

Supplementary material 1.

Cognitively enriched physical activity intervention (Group 1)

[For a similar approach with younger children, see Biino et al., 2021]

Content	The content of the cognitively enriched physical activity intervention consisted of cognitively challenging physical activity games based on different principles derived from motor learning and cognitive stimulation theories and practices.
Teaching strategies	Central to the games was to generate and maintain mental effort at an optimal challenge point by progressively increasing the complexity of movement coordination and/or the demands on thoughtful action. To this aim, games can be varied by: <ul style="list-style-type: none">• Alternating the roles played children (e.g., roles of tagger and tagged children in tag games);• Changing the motor demands by adding movements to a sequence, or increasing the coordinative difficulty of the single movements that compose a sequence;• Altering the structure of a game to encourage problem solving and divergent discovery.
Principles (described in detail in: Tomporowski, P. D., B. A. McCullick, and C. Pesce. 2015. Enhancing Children's Cognition with Physical Activity Games. Champaign, IL: Human Kinetics.	<p>The principle of contextual interference set that the context and the game conditions change requiring children to make unpredictable sequences of actions and perform shifts across multiple skills, or variations of a skill. This way children may generate mental effort and challenge cognitive flexibility to select every time different motor programs and movement parameters.</p> <p>The principle of mental control is operationalized in:</p> <ul style="list-style-type: none">• stopping games or tasks, where children must on occasion refrain from or stop moving;• updating games or tasks, where children must continuously update information held in memory to cope with ongoing movement tasks properly;• switching games or tasks, in which perception-action couplings and criteria to perform movement tasks are frequently and suddenly changed). <p>The principle of promoting discovery is translated into practice by involving children in conditions requiring divergent discovery (generating multiple solutions to a problem) and in open-ended games (the rules and the goal are explained, but not how to perform the game).</p>
Sample games	A description of sample games is presented in Appendix 1. A detailed and in-depth analysis of two sample games (Pesce et al., 2016) is presented in Supplementary File 2. Pesce, C., Marchetti, R., Motta, A., & Bellucci, M. (eds.) (2016). Joy of moving - MindMovers & ImaginAction. Playing with variability to

	promote motor, cognitive and citizenship development. Torgiano (PG): Calzetti-Mariucci.
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Biino, V., Tinagli, V., Borioni, F., & Pesce, C. (2021). Cognitively enriched physical activity may foster motor competence and executive function as early as preschool age: A pilot trial. *Physical Education and Sport Pedagogy* [online first]. <https://doi.org/10.1080/17408989.2021>.