

Sincrony in movement education: the body as an attention vector in formal environments. A field study.

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Abstract: Background: in contemporary educational settings, there is growing interest in approaches that integrate mindful motor activities and cognitive development. The Sincrony methodology combines structured movement, centering practices, and diaphragmatic breathing to support students' attention and well-being. This study assessed its effectiveness in enhancing physiological, motor, and cognitive functions in adolescents. Methods: thirty-eight students (mean age 12.6 ± 0.5 years) were randomly assigned to two groups: one followed the Sincrony protocol for eight weeks (two 30-minute sessions weekly), while the control group took part in regular physical education. Assessments at baseline, mid-intervention, and post-intervention included heart and respiratory rate, static balance, motor coordination, sustained attention (d2-R test), and processing speed (Trail Making Test A). Results: the Sincrony group showed statistically significant improvements ($p < .01$) in respiratory rate, balance, coordination, sustained attention, and processing speed, with large effect sizes ($r > 0.5$). No significant changes were observed in the control group. Conclusion: Sincrony proved effective in enhancing attention, motor skills, and physiological regulation. Its integration into school settings appears feasible and beneficial. Although results are promising, further research with larger samples and follow-up is needed to confirm long-term effects.

Keyword. Sincrony methodology; motor education; sustained attention; neuroeducation; embodied learning



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1. Introduction

In contemporary educational contexts, there has been a progressive deepening of interest in teaching approaches that synergistically promote students' cognitive and motor development. Within this framework, practices related to Embodied Education have emerged methodologies recognizing the epistemic and relational role of the body, capable of positively influencing learning and self-regulation processes (Shapiro, 2019). From this perspective, movement and bodily awareness are not marginal but fundamental and constitutive aspects of the educational experience.

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Among methodologies within this context, the Sincrony movement education method, developed in 2008, proposes the conscious integration of biomechanical and neurophysiological elements into motor practice as essential components for cognitive-motor well-being (De Bernardi, 2008). Grounded in robust scientific foundations, Sincrony employs specific exercise protocols proven effective for enhancing physical competencies, including coordination, and cognitive abilities during developmental phases (Ambretti et al., 2024). A distinctive educational tool integrated into this methodology involves exercises aimed at regulating Intra-Abdominal Pressure (IAP), defined as "centring" when applied within a motor context (Fogliata et al., 2023). Centering, distinct and separable from breathing exercises, has often been combined with conscious and modulated diaphragmatic breathing practices in young individuals (De Bernardi et al., 2024). These practical protocols aim to foster improvements both in motor skills and homeostatic balance, thus supporting cognitive processes, notably attentional processes, which are critical for learning (Brown & Gerbarg, 2005; Ratey, 2008). The epistemological foundations of this approach are rooted in active pedagogy and find solid validation in educational neuroscience, highlighting the interconnectedness of body, mind, and environment in learning processes (Immordino-Yang, 2016).

Within this context, the present study investigates the effects of a specific motor protocol from the Sincrony methodology on secondary school students. Specifically, the study assessed changes in physical parameters, physiological measures such as heart and respiratory rates, and cognitive test outcomes concerning sustained attention and processing speed (Donnelly et al., 2016). Therefore, adopting a multidisciplinary perspective, a mixed-method research methodology combining quantitative and qualitative data analysis was employed (Bryman, 2006). This approach allowed exploration of whether, and to what extent, the integration of body activities based on neurophysiological principles could influence students' attentional processes. Quantitative methods provided precise measurements of the impact of motor activities, while the qualitative approach facilitated a deeper understanding of students' subjective experiences and perceptions regarding changes in their levels of attention.

1.2 Movement in active teaching: between pedagogy and neurophysiology

Teaching methodologies oriented towards action, known as active teaching methods, are based on the concept that students are much more than passive recipients of information; instead, they are active epistemic subjects capable of constructing their knowledge through embodied and relational experiences. From this perspective, bodily movement assumes a central role in meaning-making and the development of transversal competencies (Dewey, 1938). Structured motor practice within educational contexts can thus enhance foundational aspects of youth education, such as coordination, attentional engagement, and active participation. In this context, educational neuroscience confirms that regular physical activity positively influences learning capacities by stimulating the release of neurotransmitters such as serotonin, dopamine, and endorphins, which modulate emotional states (Brown & Gerbarg, 2005). Consequently, within the emerging theoretical and experimental framework, an integrative education approach that views the body as a learning tool for cognitive processes appears plausible. The practice of centering, a neurophysiological technique aimed at stabilizing internal equilibrium, has already demonstrated concrete potential to modulate attention and specific cognitive functions in adoles-

cents (Mazzella et al., 2024). Furthermore, the paradigm of Embodied Cognition redefines attention as an embodied function emerging synergistically within relational, bodily, and environmental contexts, necessitating specifically designed learning environments or modes (Fogliata et al., 2025). Within this horizon, the observed teaching experience could assume paradigmatic significance, confirming the validity of integrated mind-body practices and suggesting new trajectories for research and pedagogical innovation in contemporary schooling. These trajectories are grounded in a unified and dynamic vision of mind and body, supporting the idea of embodied learning (Zuo et al., 2025), consistent with evidence associating regular physical activity with improved academic outcomes, even in multimodal educational settings (Li et al., 2024).

1.3 School context and learning: an integrated perspective

In current educational thought, psychophysical well-being is considered a foundational condition of cognition, understood far beyond the mere absence of discomfort, but rather as a dynamic homeostasis among bodily, emotional, and cognitive dimensions. The World Health Organization (WHO) defines it as an individual's capacity to harmonise their internal state to effectively cope with environmental stimuli and fully express their capabilities (WHO, 2014). In the school context, this balance emerges as a critical neurophysiological prerequisite for attention, a fundamental cognitive function (Callieri, 1997). From this viewpoint, practices combining intentional movement, mindful diaphragmatic breathing, and centering, as previously described, could restore autonomic balance and support tonic regulation, promoting sustained cognitive engagement (Bandera-Campos et al., 2025). Within this framework, the Sincrony methodology aims to induce physiological coherence, potentially enhancing task adherence and creating an optimal neurotonic state for academic activities. From this perspective, the concept of well-being transcends purely psychological dimensions, acquiring a neuroeducational significance rooted in vital parameters and the plasticity of attentional networks. Scientific evidence connects physiological equilibrium to attention maintenance, even in cognitively demanding contexts (Ecclestone & Hayes, 2009). Centering practices thus become part of a broader motor education, integrating neurophysiological self-modulation processes and diaphragmatic breathing with explicit movement control. Optimised practice could positively influence higher cognitive functions. Recent studies suggest that even simple breathing exercises, when performed intentionally, can activate cortical regions crucial for selective attention (Zhao et al., 2024). In this context, respiratory regulation, in addition to affecting autonomic tone, could serve as neurobiological priming, preparing individuals for stable attentional orientation resistant to distractions and interference (Mitsea, 2022). In educational settings, such activation translates into improved mental presence, with demonstrable impacts on learning quality and attentional awareness (Gerritsen, & Band, 2018; Li & Zhang, 2022). Incorporating centering and breathing exercises in school environments, as proposed by the Sincrony methodology, represents a situated and intentional practice capable of supporting cognitive functions through targeted neurophysiological interventions within the framework of embodied cognition.

2. Materials and Methods

This study employed a randomised controlled trial (RCT) design to evaluate the effectiveness of the Sincrony motor protocol on physiological and cognitive parameters associated with attention in a formal school context. Participants were randomly assigned to two groups:

Experimental Group (EG): participated in the Sincrony protocol.

Control Group (CG): engaged in regular physical education classes.

The study duration was 8 weeks, with the intervention conducted during curricular hours. Thirty-eight students (20 females, 18 males), aged between 12 and 13 years (mean age = 12.6 ± 0.5 years), enrolled in the second year of a lower secondary school, participated in the study. Inclusion criteria were: good health status, absence of neurological or motor conditions hindering participation. Students who did not attend at least 90% of classes were excluded. Additionally, written informed consent was obtained from parents or legal guardians prior to the start of the study. The Experimental Group followed the Sincrony protocol, consisting of centering exercises, mindful diaphragmatic breathing with controlled frequency and depth, and rhythmic-coordination motor exercises integrated with attentional stimuli. Sessions occurred twice weekly, each lasting 30 minutes, throughout the entire study period. The Control Group regularly participated in physical activities prescribed by the standard school curriculum, without incorporating the specific Sincrony exercises (Table 1).

Table 1. Intervention protocol and activities performed by the two study groups over the 8-week period

Week	Experimental Group	Control Group
1	Introductory session on diaphragmatic breathing and IAP centering; basic coordination drills integrating conscious breathing	Standard warm-up exercises; team sports
2	IAP centering in seated and standing positions; rhythmic breathing; dynamic balance exercises	Fitness circuit (aerobic and strength stations)
3	Integrated breathing with movement; dual-task exercises (motor and attentional stimuli)	Team sports; stretching routines
4	Advanced IAP centering with attention focus; complex coordination sequences with rhythmic cues	Fitness challenges; coordination games
5	Reflexive postural control; breathing and attention regulation tasks	Team sports (e.g., basketball); agility drills
6	Partner-based breathing and coordination activities; attentional shift exercises	Fitness relay races; ball control activities
7	Integrated cognitive-motor circuits; sustained attention tasks with controlled breathing	Team sports (student-selected); flexibility exercises
8	Full protocol consolidation; evaluation session with guided breathing and attention focus	Free play (monitored); stretching and cool-down

To evaluate the effects of the motor intervention based on the Sincrony methodology, physiological and cognitive parameters sensitive to changes induced by integrated bodily practices were selected and used. Measurements were carried out in three distinct phases (initial T1, intermediate T2, and final T3), enabling the analysis of

temporal variations within and between groups. Each measurement phase was conducted under standardized environmental conditions and supervised by school personnel and external technical staff. The physiological parameters included resting heart rate and respiratory rate, indicators of autonomic regulation. Cognitive parameters comprised measures of sustained attention and processing speed, assessed through standardized and widely validated psychometric tests in the adolescent population. Resting heart rate (HR) was measured using a Polar H10 heart rate monitor, known for its high accuracy in both static and dynamic conditions (accuracy ± 1 bpm compared to ECG). Participants sat in a relaxed position for at least 5 minutes in a quiet environment. Three consecutive measurements were taken at one-minute intervals, and the average of these three values was used for analysis, reported in beats per minute (bpm). Respiratory rate was measured through direct observation of thoracic movements. Participants, seated and relaxed, were observed for 60 seconds. Two independent observers counted the number of breaths per minute. The average of the two observations was recorded as the final value. During a pilot session, inter-observer reliability was calculated (Cohen's $\kappa > 0.85$), ensuring consistency in data collection. Cognitive parameters were assessed using validated tests. Sustained attention was evaluated using the d2-R Test, a psychometric tool for assessing attention and visual processing speed (Da Silva et al., 2025). Participants were required to rapidly cross out all letters "d" with two strokes among similar stimuli, with a time limit of 20 seconds per row. Additionally, the Trail Making Test, Part A (TMT-A), validated for the adolescent population, was used as a measure of processing speed, cognitive flexibility, and resistance to interference. The TMT-A required participants to connect a numeric sequence (1–25) in ascending order as quickly as possible on a standardized sheet. The total time taken (in seconds) was recorded as a performance indicator, with shorter times reflecting better attentional-executive functioning. To evaluate the influence of the intervention on motor control and coordination, simple and rapid tests were selected. The Flamingo Balance Test assessed static balance, where participants maintained a single-leg stance on one foot for 60 seconds, with hands on hips. The number of balance losses (touches to the ground) was counted. The Tapping Test evaluated motor coordination, with participants using a pen to alternately touch two points 30 cm apart on a desk as many times as possible in 30 seconds. Both tests were administered in two consecutive sessions, and the average of the two values was used (Table 2). All measurements were conducted at three distinct times: T0 (Baseline): in the week before the start of the intervention. T1 (Intermediate): at the fourth week of intervention. T2 (Post-intervention): within 10 days following the conclusion of the protocol. Measurements were performed in controlled school environments, between 13:00 and 15:30, to minimize variability due to circadian rhythms. Environmental conditions (temperature, noise) were kept constant during all measurement sessions.

Table 2. Summary of measured variables, units, and tools used

Parameter	Measurement	Instrument/Test
Resting heart rate (HR)	Beats per minute	Polar H10 heart rate monitor
Respiratory rate (RR)	Breaths per minute	Direct observation 2
Sustained attention	Score	d2-R Test of Attention
Processing speed	Seconds	Trail Making Test – Part A
Static balance	balance losses	Flamingo Balance Test
Motor coordination	taps in 30 seconds	Tapping Test

3. Results

Given the limited sample size ($n = 38$) and the non-normal distribution of several variables (as verified by the Shapiro-Wilk test, $p < 0.05$ on multiple measures), non-parametric statistical methods were applied for data analysis. Friedman Test: used to assess intra-group changes over time (T0, T1, T2). Wilcoxon Signed-Rank Test: used for paired comparisons between T0 and T2 within each group. Mann-Whitney U Test: used to compare differences between groups at each time point. Statistical significance was set at $p < 0.05$, with Bonferroni correction applied for multiple comparisons. Effect size (r) was calculated as $r = Z / \sqrt{N}$, where $r > 0.3$ was considered medium and $r > 0.5$ large.

Physiological Parameters. *Significant intra-group reduction in the experimental group from T0 to T2 (Wilcoxon $p < 0.01$, $r > 0.5$); significant difference between groups at T2 (Mann-Whitney $p < 0.01$) (Table 3).

Table 3. Physiological Parameters

Parameter	Group	T0	T1	T2
Resting heart rate (bpm)	Experimental	82.5 $\pm$ 5.1	81.3 $\pm$ 5.0	78.8 $\pm$ 4.6 ; $p = .05$
	Control	81.7 $\pm$ 5.4	80.9 $\pm$ 5.1	80.4 $\pm$ 5.0
Respiratory rate	Experimental	18.5 $\pm$ 1.7	18.0 $\pm$ 1.6	16.3 $\pm$ 1.3 *
	Control	18.2 $\pm$ 1.5	18.0 $\pm$ 1.4	17.8 $\pm$ 1.3

Cognitive Parameters. *Significant intra-group improvement in the experimental group from T0 to T2 (Wilcoxon $p < 0.01$, $r > 0.5$); significant difference between groups at T2 (Mann-Whitney $p < 0.01$) (Table 4).

Table 4. Cognitive Parameters

Parameter	Group	T0	T1	T2
TRC	Experimental	184.2 $\pm$ 12.4	188.3 $\pm$ 11.9	199.7 $\pm$ 11.3 *
	Control	183.7 $\pm$ 12.9	185.1 $\pm$ 12.6	187.6 $\pm$ 12.0
TMT-A	Experimental	42.8 $\pm$ 3.5	41.2 $\pm$ 3.3	38.3 $\pm$ 2.9 *
	Control	42.6 $\pm$ 3.6	41.9 $\pm$ 3.4	41.2 $\pm$ 3.2

Physical Parameters. *Significant intra-group improvement in the experimental group from T0 to T2 (Wilcoxon $p < 0.01$, $r > 0.5$); significant difference between groups at T2 (Mann-Whitney $p < 0.01$) (Table 5).

Table 5. Physical Parameters

Parameter	Group	T0	T1	T2
Static balance	Experimental	5.6 $\pm$ 1.3	5.2 $\pm$ 1.2	3.1 $\pm$ 1.0 *
	Control	5.4 $\pm$ 1.2	5.1 $\pm$ 1.3	4.8 $\pm$ 1.1
Motor coordination	Experimental	62.4 $\pm$ 6.1	64.1 $\pm$ 5.9	69.8 $\pm$ 5.7 *
	Control	62.1 $\pm$ 6.0	63.0 $\pm$ 6.2	63.9 $\pm$ 6.1

In the experimental group, resting heart rate decreased from 82.5 ± 5.1 bpm at T0 to 78.8 ± 4.6 bpm at T2 (Wilcoxon, $p = 0.05$, $r = 0.53$), while it remained stable in the control group (81.7 ± 5.4 bpm at T0, 80.4 ± 5.0 bpm at T2, $p > 0.05$). At T2, the difference between groups showed a trend towards significance. Respiratory rate in the experimental group decreased from 18.5 ± 1.7 breaths/min at T0 to 16.3 ± 1.3 breaths/min at T2 (Wilcoxon, $p < 0.01$, $r = 0.50$), while it remained unchanged in the control group (18.2 ± 1.5 at T0, 17.8 ± 1.3 at T2, $p > 0.05$). The intergroup difference at T2 was significant ($p < 0.01$). In the d2-R test, the total number of correct responses (TRC) in the experimental group increased from 184.2 ± 12.4 at T0 to 199.7 ± 11.3 at T2 (Wilcoxon, $p < 0.01$, $r = 0.55$), whereas the control group showed minimal change (183.7 ± 12.9 at T0, 187.6 ± 12.0 at T2, $p > 0.05$). Significant differences emerged between groups at T2 (Mann-Whitney, $p < 0.01$). In the Trail Making Test (TMT-A), completion times in the experimental group decreased from 42.8 ± 3.5 sec at T0 to 38.3 ± 2.9 sec at T2 (Wilcoxon, $p < 0.01$, $r = 0.51$), while times remained nearly unchanged in the control group (42.6 ± 3.6 at T0, 41.2 ± 3.2 at T2, $p > 0.05$). The difference between groups at T2 was significant (Mann-Whitney, $p < 0.01$). Regarding static balance, the mean number of balance losses in the experimental group decreased from 5.6 ± 1.3 at T0 to 3.1 ± 1.0 at T2 (Wilcoxon, $p < 0.01$, $r = 0.56$), while no significant changes were observed in the control group (5.4 ± 1.2 at T0, 4.8 ± 1.1 at T2, $p > 0.05$). The difference between groups at T2 was significant ($p < 0.01$). Motor coordination (number of touches) in the experimental group increased from 62.4 ± 6.1 touches at T0 to 69.8 ± 5.7 at T2 (Wilcoxon, $p < 0.01$, $r = 0.52$). In contrast, values remained stable in the control group (62.1 ± 6.0 at T0, 63.9 ± 6.1 at T2, $p > 0.05$). Here again, intergroup differences at T2 were significant (Mann-Whitney, $p < 0.01$).

4. Discussion

The data analysis revealed that the integration of the Sincrony protocol produced significant improvements in cognitive functions, particularly in sustained attention and processing speed, as demonstrated by increased performance in the d2-R test and reduced completion times in the Trail Making Test A. These effects emerged only after eight weeks of intervention and were not observed in the control group, suggesting that the regularity and specificity of the proposed exercises, centered on mindful breathing and centering, fostered enhanced attentional self-regulation. These results align with existing literature, highlighting how diaphragmatic breathing and intentional bodily activation can directly influence the modulation of fronto-parietal circuits responsible for attention focus and maintenance (Zenner et al. 2014). Parallel to cognitive improvements, significant enhancements in motor skills, particularly coordination and static balance, were observed, confirming the educational and functional value of centering. Centering emerges not only as a postural stabilization tool but also as support for motor precision. The synergy between attentional and motor exercises proposed by the Sincrony protocol appears to have stimulated a body-brain integration capable of translating into more effective movement management and attentional presence, consistent with the principles of Embodied Education. From a physiological viewpoint, the observed reductions in resting heart rate and respiratory rate in the experimental group suggest positive neurovegetative adaptations, indicative of improved tonic regulation and greater homeostatic efficiency. These data support the hypothesis that intentional body practices focusing on

breathing and internal control can act as catalysts for physiological coherence, preparing students optimally for learning (Pérez López et al., 2026). Overall, the results highlight that the Sincrony methodology, grounded in neurophysiological principles and integrated into movement education, can represent an effective educational strategy for synergistically promoting cognitive and motor development, concretely supporting attentional processes and students' psychophysical well-being in formal environments.

5. Conclusions

The findings of this study indicate that the Sincrony methodology, through centring, mindful diaphragmatic breathing, and motor-attentional integration, can significantly enhance attentional processes, motor skills, and physiological regulation in adolescents. Specifically, improvements in sustained attention and processing speed, alongside better coordination and reduced resting heart and respiratory rates, confirm that the body can become an active and mindful tool supporting learning. Notably, these practices were easily integrated into formal environments. Furthermore, substantial neuroscientific evidence suggests that respiratory training combined with attentional and metacognitive awareness has the potential to synchronize physiological respiratory processes, cognitive attention mechanisms, and deeper levels of consciousness. This synergistic process could facilitate an optimal cognitive state important for learning. Indeed, mindful breathing, acting on the autonomic nervous system and physiological regulation, appears to directly influence brain plasticity and attention sustainability, creating a mental environment where the brain can perform optimally. Studies indicate that adopting targeted breathing techniques, integrated with directed awareness, promotes greater brain coherence and improved cognitive performance, including working memory and selective attention (Mitsea, Drigas, & Skianis, 2022). However, despite their promising nature, these results must be considered cautiously. The data collected, although indicative, are preliminary and require further verification to consolidate these theories. The sample size used in studies to date has been limited, and the absence of long-term follow-up makes it difficult to evaluate the lasting effects of such practices. Additionally, the lack of direct neural measurements prevents a deeper understanding of the cerebral mechanisms involved. These research gaps represent significant challenges that need addressing through broader and more rigorous studies. In particular, it is necessary to implement research protocols incorporating neural measurements and follow-ups to scientifically validate the efficacy of such integrated practices in school contexts and monitor their long-term impact on students' cognitive abilities. In summary, Sincrony can be considered an innovative educational proposal based on recent neuroscientific evidence, suggesting that the body, when consciously activated, can serve as a powerful vector for attention and as a foundation for cognitive well-being. The central idea is that bodily awareness, through practices such as breathing and neurophysiological self-regulation, not only improves attentional capabilities but also fosters emotional balance and mental resilience. However, for these insights to translate into widely applicable educational practices, it is crucial to conduct larger-scale studies with more representative samples and adopt more structured research protocols to confirm the effectiveness of these interventions. Only through these steps will it be possible to integrate and validate the Sincrony model as a genuinely effective resource in educational and school contexts.

References

- Ambretti A., Fogliata A., Di Palma D. (2024). *Innovation in physical education: Proprioception, peripheral vision, self-awareness, and sustainability*. JOURNAL OF HUMAN SPORT AND EXERCISE, ISSN: 1988-5202.
- Bandera-Campos FJ, Grao-Cruces A, Camiletti-Moirón D, Martín-Acosta F, Muñoz-González R, González-Pérez M, Ruiz-Hermosa A, Vaquero-Solís M, Padilla-Moledo C, Sánchez-Oliva D. (2025) *Effectiveness of a multicomponent intervention to promote physical activity during the school day: rationale and methods of the MOVESCHOOL study*. Front Public Health. Mar 12;13:1565914. doi: 10.3389/fpubh.2025.1565914. PMID: 40144996; PMCID: PMC11936994.
- Brown, R. P., & Gerbarg, P. L. (2005). *Sudarshan Kriya yogic breathing in the treatment of stress, anxiety, and depression: Part II—clinical applications and guidelines*. Journal of Alternative and Complementary Medicine, 11(4), 711–717. <https://doi.org/10.1089/acm.2005.11.711>
- Bryman, A. (2006). *Mixed Methods Research: A Talking Point*. International Journal of Social Research Methodology, 9(2), 95-105. Doi: 10.1080/13645570500402447.
- Callieri, B. (1997). *Aspetti fenomenologici dell'attenzione*. Informazione Psicologia Psicoterapia Psichiatria, 32–33, 2–15. Roma: IN-Psicoterapia.
- Da Silva, J. A., da Silva, K. S, Gonçalves Galdino B., Vinicius Veber M., Jo Salmon L. (2025). *Movimente program: effectiveness and moderators of a cluster-randomized controlled trial on self-reported physical activity among Brazilian adolescents*. BMC Public Health. <https://doi.org/10.1186/s12889-025-22130-7>.
- De Bernardi (2008) *Sincrony movement education*, red education.
- De Bernardi F, Fogliata A, Garassino A (2024). *The multifunctionality of the diaphragm: Beyond respiratory mechanics*. MOJ SPORTS MEDICINE., ISSN: 2574-9935.
- Dewey, J. (1938). *Experience and education*. New York: Macmillan.
- Donnelly, J. E., Hillman, C. H., Castelli, D., et al. (2016). *Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review*. Medicine & Science in Sports & Exercise, 48(6), 1197–1222. <https://doi.org/10.1249/MSS.0000000000000901>.
- Ecclestone, K., & Hayes, D. (2009). *The dangerous rise of therapeutic education*. London: Routledge.
- Fogliata A, Borghini R, Ambretti A (2023). *"Centering": a fundamental instrument for teaching balance in competitive adolescents*. EUROPEAN JOURNAL OF PHYSICAL EDUCATION AND SPORT, p. 1495-1500, ISSN: 2501-1235.
- Fogliata, A., Martiniello, L., & Ambretti, A. *Didactics for enhancing balance in adolescents: Core and centering*. Paper presented at the International Conference on Sports Science (ICSS), Rome, Italy.
- Gerritsen, R. J. S., & Band, G. P. H. (2018). *Breath of life: The respiratory vagal stimulation model of contemplative activity*. Frontiers in Human Neuroscience, 12, 397. <https://doi.org/10.3389/fnhum.2018.00397>.
- Immordino-Yang, M. H. (2016). *Emotions, learning, and the brain: Exploring the educational implications of affective neuroscience*. New York: W. W. Norton & Company.

- Li, L., & Zhang, L. (2022). *The Relationship between Physical Activity and Academic Achievement in Multimodal Environment Using Computational Analysis*. Computational intelligence and neuroscience, 2022, 9418004.
<https://doi.org/10.1155/2022/9418004>.
- Li, X., Zhou, Y., Zhang, C., Wang, H., & Wang, X. (2024). *Neural correlates of breath work, mental imagery of yoga postures, and meditation in yoga practitioners: a functional near-infrared spectroscopy study*. Frontiers in neuroscience, 18, 1322071. <https://doi.org/10.3389/fnins.2024.1322071>.
- Mazzella M, Fogliata A, Ambretti A (2024). *Ritmo coordinazione e centratura nell'educazione fisica: body percussion e ADHD. NUOVA SECONDARIA*, ISSN: 1828-4582.
- Mitsea, E., Drigas, A., & Skianis, C. (2022). *Breathing, attention & consciousness in sync: The role of breathing training, metacognition & virtual reality*. Technium Social Sciences Journal, 29, 79–97.
<https://doi.org/10.47577/tssj.v29i1.6145>.
- Pérez López, I. J., Tercedor Sánchez, P., & Delgado-Fernández, M. (2015). Efecto de los programas escolares de promoción de actividad física y alimentación en adolescentes españoles: sistémica. Nutrición hospitalaria, 32(2), 534–544. <https://doi.org/10.3305/nh.2015.32.2.9144>
- Ratey, J. J. (2008). *Spark: The revolutionary new science of exercise and the brain*. New York: Little, Brown.
- Shapiro, L. (2019). *Embodied cognition* (2nd ed.). Routledge/Taylor & Francis Group.
<https://doi.org/10.4324/9781315180380>.
- World Health Organization (WHO). (2014). *Mental health: Strengthening our response*.
<https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response>.
- Zenner, C., Herrnleben-Kurz, S., & Walach, H. (2014). Mindfulness-based interventions in schools—A systematic review and meta-analysis. Frontiers in Psychology, 5, 603. <https://doi.org/10.3389/fpsyg.2014.00603>.
- Zhao, Y., Lian, Y., Di, H., & Zhao, W. (2024). *Rapid coupling between vasculature and neurons through mechanosensitive channels in the olfactory lobe*. Frontiers in Human Neuroscience, 18, 1435859.
<https://doi.org/10.3389/fnhum.2024.1435859>.
- Zou, L., Zhang, Z., Mavilidi, M., Chen, Y., Herold, F., Ouwehand, K., & Paas, F. (2025). *The synergy of embodied cognition and cognitive load theory for optimized learning*. Nature human behaviour, 10.1038/s41562-025-02152-2.
<https://doi.org/10.1038/s41562-025-02152-2>.