INPLASY

INPLASY202650086

doi: 10.37766/inplasy2026.5.0086

Received: 15 May 2026

Published: 15 May 2026

Exploring the Mechanisms and Pathways of Physical Activity Promoting Metacognitive Skills in Adolescents: A Qualitative Systematic Literature Review with Meta-Synthesis

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ADMINISTRATIVE INFORMATION

Support - This research was funded by the Key Project of the Ministry of Education under the National Education Science Planning of China.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202650086

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 May 2026 and was last updated on 15 May 2026.

INTRODUCTION

Review question / Objective Adolescence is a critical period for the development of metacognitive skills. Most existing studies adopt a quantitative approach to examine the effects of metacognitive interventions on various physical skills, lacking a systematic qualitative review of the intrinsic mechanisms and interrelationships between different sports and metacognitive skills in physical activity contexts. This qualitative systematic review and meta-synthesis aims to identify the intrinsic mechanisms and practical pathways through which physical activity and sport interventions promote metacognitive skills in adolescents.This qualitative systematic review and meta-synthesis aims to identify the intrinsic mechanisms and practical pathways through which physical activity and sport interventions promote metacognitive skills in adolescents.

Rationale Metacognitive theory and self-regulated learning theory serve as the foundational theories for metacognitive skills. Metacognition is the cognition of self-awareness and self-regulation of one's learning process (Flavell, 1979). Metacognitive skills are crucial for assessing students' learning abilities (Hameed & Cheruvalath, 2021). Self-regulated learning (SRL) is a critical concept belonging to metacognitive skills. It involves the process of learners controlling and regulating their learning activities, which is an advanced learning ability (Zimmerman, 2000). Metacognition, as a higher-order cognitive function, fundamentally involves self-awareness, self-regulation, and self-control of cognitive activities . Metacognitive skills are a key factor closely related to academic performance and a necessary condition for achieving lifelong learning. High-level metacognitive skills provide individuals with greater well-being, self-confidence, and happiness, increase opportunities for personal success , help cultivate students' critical thinking

and problem-solving abilities optimize students' learning strategies , and enhance self-regulation skills . Additionally, metacognitive skills aid in controlling and regulating negative emotions, thoughts, and distressing memories. Hence, Ataseven and Oguz (2016) stated that the development of metacognitive skills should be integrated throughout the education process, starting from preschool and continuing to university-level education. Thus metacognitive skills is a crucial skill for individuals to flexibly and innovatively navigate complex, dynamic environments in the future.

Condition being studied The 21st century, an era defined by digital transformation, presents humanity with numerous opportunities and challenges. To navigate this rapidly changing landscape of uncertainty, people must break through entrenched cognitive barriers (Kim et al., 2026). Consequently, two ontological shifts in cognitive function have emerged: a transition from general cognitive skills to specialized cognitive skills, and a shift from external control of cognitive skills to internal control .Adolescence represents a critical period for cognitive maturation, during which metacognition plays a foundational role in learning, decision-making, and adaptive behavior . A large body of research demonstrates that physical activity or exercise has a positive effect on adolescents' cognitive function . However, current approaches to physical activity or exercise for adolescents, influenced by traditional teaching and training models, often emphasize imitation and repetitive drills while neglecting the cultivation of metacognitive skills essential for learning motor skills—such as self-monitoring, strategy adjustment, and self-reflection . This results in students prioritizing technical proficiency over critical thinking, strong training, weak transfer. Independent learning often stagnates at the level of mastering movement techniques and executing training plans, lacking the ability to manage, evaluate, and transfer learning processes. The consequences are twofold: First, the absence of student agency severely suppresses adolescents' potential for autonomous and creative learning in physical activity. Second, it obscures the cultivation and training of cognitive abilities, leaving students lacking in self-reflective cognitive skills and autonomous survival wisdom for lifelong learning.

METHODS

Participant or population The inclusion and exclusion criteria comprised the following five elements: 1) Population: Focused exclusively on the age range for adolescents as defined by the World Health Organization (aged 10 to 19 years), with no gender restrictions.

Intervention Not applicable.

Comparator Not applicable.

Study designs to be included Study Design: Only qualitative research designs or the qualitative components of mixed-methods studies were considered.

Eligibility criteria Language: Eligible studies were limited to peer-reviewed manuscripts published in English or Chinese; Publication Type: Quantitative research, conference abstracts, books, book chapters, opinions, letters, and papers not published in peer-reviewed journals were excluded.

Information sources Five electronic databases—Web of Science, SPORTDiscus, ProQuest, PubMed, Scopus, and CNKI (China National Knowledge Infrastructure) were searched to identify literature relevant to this topic.

Main outcome(s) Outcomes: Studies were required to report outcomes related to any form of physical activity, exercise, physical education, and any metacognitive skills. Eligible qualitative studies were included. Thematic meta-synthesis identified some descriptive themes.

Quality assessment / Risk of bias analysis Two reviewers independently assessed the quality of the included articles in strict accordance with the "Critical Appraisal Skills Scheme" (CASP) checklist for qualitative research.

Strategy of data synthesis The study employed thematic analysis to conduct a meta-synthesis of the data sections one by one . To ensure the accuracy of the data synthesis, the research team first assigned a professor with extensive experience in physical education teaching and research to independently use an inductive, line-by-line initial coding method. One researcher identified and labeled the core relevant concepts presented in the "Results" sections and related supplementary materials of the included articles. Next, another experienced researcher, Associate Professor, randomly selected 20% (n=3) of the included articles to verify the accuracy of the coding. Subsequently, the two researchers constructed descriptive themes through discussion, recording the entire process and content with a video camera to enhance their

reflexivity. Finally, axial coding was employed to further refine the coding framework, elucidating the set of characteristics underlying the internal dynamics of each descriptive theme. The descriptive themes were then analyzed to reflexively construct a hypothetical model of the proposed relationships among them.

Subgroup analysis Not applicable.

Sensitivity analysis Two reviewers independently appraised the confidence level of the included studies using the GRADE-CERQual approach. Any discrepancies between the two reviewers were resolved through discussion with a third reviewer until a consensus was achieved. Accordingly, the overall CERQual rating for all evidence was moderate confidence. This indicates that the synthesized findings are sufficiently reliable to inform practice and future research.

Country(ies) involved China.

Keywords adolescent; metacognitive skill*; self-regulation skill*; physical activity; physical exercise; sport.

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