as the influence of person, task and strategy factors, and emotional experience on performance in the context of PE, PA, and other sports settings. However, such evidence needs to be systematically compiled. A systematic review with meta-analysis may help to pinpoint gaps and

shortcomings in the quantitative literature and provide practitioners or scholars with valuable insights on future research directions. Therefore, the primary purpose of this study is to explore the evidence published about the emerging themes of metacognition on academic performances in PE and PA by conducting a systematic literature review with a meta-synthesis of qualitative findings.

Condition being studied No.

METHODS

Search strategy On the 6th of June 2023, Web of Science Core Collection, SPORTDiscus, ProQuest, PubMed, and SCOPUS five electronic databases were searched to obtain articles pertinent to the topic. Considering the novel topic of metacognition to be studied, only articles published since 2000 were included. Previous reviews were used to help define our search strategy; keywords and Boolean operators were considered separately and in aggregation while searching the five databases. This study employed the following terms and operators: ("metacognition*" OR "self-regulation learning") AND ("physical activity" OR "physical education" OR "physical exercise" OR "sport") AND ("qualitative study" OR "observational study" OR "interview study"). Moreover, we carefully reviewed relevant review articles published before June 30, 2023. Furthermore, our research team screened the reference lists of all the identified articles to discover any publications that were not detected by the initial search. Finally, we invited an experienced librarian to participate in the data collection process to ensure the search process was performed correctly. Initially, we uploaded search results to Zotero (version 6.0.26.0). After removing duplicates, two reviewers independently extracted data from each article based on all titles, abstracts, and full-text articles for eligibility criteria. The reason for exclusion was documented during the full-text screening phase. In case of any disputes regarding an article's eligibility, a third reviewer was consulted to discuss and resolve the matter.

Participant or population Population: Inclusion of physically healthy students, athletes, players and any other participants (no gender restriction) of any age and competition level (no restriction).

Intervention Interventions related to metacognition include teaching methods, teaching methods, teaching models, teaching styles, etc.

Comparator No.

Study designs to be included Systematic searches identified English-language, peer-reviewed journal articles reporting the results of qualitative or mixed-methods studies of the emerging themes of metacognition on academic performances in sports.

Eligibility criteria The criteria include the following 1) Population: Inclusion of physically healthy students, athletes, players and any other participants (no gender restriction) of any age and competition level (no restriction); 2) Outcome: Reporting any emerging themes related to metacognition in schools' or in out-of-school settings' PE and acute or chronic PA, physical exercises; 3) Language: Eligible studies were peer-reviewed English-language manuscripts; 4) Research design: Inclusion of primarily qualitative or mixed-methods, reporting first-hand information. Quantitative research, conference abstracts, books, book sections, opinions, letters, or papers not published in peer-reviewed journals were excluded. Only qualitative data from mixed methods were analyzed. Studies reporting only on technical skills were excluded, but those discussing metacognitive and psychosocial influences and learning abilities were included.

Information sources On the 6th of June 2023, Web of Science Core Collection, SPORTDiscus, ProQuest, PubMed, and SCOPUS five electronic databases were searched to obtain articles pertinent to the topic. Considering the novel topic of metacognition to be studied, only articles published since 2000 were included. Previous reviews were used to help define our search strategy; keywords and Boolean operators were considered separately and in aggregation while searching the five databases (S2. Table). This study employed the following terms and operators: ("metacognition*" OR "self-regulation learning") AND ("physical activity" OR "physical education" OR "physical exercise" OR "sport") AND ("qualitative study" OR "observational study" OR "interview study"). Moreover, we carefully reviewed relevant review articles published before June 30, 2023. Furthermore, our research team screened the reference lists of all the identified articles to discover any publications that were not detected by the initial search. Finally, we invited an experienced librarian to participate in the data collection process to ensure the search process was performed correctly.

Main outcome(s) This systematic literature review and meta-analysis, by exploring the relationship between metacognition and academic performance in PE and PA settings, synthesized

five emerging descriptive themes. Based on the relationships observed among these emerging themes, an analytical theme is proposed: the metacognitive learning model in PE and PA settings. This study provides a valuable information resource for PE teachers, coaches, and trainers. As well as it offers theoretical insights and empirical evidence to guide future research. In particular, it provides new perspectives for exploring the correlations between metacognition and physical performance as well as academic achievement in the context of motor learning, comparative studies involving different demographic groups, and the design of further intervention experiments.

Quality assessment / Risk of bias analysis Two reviewers (BL, XH) used the Critical Appraisal Skills Programme (CASP) checklist for qualitative research to independently assess the methodological quality of the included articles. Differences were resolved through discussion or by involving a third reviewer (NJ). Cohen's kappa (k) is used to establish inter-rater agreement, $k \leq 0.68$ points indicated "lower" agreement, $k = 0.69-0.79$ points indicated "moderate" agreement, and $k \geq 0.80$ points indicated "high" agreement. The intraclass correlation coefficient (ICC) was used to establish inter-rater reliability, $ICC > 0.75$ indicates good inter-rater reliability. The Grading of Recommendations Assessment, Development and Evaluation–Confidence in Evidence from Reviews of Qualitative Research (GRADE-CERQual) approach was used to establish the degree of confidence that can be applied to the descriptive findings (Lewin et al., 2018). Data supporting five descriptive themes were assessed according to the GRADE-CERQual criteria from 1) methodological limitations; 2) relevance; 3) coherence; 4) adequacy, and each finding (theme) assigns an overall confidence rating of "high", "moderate", "low", or "very low".

Strategy of data synthesis We uploaded the full text of the articles included in the included studies to NVivo (v20.5.1.940) qualitative data analysis software and analyzed the Results section (including narratives and participant citations) as well as relevant supplementary material from the included studies, using thematic analysis conduct a meta-synthesis (Thomas & Harden, 2008). To ensure the accuracy of data synthesis, the research team first selected two associate professors who have rich teaching and practical experience and have been engaged in physical education teaching and academic research for more than ten years to code the data. First, one researcher BL applied inductive line-by-line initial

coding individually to mark the relevant concepts raised in the findings. A second investigator, XH, randomly selected 20% (n = 4) of the articles included in the study and reviewed their coding accuracy. Then they constructed descriptive themes through discussion, and the entire discussion process and content were recorded with cameras to improve the reflectivity of researchers. Lastly, they further refined the coding paradigm using axial coding to detail the set of features operating within each descriptive theme. Descriptive themes were then analyzed to reflexively construct a hypothetical model of proposed relationships between themes.

Subgroup analysis No.

Sensitivity analysis The Grading of Recommendations Assessment, Development and Evaluation–Confidence in Evidence from Reviews of Qualitative Research (GRADE-CERQual) approach was used to establish the degree of confidence that can be applied to the descriptive findings (Lewin et al., 2018). Data supporting five descriptive themes were assessed according to the GRADE-CERQual criteria from 1) methodological limitations; 2) relevance; 3) coherence; 4) adequacy, and each finding (theme) assigns an overall confidence rating of "high", "moderate", "low", or "very low".

Aggregate Critical Skills Appraisal Programme (CASP) checklist results for contributing studies were used to assess the methodological limitations of contributing studies for each integrated finding (Munthe-Kaas et al., 2018). The synthesis findings are assessed as having “no or very minor consistency issues” about coherence if there is a “good and consistent fit” between the theme and data of the contributing study (Colvin et al., 2018). The synthesis findings were assessed as having “no or very slight concerns” about adequacy if more than 50% of the contributing studies contributed to the theme and data (Glenton et al., 2018). The synthesis findings are assessed as having "no or very slight concerns" about relevance if the most of papers included in the descriptive theme openly address the review question (Noyes et al., 2018). As with all GRADE CERQual standards, the evaluation begins with the assumption that there were no concerns for each discovered data body, and the rating is downgraded based on the results of the evaluation. However, the evidence shows that the GRADE CERQual method is only suitable for descriptive topics and not for analytical topics (Cohen, 1960).

Country(ies) involved All the authors of this article are from China and Malaysia. One of the corresponding authors is from China and is studying for a PhD in Malaysia, and the other.

Keywords metacognition; metacognitive skill*; self-regulation learning; metacognitive learning.

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