

Physically Active Lifestyles within the School context: Morpho-Physiological and Functional Aspects Estilos de Vida Físicamente Activos en el Contexto Escolar: Aspectos Morfo-Fisiológicos y Funcionales

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Abstract. The school context embodies the optimal environment for educating children towards the adoption of active lifestyles. This is auspicious not only in terms of physical health but also from a psycho-pedagogical and social standpoint. The need to integrate physical activity into the school routine, particularly in primary education, where behaviors are established and carried on into later stages of life, emerges clearly from the scientific literature. Health education sessions with a focus on preventive measures can be organized by the school's medical services for the benefit of students. It is imperative within educational practices to view the motor domain as a crucial instrument for instilling appropriate lifestyles, enhancing cognitive growth, fostering inclusivity, and addressing psycho-emotional and socio-relational aspects. The school environment can significantly contribute by serving as a pivotal setting for promoting physical activity throughout various periods of the day. Movement can be incorporated into teaching activities, and active breaks can be integrated into class hours, either before or after lessons. This study stems from a comprehensive examination of the existing literature regarding the correlation between the school environment, health, and preventive health promotion. It recognizes the ongoing nature of the issue and the need for further investigation to align with forthcoming changes.

Keywords: physical activity, physiology, school.

Resumen. La escuela encarna el entorno óptimo para educar a los niños hacia la adopción de estilos de vida activos, que se consideran no solo en términos de salud física sino también desde un punto de vista psicopedagógico y social. La necesidad de integrar la actividad física en la rutina escolar, particularmente en la educación primaria, donde las conductas se establecen y se llevan a etapas posteriores de la vida, es evidente en la literatura científica. Los servicios médicos de la escuela pueden apoyar la organización de sesiones de educación para la salud dirigidas a los estudiantes, con un enfoque en las medidas preventivas. Es imperativo dentro de las prácticas educativas ver el dominio motor como un instrumento crucial para inculcar estilos de vida adecuados, mejorar el crecimiento cognitivo, fomentar la inclusión y abordar los aspectos psicoemocionales y sociorelacionales. La escuela puede contribuir significativamente sirviendo como un entorno fundamental para promover la actividad física a lo largo de varios períodos del día, como la incorporación del movimiento en la enseñanza, los descansos activos durante las horas de clase, los descansos y las lecciones antes y después. Este análisis se deriva de un examen exhaustivo de la literatura existente con respecto a la correlación entre el entorno escolar, la salud y la promoción preventiva de la salud, reconociendo la naturaleza continua del problema y la necesidad de una mayor contemplación para alinearse con los cambios futuros.

Palabras clave: actividad física, fisiología, escuela.

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Introduction

Childhood epitomizes a developmental phase of human existence that holds significant importance for all subsequent progress. The foundations laid during this stage significantly influence the subsequent formation and equilibrium of the individual (WHO, 2003).

Educational institutions, particularly primary schools, assume a pivotal role in advancing the provision of medical-psycho-pedagogical support services and in preventing neuropsychological disorders among children (Keeton, Soleimanpour, & Brindis, 2012). Considering the pressing urgency characterizing contemporary society in addressing diverse issues pertaining to medical-psycho-pedagogical support for children in their formative years, the Italian School Medical Service presents a tangible solution to safeguard the psychophysical well-being of students at school-going age (from preschool to the completion of secondary education) (Veltro, Ialenti, Iannone, Bonanni, & Morales García, 2015).

When considering the provision of medical services in educational institutions, particularly in terms of preventive measures and activities aimed at enhancing the overall well-

being of students within compulsory schooling, it encompasses a multidisciplinary framework that must address various interconnected needs and competencies (Bains, & D'Allo, 2016). This perspective operates on the premise that the concept of health extends beyond individual concerns, encompassing a broader societal context that acknowledges the significance of communal welfare, influenced by environmental quality and living conditions. Consequently, adopting a holistic approach to health, it necessitates the establishment of a well-coordinated network that is adaptable to evolving circumstances, aligning with the objectives outlined in the National Recovery and Resilience Plan (Ricciardi, & Tarricone, 2021).

In this scenario, the strategies devised are designed to effectively navigate the evolving landscape of social and health dynamics, demanding a strategic and inclusive approach involving key stakeholders such as the school medical staff, administrators, educators, students, and families. This approach must be responsive to the diverse array of current needs, while also addressing immediate challenges, particularly emphasizing the pivotal role of schools as outlined in the National Prevention Plan 2020-25 (Ludici, Tassinari Rogalin, & Turchi, 2021), serving as a cornerstone

for health promotion and preservation efforts.

Within the framework of a comprehensive health-oriented approach, educational institutions play a crucial and strategic role in fostering health-promoting initiatives and facilitating sustainable practices. Within this domain, the concept of health within school environments transcends traditional boundaries, permeating various aspects including institutional policies, physical and social surroundings, as well as educational curricula and training programs (MacKenzie, & Jeggo, 2019).

The National Prevention Plan 2020-2025 (Ministry of Health, 2020) has emphasized the importance of focusing on the individual in promoting well-being and health, advocating for the use of the setting approach to facilitate health promotion and prevention efforts throughout one's life course. Within this framework, the educational institution, particularly the school environment, is identified as a crucial setting for promoting health and implementing prevention strategies. The school's role in health literacy and promotion is underscored by the comprehensive educational content, the conducive physical surroundings, the health-related challenges affecting student life, and the impact on learning quality. Functioning both as an institutional entity and an educational agent within the community, the school significantly contributes to the advancement of health promotion and prevention endeavors that extend beyond specific initiatives, benefiting from specialized interventions (Thomas, Price, Phillippi, Wennerstrom, 2020). By leveraging the school medical service's support, the educational institution becomes an ideal platform for organizing health education sessions targeting students, especially in terms of prevention strategies. Among the diverse responsibilities of the school medical service is the task of promoting healthy lifestyles during the formative years. When conducted within an inclusive and educational framework, these efforts have the potential to greatly influence families and the broader community (Ronto et al., 2020).

An essential starting point that urges us to focus more on a revamped model of school medical service, geared towards promoting health and empowering all individuals involved (particularly starting from young students), can be traced back to the concept of health literacy (Paakkari, & Okan, 2020) and its derivative, specifically Physical literacy (Cornish et al., 2020). Physical Literacy represents a primary objective for every health education initiative. SHAPE America (Young, O'Connor, Alfrey, & Penney, 2021) provides the subsequent definitions in relation to physical literacy and health literacy. Physical Literacy denotes an individual's capacity, confidence, and inclination to engage in physical activities throughout their lifetime.

On the contrary, Health Literacy pertains to the ability to make informed health choices that result in the adoption of healthy lifestyles both now and in the future. Recognizing the significance of physical literacy within the realm of health supports clinical, population, and school health initiatives. It is widely acknowledged that physical activity, as supported by neuroscience, yields substantial benefits for

both physical and mental health (Shape America, 2022).

Within this framework, physical activity within the educational setting presents distinctive and exceptional circumstances where efforts can be directed towards regulating emotions, while also fostering peer relationships and classroom dynamics (Shen, McCaughtry, & Martin, 2007). Consequently, emotional management and self-esteem are cultivated, socialization and autonomy abilities are enhanced, thereby promoting an understanding of one's own capabilities and boundaries (Whitehead, & Corbin, 1997).

The educational institution, inherently a hub of culture and knowledge, can primarily evolve into a hub for culture, prevention, health, physical literacy, and health promotion, including in terms of intergenerational outreach (targeting not only students but also educators and parents). The Covid-19 crisis has underscored the importance of cultivating a culture of health and well-being. The academic setting has the potential to serve as a platform for education and dialogue, commencing with the essential components of health and physical literacy, extending beyond scientific disciplines into the broader interdisciplinary fabric of the school curriculum (Braksiek, Pahmeier, Gröben, & Lindemann, 2022).

Thus, the objective of this manuscript is to present a framework regarding the topic of school healthcare services with the goal of examining both the current status quo and contemplating potential interventions and approaches within the school setting to enhance medical, psychological, and pedagogical circumstances. This will be achieved through a discourse grounded in the principle that diverse professions and perspectives are essential for a logical and productive analysis of a shared subject matter.

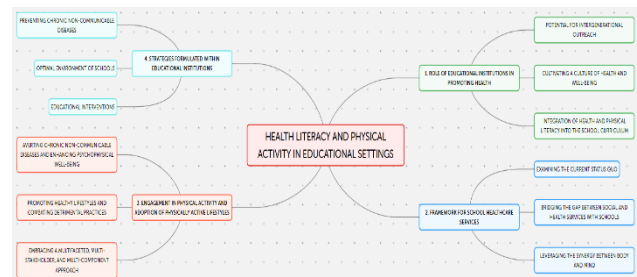


Figure 1. Characteristics of the study.

A Revised Understanding of the Corporeality

Discussing health within educational institutions in relation to the interplay between social and health services and schools requires the implementation of novel methodologies, tactics, and organizational frameworks tailored to the specific cultural and geographical settings of the nation. Implementing health promotion initiatives within schools has the potential to yield advantages and favorable outcomes not solely for students but also for families and communities (e.g., through the dissemination of knowledge from the educational setting to the family environment) (Ekwaru et al., 2021). Through educating and sensitizing students, bridging the gap between social and health services with schools,

and fostering a wholesome atmosphere within the educational sphere, it becomes plausible to impact health determinants and promote enhanced fairness in the delivery of social and health services, subsequently easing accessibility to these services. Furthermore, establishing a link between the educational institution and health services can serve as a valuable mechanism for addressing vulnerabilities and handling health crises among students, particularly those grappling with chronic ailments. This strategy primarily revolves around developing pathways for cultivating healthy behaviors that are efficacious in combating childhood obesity and enhancing the psycho-physical well-being of students (Leger, Buijs, Mohammadi, & Lee, 2022). When proposing a novel framework, leveraging the potential of incorporating the synergy between body and mind presents valuable prospects. Within educational settings, physical activity can serve as a comprehensive approach to promoting health and healthy lifestyles, considering various factors such as context, psychosocial circumstances, individual abilities, and knowledge. Integrating diverse contexts to encourage physical activity enhances the feasibility of behavior change and the development of effective strategies to address the issue of physical inactivity (Vaquero-Solís et al., 2021).

The body and movement act as intermediaries between the child and the environment, particularly during primary school years, facilitating information gathering, processing, and adaptive responses. Additionally, they serve as powerful tools for expression and communication, enabling children to explore, learn, and enhance adaptive functions necessary for environmental modification. Consequently, children advance their cognitive, social, and motor skills through body movements (Andermo et al., 2020).

Recent studies rooted in neuroscientific theories underscore the pivotal role of bodily experiences and movements in cognitive development, with individual differences shaping the relationship between physical experiences and mental processes (Gallagher, 2006; Gibbs, 2005; Tomporowski, Lambourne, & Okumura, 2011). Perception and the ability to act on perceptions significantly influence knowledge acquisition (Pascoe et al., 2020). Therefore, the psychological and pedagogical dimensions of body movements in early childhood education are a focal point in various research endeavors, aiming to enhance learning and social skills. Effective educational approaches have been shown to strengthen mechanisms for altering attitudes, knowledge, and behaviors related to lifestyle during early childhood.

Primary schools, especially, have a crucial role to play in promoting a wide range of motor activities. They should not only provide tools and opportunities for practice but also impart knowledge and skills (Schmidt et al., 2019). These resources can help in making informed choices, encouraging participation, and ultimately, enhancing the well-being of both students and educators. Educational institutions serve as key environments for personal develop-

ment and learning. These processes inevitably involve physicality, bodily experiences, and the various possibilities that movement offers (Bang, Won, & Park, 2020; Cairney, Dudley, Kwan, Bulten, & Kriellaars, 2019). Therefore, it is imperative to stimulate the expressive and communicative capabilities of the body within educational settings.

Engagement in physical activity and adoption of physically active lifestyles

Scientific literature accords a crucial role to the consistent engagement in physical activities in averting chronic non-communicable diseases and enhancing psychophysical well-being, thereby augmenting the quality of life across all age brackets and societal groups (Caldwell et al., 2020). Conversely, sedentary behaviors represent a prominent health hazard, with over 800,000 global fatalities annually attributed to physical inactivity. In this regard, health promotion, advocating for the embrace of healthy lifestyles and combatting detrimental practices, assumes a pivotal role that transcends the health sector, encompassing all facets of civil society and political spheres (Jakicic et al., 2019). Consequently, a multifaceted, multi-stakeholder, and multi-component approach becomes imperative for health promotion. The variables entailed in health promotion initiatives, including the encouragement of regular physical exercise, exhibit a nuanced and intricate nature. The World Health Organization (WHO, 2019) has, over time, issued a succession of policy papers to furnish nations with benchmarks for viable and efficacious national policies and strategies. With a specific focus on physical activity promotion, the "Global action plan on physical activity 2018-2030: more active people for a healthier world" accentuates the necessity for holistic and intersectoral measures in combating physical inactivity. Such actions should address individual behaviors as well as the social, economic, and environmental determinants influencing lifestyles.

The beneficial impacts of engaging in physical activities can directly and indirectly contribute to the attainment of specific Sustainable Development Goals outlined in the UN 2030 Agenda (UN, 2015). These benefits encompass a reduction in fossil fuel usage and air pollution, alleviation of traffic congestion, enhancement of road safety, promotion of sustainable urban development, mitigation of premature mortality resulting from chronic non-communicable diseases and health disparities, and advancement of gender equality. The rise in unhealthy behaviors, such as physical inactivity and sedentary routines, along with the increase in chronic non-communicable diseases, can be attributed to socio-economic and environmental transformations resulting from globalization and escalating urbanization.

Given the multifaceted nature of health risk elements, it is imperative to embrace an approach that considers factors beyond the health domain. Sectors like educational institutions have a pivotal role in fostering and perpetuating healthy lifestyles, while also equipping individuals with the necessary competencies and resources to enhance physical activity levels. This perspective aligns with the global and

national strategies implemented over the past decade to promote physical activity, characterized by an integrated, cross-sectoral, and partnership-oriented outlook.

The proposed intervention within the school setting to instill physically active habits is systemic in nature, emphasizing coordination between educational institutions and medical services. The Italian strategy aligns with the international framework by prioritizing health promotion policies that advocate for healthy and active lifestyles through a comprehensive and integrated approach. This strategy avoids fragmented interventions and considers all determinants influencing health behaviors that impact the well-being of individuals and communities (Deschesnes, Martin, & Hill, 2003).

The National Prevention Plan 2020-2025 affirms the intersectoral approach of the "Gaining Health" program and emphasizes the necessity of implementing interventions to modify unhealthy behaviors. This involves influencing individual lifestyles and establishing environmental and social conditions conducive to behavior change. The school community, in collaboration with the school medical service, should work harmoniously to strategize and execute structured interventions that encourage physical activity and advocate for an active lifestyle as a key component of well-being. By selecting specific programs, the aim is to standardize approaches, techniques, and successful practices that have been verified and refined over time (Lavin, Shapiro, & Weill, 1992). The establishment of a school ethos centered on an active lifestyle relies on a holistic approach within the community that encompasses intricate and diverse efforts to achieve the strategic objectives outlined. This includes:

- Fostering active societies where the knowledge, comprehension, and value of the various advantages of regular physical activity are disseminated across all age groups and levels of ability.
- Cultivating active environments, such as secure areas and facilities, that uphold everyone's right to engage in regular physical activity.
- Encouraging active individuals through initiatives and prospects that enhance the health literacy of individuals, families, and communities to promote the adoption of an active lifestyle in various contexts.
- Establishing active systems that formulate cohesive policies and measures to boost physical activity levels and decrease sedentary behaviors.

Strategies formulated within educational institutions

The strategies implemented within educational institutions align with national and global objectives and initiatives. These programs focus on preventing chronic non-communicable diseases and enhancing public health through cross-sectoral policies and efforts, utilizing an integrated and thorough approach. Schools serve as an optimal environment for promoting physical activity among children, given that they typically spend a significant portion of their day there during their formative years (Herlitz, MacIntyre,

Osborn, & Bonell, 2020). Various educational interventions have been introduced to foster physical activity within the school setting, many of which are designed as multi-faceted initiatives (Andermo et al., 2020). These efforts aim to encourage active lifestyles and explore the connections between increased physical activity levels and their impact on cognitive functions, academic performance, and associated psychological and social factors (Costigan et al., 2019).

The primary actions and organizational strategies that support the engagement in motor activities during childhood fall under three main categories (Colella, Bellantonio, D'Arando, & Monacis, 2020): (i) broadening opportunities for children to be physically active (e.g., engaging in activities before or after school, during breaks); (ii) expanding current chances for physical activity (e.g., increasing time dedicated to physical education, introducing more sports sessions); and (iii) improving existing motor activity opportunities within the curriculum by extending periods of physical engagement, enhancing available equipment, offering a variety of sports options, and identifying suitable spaces for activities. Physical activities in schools can be integrated into regular lessons, breaks, and recess. By combining traditional teaching methods with active strategies, subjects like mathematics, geography, and foreign languages can be taught through experiential activities followed by theoretical concepts (Vazou et al., 2020).

A promising approach in this context is the implementation of Active Breaks, which have been identified as a key method to improve children's physical and cognitive skills during their early education years. Furthermore, research has shown that Active Breaks significantly enhance social skills in young children and cater to diverse learning styles, thus promoting an enjoyable learning experience (Mullins et al., 2019).

They involve engaging in physical activities during regular school hours, interspersing prolonged periods of inactivity with short bursts of physical activity that can also enhance academic performance. According to a recent analysis by Watson, Timperio, Brown, & Hesketh (Watson, Timperio, Brown, & Hesketh, 2018), the various ways in which these activities are currently suggested, in terms of timing, goals, and organizational approaches, include the following:

- Active breaks taken between consecutive lessons;
- Incorporation of active breaks within lessons;
- Integration of physical activity into different academic subjects (e.g. geography, mathematics, history) to create physically active lessons.

Numerous studies have demonstrated that brief active breaks are effective in boosting physical activity levels, enjoyment, and motivation to learn (Rasberry et al., 2011). Nevertheless, obstacles such as teacher demands, a crowded school curriculum, emphasis on standardized tests, and institutional constraints pose significant challenges to implementing such interventions in schools (Watson et al., 2018). Thus, active break periods are deemed crucial from an educational perspective, offering substantial pedagogical

value by providing opportunities to develop various skills essential for a child's development, including collaboration, interpersonal relationships, adherence to rules, conflict resolution, and independence (Turner, & Chaloupka, 2016).

In a synthesized manner, active breaks (ABs) can be defined as brief intervals characterized by engaging in physical activity by educators during regular disciplinary tasks within the classroom setting throughout academic lessons (Mullins et al., 2019). Initially introduced to boost daily physical activity levels amidst the predominantly sedentary childhood population of today, ABs have proven to enhance the mental and physical wellness of children, as well as positively impact classroom ambiance and teacher well-being. Their implementation appears to enhance school life quality, including social conduct, focus, concentration, and engagement in activities (Kidokoro, Shimizu, Edamoto, & Annear, 2019). Active breaks provide teachers with the opportunity to schedule breaks based on various factors and circumstances, making them highly adaptable and adjustable to the school environment and specific classroom dynamics (Egger, Benzing, Conzelmann, & Schmidt, 2019). The duration of these breaks can vary from 3 to 15/20 minutes, and their execution, predominantly within the classroom vicinity, has extended to outdoor spaces like the schoolyard, where some educators find it safer and more conducive for conducting planned activities.

Ultimately, ABs can serve as an effective and sustainable solution to address two primary needs: a) as a public health initiative aimed at promoting increased physical activity among children and reducing sedentary behavior (Schmidt, Benzing, & Kamer, 2016); b) as an innovative educational strategy that fosters a sense of mental and physical well-being throughout the school day for both students and teachers, while enhancing behavior, focus, and participation in various academic tasks (Poitras et al., 2016).

The instance of pause is orchestrated and overseen by established norms resulting from discourse and mediation between educators and students, acquainting with the regulations and initial social structures. The classroom, in a comprehensive manner, undergoes a transformation into an atmosphere where not only elements linked to disciplinary knowledge and skills are tended to, but also broader and more decisive facets for the individual's life, who is essentially positioned at the core of the educational process alongside authentic needs and demands. It is implicit that these actions do not supplant Physical Education but function as a sensorimotor prompt that eases involvement in school life by reviving the individual, frequently rendered inert at their desk, seated on the chair in passive and incorrect bodily postures. Besides the direct impact on health, which certainly cannot be entirely addressed with active breaks, the most notable aspects of this approach are rooted in the mental readiness towards physical activity overall and in the enhancement of conduct. Some research has indicated that cognitively and academically engaging active breaks, intertwined with references to disciplinary

knowledge explored in the curriculum (mathematical, linguistic, etc.), yield the most favorable outcomes on children's cognitive abilities and learning (Mavilidi et al., 2020).

Active breaks, alongside other suggestions for sensorimotor activities, should be encompassed within children's educational experience and assimilated into the pedagogical framework characterizing teaching-learning endeavors, emerging as crucial and efficient elements for the optimal advancement of each individual. Consequently, it is not about locating additional space and time, but merely about shaping a scholastic routine that acknowledges the educational intricacy of every person, encompassing not only aspects related to individual subject teachings. Within this educational intricacy, ABs must secure a fitting position as a complement to teaching methodologies aimed at enhancing the learning milieu and fostering motivation towards educational pathways (Jiménez-Parra et al., 2022; Lander et al., 2024).

Within the context of this discourse, the objective is to present a structure on the impacts of active breaks in primary school concerning: (i) levels of physical activity and combatting overweight/obesity; (ii) academic achievement; (iii) associated psychological elements, accentuating strengths and weaknesses in connection to their reasoned proposition.

The impacts of engaging in active breaks and participating in physically active classes

Physical activity levels and reduction of overweight/obesity status

The recognition of obesity as a crucial public health concern, and thus the importance of closely observing the nutritional status of the overall populace, particularly children, constitutes a key goal of the school health services (Murtagh, & Martin, 2016).

The most recent research in the field cautions about the rise of unhealthy lifestyles and the prevalence of physical inactivity, which are continuing to increase. It has been observed that the percentage of overweight teenagers has more than tripled over the past two decades. Based on the existing data, regrettably, contemporary youth tend to dedicate a majority of their leisure time to sedentary pursuits, such as watching television and engaging in computer gaming. A sedentary way of life and insufficient physical exercise represent detrimental habits that emerge early in life, persist during adolescence, and are frequently coupled with other risky behaviors, potentially leading to health issues and chronic conditions in adulthood. It is evident that there is a pressing necessity to place greater emphasis on enhancing both the quantitative and qualitative aspects of physical activity opportunities. This is particularly important given that the prevalence of obesity seems to be more closely linked to a lack of physical movement rather than simply an increase in caloric intake (Guthold, Stevens, Riley, Bull, 2019). In this context, prevention, contrary to the conven-

tional negative implication of the biomedical framework focused on investigating disease causes (pathogenesis), aims to enhance the foundation of early years, and cater to those most vulnerable or safeguard children from engaging in risky behaviors. Promotion and prevention are integral components of the salutogenic concept, which essentially involves the exploration of health origins. Within the salutogenic framework, health promotion and prevention activities seek to foster empowerment, defined as enabling "individuals, families, and communities to assert control over their lives and surroundings, thus assuming an active role in relation to their environment and existence" (Rapaport, 1981).

The advantages of engaging in physical exercise for health, particularly in relation to addressing overweight and obesity, have been extensively documented over time. Indeed, especially in the last decade we have witnessed a radical change in eating habits and risky behaviors (sedentary lifestyle, unhealthy lifestyles, use of technology), as well as the promotion of interventions and strategies aimed at urging individuals to practice physical activity. Despite the recommendation from WHO guidelines for children aged 5 to 17 to engage in at least 1 hour of physical activity daily, a significant proportion, approximately 80%, of children and adolescents continue to display physical inactivity (Silva, 2022).

The educational institution serves as an optimal setting for conducting surveillance due to its operational efficiency and the concentration of children in one place, as well as its practicality for implementing necessary interventions. Consequently, there is a pressing need to prioritize the promotion of physical activity and the mitigation of the prevalent sedentary lifestyle within the 6-14 age bracket, with schools emerging as a highly suitable environment for numerous reasons. Schools are where children spend a substantial amount of time starting from a young age, they foster inclusivity, and they overcome various barriers (such as limited resources, availability, and costs) that often hinder participation in extracurricular physical activities. Additionally, schools offer numerous opportunities throughout the day and week, beginning with physical education classes (Mora-Gonzalez et al., 2019).

Active Breaks are an evidence-based strategy aimed at enhancing physical activity levels and reducing sedentary behavior among students during the school day, a practice that is implemented in the majority of Italian schools starting from the primary level. Active Breaks are advocated in the American Community Guide. Two systematic reviews (Masini et al., 2020; Norris, van Steen, Direito, & Stamatakis, 2020), focused on primary school students, examine the impact of breaks and active lessons on factors such as intervention timing and school day structure: an increase in moderate to vigorous physical activity during school hours, a rise in step count throughout the school day, and the adoption of health-promoting behaviors. The research conducted by Bobe, Perera, Frey, and Frey (2014) not only

emphasizes the effectiveness of these approaches in enhancing physical activity levels among primary school children but also underscores the positive reception and utilization of such strategies by teachers, leading to a sustained implementation of interventions.

Cognitive Functioning Improvement

Within a broader analytical framework concerning the correlation between school medicine and physical activity, our investigation delves into the impact of movement on cognitive and learning development. The conventional interpretation of physical activity merely as a means to enhance health appears overly simplistic, as a substantial body of literature indicates its positive effects on cognitive functions, attention, concentration, memory, and indirectly on academic performance, as well as the overall well-being of children and teachers (Luke, Vail, & Ayres, 2014).

The knowledge derived from neuroscience research data suggests that physical activity holds the potential to stimulate optimal brain function, thereby facilitating neuronal proliferation and the reinforcement of neural connections. Recent research findings have enhanced our understanding of the influence of physical activity on brain structure and associated neurobiological alterations, underscoring its impact on neuronal plasticity (Domingos, Pêgo, & Santos, 2021; Chaddock, Pontifex, Hillman, & Kramer, 2011; Gunnell et al., 2019). The fundamental concept of plasticity is essential for comprehending how physical activity can enhance brain function by improving learning quality (Pontifex et al., 2013). Neuroplasticity represents an ongoing process that continuously modifies existing neuronal networks through structural and functional changes in synapses in response to behavioral adjustments (Erickson, Gildengers, & Butters, 2013).

Physical activity, particularly ABs, may elicit the production of Brain Neurotrophic Factor (BDNF), which promotes the proliferation of fresh brain cells. This serves as a fundamental biological connection between physical activity, education, and scholastic achievement. Moreover, elevated levels of physical activity appear to induce brain modifications resulting from enhanced oxygen supply and tissue irrigation, along with escalated metabolic functions, fostering enhanced neurodevelopment. It is postulated that engaging in a regular physical activity regimen triggers significant alterations in neurogenesis and angiogenesis, subsequently enhancing the metabolism of the central nervous system. The process of neurogenesis predominantly occurs in the hippocampus, a region specialized in spatial learning and the consolidation of both short- and long-term memory (Latino, & Tafuri, 2024).

While a few studies have indicated minor adverse relationships, most scientific investigations have now extensively proven how the impacts of physical activity on the brain can yield favorable results on academic performance.

Employing movement within educational settings as a pedagogical approach is a valuable tactic for enriching the learning process and affording all students the chance to advance cognitively, socially, and physically. The objectives

encompass: (i) priming the brain; (ii) incorporating brain breaks; (iii) fostering class unity; (iv) revisiting course material; (v) delivering instructional content.

Indeed, multiple investigations have demonstrated that brief intervals of active breaks can effectively enhance levels of attention, focus, and enjoyment while reducing disruptive behavior in educational settings. These breaks can also place students in the optimal state for learning and enhancing their academic achievements. When comparing the progress in standardized test scores, students participating in active sessions outperformed their inactive counterparts by 6%. Donnelly et al. (Donnelly et al., 2016) contend in their literature review that regular engagement in physical activity, along with incorporating short breaks during lessons, which aim to promote motor skills practice, can positively impact children's cognitive functions. Some researchers have even highlighted a positive relationship between physical activity before a lesson and subsequent classroom behavior, particularly in terms of attention, focus, and memory improvement.

Furthermore, after assessing various studies on the duration of physical activity in schools, it was established that individual physical education classes may enhance student attention but do not necessarily boost executive functions or academic performance. Conversely, integrating physical activities across different subjects can better stimulate executive functions and academic achievements compared to standalone lessons, especially when the programs involve aerobic activities with cognitive challenges (de Greeff et al., 2018).

Hence, implementing ABs throughout the school day proves to be a beneficial approach in enhancing behavior during subsequent academic tasks, fostering student engagement, maintaining focus on learning objectives, and establishing a motivational environment centered on competence.

Blom Skrade (2013) conducted an analysis on the correlation between the duration of physical education and academic performance in adolescents by incorporating a physical activity initiative named Move for Thought (M4T) into the school mathematics curriculum. The research revealed that integrating physical activity during other academic lessons within the classroom enhanced mathematical learning. The researcher inferred that this program empowered students to enhance their drive towards attaining academic excellence, as the perceived competency positively influenced mathematical achievement, making a distinctive and favorable contribution to the subject. Similarly, Resaland et al. (2016) explored the impacts of a 90-minute physical education regimen, accompanied by a 5-minute active break during school recess and 10 minutes of physical activity at home. The outcomes of the study prompted the researchers to theorize about a heightened learning stimulation.

Hence, the adherence to well-structured physical activity schemes during the school day, alongside various opportunities for an active lifestyle during leisure time, emerges as the paramount approach for fostering the physical and

cognitive well-being of children.

Emotional and social factors

A growing body of research indicate that individuals who maintain a more active lifestyle exhibit distinct developments in psycho-affective factors, enhanced problem-solving abilities, increased emotional stability, improved creativity, and heightened levels of attention and concentration. The impacts on enhancing behavioral, cognitive, and psychological aspects are in alignment with the findings of international literature. A recent literature review suggests that engaging in regular physical activity, taking short breaks, and participating in educational programs focused on motor practice can have a positive impact on children's cognitive functions (Latino, Tafuri, Saraiello, & Tafuri, 2023.). Some research has demonstrated a positive correlation between physical activity before classes (e.g., during breaks) and classroom behavior in subsequent lessons (Trudeau, & Shephard, 2008). Additionally, one study noted a slight to moderate enhancement in focused attention after introducing active breaks for elementary school students. Implementing short-term educational interventions could also offer opportunities for group-class engagement, promoting enjoyment, intrinsic motivation, and personal achievements. These experiences aim to foster peer relationships, aiding in the development of social skills that may not be acquired in a more formal educational setting. As a result, the classroom environment or other school spaces can become enjoyable and emotionally stimulating areas, where traditional theoretical instruction is interrupted to incorporate bodily-motor experiences. These experiences play a role in giving purpose and guidance to all educational endeavors within the curriculum (Latino, Saraiello, & Tafuri, 2023; Mazzeo et al., 2016).

Physical activity, indeed, encompasses more than just motor skills objectives, extending to broader implications. Engaging in physical movement fosters self-awareness, allowing individuals to explore their physical capabilities and constraints, thus nurturing self-regulation towards themselves and others. The incorporation of physical activity within educational settings, outdoor play, and utilization of equipment promotes the establishment of positive habits related to nutrition (Cataldi et al., 2019; Latino, & Tafuri, 2023), personal hygiene, and overall health education (Tafuri, & Latino, 2024). Moreover, within the educational journey, physical activity within school premises prompts contemplation on bodily transformations, often through comparison with peers. This engenders experiences that encompass cognitive, social, cultural, and emotional dimensions. The body evolves into a progressively proficient instrument for communication and interpersonal connections. Encountering triumphs and setbacks facilitates emotional regulation, resilience, and self-assessment. Physical activities and collaborative efforts frequently facilitate the expression of discomfort and messages that may be challenging to articulate verbally, aiding educators in identify-

ing behavioral or relational issues and tailoring interventions accordingly. Collaboration and teamwork are instilled through physical endeavors, fostering values such as self-esteem, respect for adversaries, integrity, belongingness, and accountability (Farì et al., 2021; 2023).

This methodology enables a shift from didactic teaching methods to those emphasizing active student engagement. Integrating physical activities in the academic setting empowers learners to grasp concepts like engagement, cooperation, independence, and accountability during group interactions. Group learning plays a pivotal role in skill acquisition, as it serves as a platform for numerous social exchanges, offering opportunities for members to learn, share, and encounter situations fundamental to team-based activities and games (Aidar et al., 2022; Latino et al., 2021; La Torre, 2023).

Physical activity within the educational setting offers opportunities for well-being, motor recovery, personal autonomy, and gratification, serving as a tangible educational instrument. The significance of promoting a re-elaboration process of physical activity is particularly crucial for individuals with disabilities, who increasingly seek avenues for self-expression through bodily movements. These initiatives, conducted in school environments, enable individuals with disabilities to transcend the confines of recovery and socio-educational settings where interventions and sports activities are primarily tailored for them. An essential element here is the motivational impetus stemming from the motor aspect (Morsanuto et al., 2023; Muscogiuri et al., 2016; Rocca et al., 2016). The incorporation of physical activity in classroom settings for disabled students provides a platform to showcase their capabilities, albeit limited, and how these abilities relate to their environment, where their shortcomings are often highlighted. The enhanced autonomy of disabled students in terms of physical activities not only impacts their learning but also influences their emotional well-being, fostering self-esteem. Consequently, physical activity, besides enhancing cognitive functions, emerges as a catalyst for empowerment and personal development. Nurturing spontaneous motor skills and emphasizing motor education are indispensable for the holistic development of children with disabilities, serving as a constant support for their engagement in active pursuits through their formative years. Physical activity is, indeed, a significant element in the process of social integration, playing a unique role in facilitating connections between teachers, families, and the disabled child. Engaging in physical activity within the school environment or incorporating active breaks can serve as a means for personal and collective development. When educators effectively encourage active participation among all students by fostering a supportive classroom atmosphere, where relationships promote the well-being of children, disabilities may not be viewed as a barrier by the disabled child or their peers. Furthermore, disabilities should not hinder the execution of educational activities (Guerra et al., 2014; Sagun-Ongtango, Medallón, & Tan, 2021; Lieberman, Houston-Wilson, &

Grenier, 2024).

Conclusions

The educational environment plays a crucial role in the developmental stage, being essential for carrying out initiatives that enhance mental and physical well-being, education, social connections, and the adoption of proper lifestyles, utilizing a comprehensive and systemic method facilitating the promotion of health in its widest scope.

The promotion of health within educational institutions emerged and progressed through a robust partnership between the educational sector and healthcare services, with the assistance of families. Health promotion within schools involves not only the health education provided in classes but also all endeavors directed towards establishing an environment, educational policies, and a syllabus designed to facilitate the availability of healthy choices. A health-promoting school transcends mere health-related activities to embrace a holistic approach to health promotion, being recognized as the primary institution capable of significantly contributing to the enhancement of well-being, lifestyles, and healthy conduct among young individuals. Given that children devote a substantial portion of their time at school, proper guidance can equip them with the knowledge, abilities, and expertise required to opt for healthy lifestyles. A school that not only shapes the curricula but also aligns the entire school community's structure towards fostering healthy and active lifestyles provides a conducive setting for students to cultivate the knowledge, skills, and routines essential for leading a healthy and active life, even into adulthood.

In this framework, the principal aim is to augment the population of individuals who, by embracing an active and healthy lifestyle, by relishing physical activity and engaging in sports, unlock their potential across all domains (physical, cognitive, artistic, emotional, social) within the overarching context of active and engaged citizenship.

In this context, ABS find practical space due to their validity and their inclusion in the school day. Their practical repercussions are directly reflected on the possibility of creating a positive classroom climate, more serene and constructive, with reference to the psycho-physical well-being of all and in relation to both the work of students and the teaching work of teachers, more profitable and effective. In detail, the salient aspects attributable to ABs are not only imputable to better cognitive behavior (attention, concentration, memory) and social behavior (reduction of conflicts, emotional control, collaboration) but also to the quality of educational action. Finally, and no less important for the sustainability of projects, teachers increasingly recognize the applicability of ABs in relation to their feasibility, simplicity of management and organization, so much so that they express the desire to live this experience. The evidence above explains the speed with which ABs projects are spreading, especially in primary schools. Nevertheless, the positive and encouraging diffusion of ABs requires long-term verification to understand whether

they will really represent a turning point for the conception of a different, innovative, more dynamic and engaging school. Further studies will have to follow one another to consolidate the evidence that has emerged in these years of research and support, improving and refining, the methodological guidelines referring to the application of active intervals to school curricular teaching. The problem is strongly felt in the school environment, so much so that more and more schools are opening to the use of ABs as an integrative device of school teaching. Consequently, it becomes the responsibility of educational institutions to prioritize physical education within the academic schedule, aiming to facilitate learning for all students and cultivating motivation to empower them in attaining higher academic accomplishments.

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Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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