

Effectiveness of six weeks of school-based active breaks on cardiorespiratory fitness and working memory index in elementary schoolchildren

TOMÁS REYES-AMIGO^{1*}, JOAQUÍN LAZCANO-NIETO², EDGARDO MENDOZA³, ALBERTO GRAO-CRUCES⁴, DAVID SÁNCHEZ-OLIVA⁵, DANIEL CAMILETTI-MOIRÓN⁶, RAFAEL ZAPATA-LAMANA⁷, JORGE OLIVARES-ARANCIBIA⁸, DANIEL REYES-MOLINA⁹, JUAN HURTADO-ALMONACID¹⁰, JACQUELINE PÁEZ-HERRERA¹¹, GABRIEL SALINAS-GALLARDO¹², FELIPE SEPÚLVEDA-FIGUEROA¹³, RODRIGO YAÑEZ-SEPÚLVEDA¹⁴, JESSICA IBARRA-MORA¹⁵

^{1,2,3,12,13}Observatorio de Ciencias de la Actividad Física (OCAF), Departamento de Ciencias de la Actividad Física, Universidad de Playa Ancha, CHILE

^{4,6}GALENO Grupo de Investigación, Departamento de Educación Física, Facultad de Ciencias de la Educación, Universidad de Cádiz, ESPAÑA

⁵ACAFYDE Grupo de Investigación, Departamento de Didáctica de la Expresión Musical, Plástica y Corporal, Facultad de Ciencias del Deporte, Universidad de Extremadura, Cáceres, ESPAÑA

^{7,9}Escuela de Kinesiología, Facultad de Salud, Universidad Santo Tomás, CHILE

⁸Grupo AFySE, Investigación en Actividad Física y Salud Escolar, Escuela de Pedagogía en Educación Física, Facultad de Educación, Universidad de las Américas, CHILE

^{10,11}Escuela de Educación Física, Pontificia Universidad Católica de Valparaíso, CHILE

¹⁴Universidad Andres Bello, Facultad de Educación y Humanidades, Escuela de Ciencias del Deporte, CHILE

¹⁵Departamento de Educación Física, Universidad Metropolitana de las Ciencias de la Educación, CHILE

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Abstract:

Background: The classroom environment provides an ideal setting for implementing physical activity interventions. **Objective:** To evaluate the effect of a six-week intervention with active breaks on cardiorespiratory fitness (CRF) and working memory index (WMI) in schoolchildren. **Method:** The study involved 61 elementary schoolchildren aged 10–11 years (mean age: 10.48 ± 0.5 years). Participants were randomly allocated to either the experimental group (EG) or the control group (CG). The EG performed six active breaks of four minutes and 30 seconds each during the school day over a period of six weeks. The CG completed their regular school day. CRF was assessed with the Six-Minute Walking Test and WMI through the Wechsler Intelligence Scale for Children. To assess the effects of the intervention, a two-way mixed repeated-measures analysis of variance was performed. Statistical significance was established at $p < 0.05$. **Results:** A significant time $\times$ group interaction was observed for CRF on maximum oxygen consumption (EG pre = 31.0 ± 7.46 ; post = 35.7 ± 7.66 ml·kg⁻¹·min⁻¹ vs CG pre = 33.6 ± 4.96 ; post = 27.9 ± 5.69 ml·kg⁻¹·min⁻¹, $F = 45.86$, $p < 0.001$, ES = 1.1) between the EG and the CG. There were no significant differences in time interaction between groups for WMI (EG pre = 92.2 ± 15.5 ; post = 91.4 ± 17.1 vs CG pre = 89.7 ± 10.2 ; post = 95.0 ± 14.3 , $F = 3.105$, $p < 0.083$). **Conclusion:** This study suggests that six active breaks during a school day for six weeks are effective for improving CRF in schoolchildren. However, the effects of these interventions on working memory require further investigation. **Trial registration:** ClinicalTrials.gov Identifier: NCT05403996.

Keywords: classroom; cognition; physical activity; childhood.

Introduction

Insufficient physical activity during childhood is one of the main challenges in promoting holistic development in childhood and adolescence (Aubert et al., 2018; Hallal et al., 2012). Physical inactivity is a phenomenon characterized by high levels of sedentary behaviour, increased use of electronic devices with screens, and few opportunities for free play and spontaneous physical activity (Woessner et al., 2021). Evidence shows that a significant proportion of children and adolescents do not meet the recommendation of at least 60 minutes of moderate-to-vigorous physical activity per day, which can negatively affect their growth and development (Guthold et al., 2020). Within this context, integrating physical activity into the school setting represents an ideal opportunity for children to engage in physical activity, given the substantial amount of time they spend at school (Daly-Smith et al., 2020). Moreover, the school environment provides a safe and structured

setting with educators who can not only guide physical activity but also incorporate educational content (Colella et al., 2020). This integration plays a key role in the promotion of an active lifestyle by improving cognitive skills and fostering meaningful learning (Harvey et al., 2018; Hillman et al., 2006; Ruiz & Ortega, 2009). However, efforts to allocate more time to physical activity during the school day often conflict with curricular demands, potentially limiting the implementation of policies aimed at promoting it.

Therefore, effective strategies are needed to make physical activity a priority in schools (McMullen et al., 2014), and educational institutions must contribute to the creation of physical and social environments that promote active lifestyles (Grao-Cruces et al., 2023). Relatedly, the participation of administrators, teachers, students, families, and other associations linked to education is essential to ensure sustainable incorporation of physical activity in the school context (Daly-Smith et al., 2018). New integrated approaches have emerged that enable the identification and combination of the experience of multiple stakeholders in the development of systemic approaches to physical activity (Grao-Cruces et al., 2019). In this regard, the creating active schools framework includes the integration of physical activity throughout the school day as a key strategy for reducing sedentary time by implementing physically active learning and active breaks (ABs) (Daly-Smith et al., 2020), which have emerged as an effective strategy for integrating physical activity into educational settings, as they fit within the school curriculum by interrupting prolonged periods of sitting with short bouts of physical activity (Carlson et al., 2015). Additionally, these interventions typically involve simple movements that modify physiological activity or align with educational content, offering enhancing cognitive stimulation (Álvarez-Bueno et al., 2017; Colella et al., 2020).

Different AB programmes have proven to be an efficient alternative that can be incorporated into the school context (Masini et al., 2023; Muñoz-Parreño et al., 2021; Watson et al., 2017). Additionally, evidence suggests that ABs are effective in increasing the level of physical activity among children (Muñoz-Parreño et al., 2020), for improving classroom behaviour (on-task behaviour) (Mavilidi et al., 2020), and for enhancing the enjoyment of movement (Mullins et al., 2019). However, according to current evidence, the effects of ABs on fitness remain inconclusive, particularly in relation to cardiorespiratory fitness (CRF) (Reyes-Amigo et al., 2025). Although some studies have demonstrated improvements in CRF (Latino et al., 2023; Masini et al., 2023), others have reported no significant effects following the implementation of ABs during the school day (Graham et al., 2021; Innerd et al., 2019; Kvalø et al., 2017; van den Berg et al., 2019). This evidence implies that further research is needed to clarify the effects associated with the implementation of AB programmes and to identify their effects on CRF, as this outcome is extremely important for the overall development of children (Cantell et al., 2008; Raghuveer et al., 2020). With regard to the effect of chronic AB practice on physical fitness levels and general cognitive functioning, the current literature suggests that these benefits could be based on an increase in CRF (Visier-Alfonso et al., 2020).

Therefore, based on the physiological adaptations attributed to regular physical activity, structural and functional brain modifications could be expected, positively impacting cognitive performance (Chaddock-Heyman et al., 2014; Esteban-Cornejo et al., 2021). Accordingly, it has been hypothesized that regular ABs may also improve working memory, although the evidence remains limited (Masini et al., 2023). However, the existing literature related to ABs has shown considerable levels of heterogeneity in samples, intervention components, and outcomes (Reyes-Amigo et al., 2025). Despite the increasing implementation of school-based ABs, there remains limited evidence regarding the minimum effective dose and characteristics (e.g. intensity, frequency, and cognitive engagement) required to simultaneously improve CRF and executive functions in ecologically valid educational settings (Schmidt et al., 2016). Thus, the present study aimed to evaluate the effect of a six-week intervention with ABs on CRF and working memory index (WMI) in schoolchildren.

Material & methods

Study design

A quasi-experimental study design with pre- and post-intervention assessments was employed. Participating schools were randomly allocated to either the experimental group (EG) or the control group (CG). This random assignment was performed by an independent researcher, blinded to the schools and participants, using a computer-generated random numerical sequence created with the Oxford Minimization and Randomization (OxMaR) software (Guillaumes & O'Callaghan, 2019). All participating schools belonged to low- to middle-socio-economic strata (C3–D) according to the classification of the Ministry of Social Development and Family (Ministry of Social Development and Family, 2023) and were situated within the same geographical area to reduce potential differences in baseline characteristics between groups. The study protocol was developed in accordance with the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) guidelines and followed the reporting recommendations established by the Consolidated Standards of

Reporting Trials (CONSORT) statement. Figure 1 presents an overview of the study timeline, including participant enrolment, interventions, and assessment procedures.

Participants

The study was carried out in two elementary schools located in Valparaíso, Chile. A total of 61 volunteer children (36 boys and 25 girls) participated in the study. The participants were between 10 and 11 years of age (mean age: 10.48 ± 0.50 years) and were classified as Tanner stages 1–2 of sexual maturation (Tanner & Whitehouse, 1976). Eligible participants were sixth-grade students aged 10–11 years. Students were excluded if they had any medical condition or health limitation that prevented them from participating in the ABs or completing the physical fitness assessments. In addition, students who were absent from either the baseline or post-intervention assessment, or who declined to participate in the ABs, were excluded from the analysis. All eligible participants completed the study protocol, and no adverse events or intervention-related negative effects were reported during the study. All remaining participants completed the study, and there were no negative effects after the interventions. Prior to conducting the current study, a power analysis was performed (G*Power 3; Heinrich-Heine-Universität Düsseldorf, Germany) to calculate the adequate sample size (F-test, effect size = 0.25, α error = 0.05, power = 0.95) (Chuan & Penyelidikan, 2006). Based on this calculation, the participation of 54 students was estimated in this study. The estimated sample size provided sufficient statistical information and was considered enough to detect the expected effect under the specified assumptions (Masini et al., 2020).

The EG was made up of 28 children (18 boys and 10 girls) and the CG consisted of 33 (18 boys and 15 girls) (Figure 1). The AB intervention was implemented in the EG during their regular classes throughout the school day for six weeks, while the CG continued with their usual school activities (without any physical intervention) (Table 1).

Written informed consent was obtained from parents or legal guardians and children's assent was collected before the start of the intervention. Ethical approval for this investigation was obtained from the Ethical Scientific Committee of Playa Ancha University (N°005/2022).

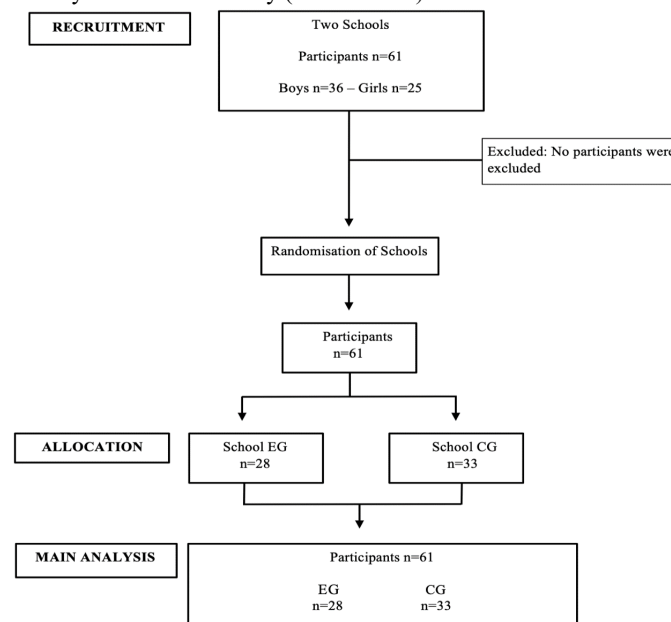


Figure 1. CONSORT Participant Flow During the Study. EG = Experimental Group, CG = Control Group.

Measurements

Prior to starting the study, all participants were introduced to the research staff who conducted it and were informed about the experimental procedures. Subsequently, participants underwent testing on three different days at their school facilities, and the same assessment procedure was applied at the end of the intervention period. On the first day, anthropometric measurements (height and body mass) were obtained using a wall-mounted stadiometer and a SECA 703 scale. These measurements were used to estimate body mass index (BMI, kg/m^2) (De Onis & Lobstein, 2010), and all calculations were performed using AnthroPlus software.

On the second day of data collection, participants completed the Six-Minute Walk Test (6MWT) over a 30 m indoor course located in a school hallway. The assessment was conducted in accordance with the 1400-

guidelines established by the American Thoracic Society (ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories, 2002) and the validated protocol for paediatric populations described by Li et al. (2005). Participants were instructed to walk continuously back and forth along the course at the fastest pace they could maintain for six minutes without external pacing. Throughout the test, standardized verbal encouragement was provided, and participants were notified of the elapsed time at one-minute intervals. The total distance walked during the six-minute period was recorded as the 6MWT performance outcome. To assess the reproducibility of the test, a randomly selected subsample of 25 schoolchildren repeated the 6MWT one week after the initial assessment. The data obtained from both measurement processes were used to predict maximum oxygen consumption (VO_{2max}) using the formula $VO_{2max} (ml \cdot kg^{-1} \cdot min^{-1}) = 12.701 + (0.06 \times 6MWD_m) - (0.732 \times BMI_{kg/m^2})$, as proposed by a study in schoolchildren (Jalili et al., 2018). On the third day, to measure the WMI, the Wechsler Intelligence Scale for Children (WISC-V) cognitive test battery was used, specifically the auditory working memory subtest. This is a standardized, verbally administered subtest in which participants must point to digits in forward, backward, or ascending order. In this study, the examiner read sequences of numbers or letters aloud, and each child had to recall and then repeat them according to the level of difficulty indicated in the test. The test was administered using the aforementioned subtest sequences contained in a booklet. The administration procedure was individualized, took place in a calm and quiet place, and lasted for 15 minutes (Sistiaga et al., 2021). All measurements were performed by specially trained members of the research team under standardized conditions. The same researcher performed both the pre- and post-test measurements. To avoid circadian variation of the parameters, the remeasurements after the observation period were performed at the same time each day. To minimize external influences, parents were instructed to ensure that their children abstained from consuming caffeinated beverages and refrained from intensive physical activity for 12 hours prior to the test day.

Intervention

The ABs applied to the EG were those proposed by the ACTIVA-MENTE programme (Reyes-Amigo et al., 2024). ABs were based on other programmes previously reported in the literature, which carried out ABs at school using audiovisual material (videos) (Glapa et al., 2018; Popeska et al., 2018). The intervention involved the implementation of ABs by classroom teachers using prerecorded videos specifically developed for the programme. Online access to the programme's official website is free at: [ACTIVE BREAK ACTIVA-MENTE](#). Each video lasted four minutes and 30 seconds, with the time being divided into one minute of preparation (general explanation and instructions) followed by three minutes for six activities (e.g. jumping jacks, skipping) of moderate to vigorous intensity (3 to 8 on the rating of perceived exertion (RPE) scale) (Robertson et al., 2005). Every activity was conducted for 20 seconds with 10 seconds of recovery. During the recovery time, the following activity was explained. The final 30 seconds were for cooling down (Table 1). The ABs carried out through the videos were performed in the middle of each class (for classes of 45 minutes the break was applied at minute 20), except for physical education classes. This protocol was performed six times daily over a six-week period. There are 31 different videos that could be used interchangeably and the choice was up to the teacher (all the videos have the same structure). The activities suggested in the videos were based on previous studies (Lambrick et al., 2016; Ma et al., 2015; Tabata et al., 1996) and the students could perform them standing up beside their desks. All the proposed activities have even been adapted for children with motor, auditory, and/or visual disabilities (Rimmer & Rowland, 2008).

Table 1
Description of AB Intervention (ACTIVA-MENTE Programme)

Groups	Approaches	Activities description	Times
EG	In-person classes	Students beside their desks	-----
	Teacher's instructions to the class	Beginning: general instructions of ABs	1 min
		6 activities / intensity: moderate to vigorous 3–8 RPE	Total 3 min
	Instructions of the video guide	Execution of each activity (e.g. skipping, jumps)	20 s
		Recovery and explanation of following activity	10 s
CG	This group had their normal school activities in the different subjects without the application of ABs.	End: reincorporation to the other class activities	30 s
			Total 4 min 30s
		-----	-----

EG: experimental group; CG: control group; min: minutes; s: seconds; ABs: active breaks; RPE: rate of perceived exertion

Implementation, intervention fidelity, and teacher training session

In order to optimize the implementation of the intervention protocol, one week before implementing the AB programme, all the teachers were trained for 90 minutes, with a training session being conducted at each school by the research team to provide teachers with the necessary skills and knowledge required to implement the AB programme. The content of the training session included: the importance of adding physical activity times into the classroom routine; the evidence of current research that emphasizes the potential positive effect of ABs for improving CRF and WMI; an explanation of the programme; and finally, instructions for applying the programme. Since a researcher would be present during the first two weeks of the programme being implemented, extensive demonstrations of the AB activities were not provided during the training session. After the training, the printed and digital materials used in the AB programme were distributed, as well as certification.

Statistical analysis

The normal distribution of the data was checked using the Shapiro–Wilk test. Differences in subject characteristics between groups were determined using an independent samples t-test at baseline. A 2×2 repeated-measures analysis of variance was used to evaluate the main effects and the interaction effects between groups over time (pre- and post-test). The model included a within-subjects factor for time (pre-intervention and post-intervention) and a between-subjects factor for group (experimental and control group). Effect sizes (ESs) were estimated using Cohen's *d*. According to Cohen's classification, values of 0.2–0.4 were considered small, 0.5–0.7 moderate, and ≥ 0.8 large (Cohen, 1992). The threshold for significance was set at $p < 0.05$. All the statistical analyses were performed using jamovi software (Şahin & Aybek, 2019).

Results

There were no significant differences between the groups at baseline in terms of age, height, weight, BMI, distance covered, VO_{2max} (distance and covered, VO_{2max} are CRF indicators) (Table 2), and WMI. A total of 61 participants completed the intervention procedure. No adverse events were reported, and no participants were excluded from the analysis; therefore, data from all participants were included for the final analysis. Children randomized to the EG and CG groups had a 94% attendance rate.

Table 2
Sample Characteristics, EG and CG at Baseline

Outcomes	Groups		p-values
	EG (n = 28) Mean – SD	CG (n = 33) Mean – SD	
Age (years)	10.28 ± 0.71	10.23 ± 5.85	0.80
Height (cm)	154 ± 0.07	155 ± 0.06	0.92
Weight (kg)	54.61 ± 11.31	55.91 ± 14.1	0.70
BMI ($kg \cdot m^{-2}$)	22.9 ± 3.98	23.4 ± 4.67	0.65
CRF (VO_{2max} ; $ml \cdot kg^{-1} \cdot min^{-1}$)	31.0 ± 7.4	33.6 ± 4.96	0.11
CRF (distance covered; m)	593 ± 111	634 ± 113	0.05
WMI	92.2 ± 15.5	91.4 ± 17.1	0.84

EG: experimental group; CG: control group; cm: centimetres; kg: kilograms; BMI: body mass index; $kg \cdot m^{-2}$: kilograms per square metre; m: metres; CRF: cardiorespiratory fitness; VO_{2max} : maximum oxygen consumption; $ml \cdot kg^{-1} \cdot min^{-1}$: millilitres per kilogram of body weight per minute; WMI: working memory index; SD: standard deviation; p-values: statistical significance

With regard to CRF, Table 3 shows that there is no time effect on the VO_{2max} ($F = 0.48$, $p = 0.49$) and distance covered ($F = 1.03$, $p = 0.31$) from pre- to post-intervention. Nevertheless, a significant time $\times$ group interaction was observed for the VO_{2max} ($F = 45.86$, $p < 0.001$; $ES = 1.1$) and distance covered ($F = 33.82$, $p < 0.001$; $ES = 1.2$).

Therefore, both indicators of CRF changed, with the EG showing an improvement in CRF from pre- to post-intervention, while the CG decreased. In this sense, the VO_{2max} and distance covered indicate a large effect size on CRF with respect to the interaction between groups.

As can be seen in Table 3, there was no time effect on the WMI average from baseline to post-intervention ($F = 0.102$, $p = 0.751$). The EG decreased its WMI while the CG increased it; however, as regards the time $\times$ group result, there were no significant differences in the interaction for WMI ($F = 3.105$, $p = 0.083$).

Table 3 Results of Interaction at Pre- and Post-intervention of EG and CG

Outcomes		Groups						ES
		EG n = 28	CG n = 33	Time	p-values	Time x Group	p-values	
		Mean – SD	Mean – SD					
CRF (VO _{2max} ; ml·kg ⁻¹ ·min ⁻¹)	Pre	31.0 ± 7.46	33.6 ± 4.96	0.48	0.49	45.86	< 0.001	1.1
	Post	35.7 ± 7.66	27.9 ± 5.69					
CRF (distance covered; m)	Pre	593 ± 111	634 ± 1.03	1.03	0.31	33.82	< 0.001	1.2
	Post	654 ± 42.2	546 ± 58.3					
WMI	Pre	92.2 ± 15.5	89.7 ± 10.2	0.10	0.75	3.10	0.083	----
	Post	91.4 ± 17.1	95.0 ± 14.3					

EG: experimental group; CG: control group; cm: centimetres; CRF: cardiorespiratory fitness; m: metres; VO_{2max}: maximum oxygen consumption; ml·kg⁻¹·min⁻¹: millilitres per kilogram of body weight per minute; WMI: working memory index; SD: standard deviation; p-values: statistical significance; ES: effect size.

Discussion

The main purpose of the present study was to assess the effect of a six-week AB intervention on CRF and WMI in elementary students. The inclusion of schoolchildren in this study was justified by previous evidence indicating that ABs represent a feasible and engaging approach to integrating physical activity into the school setting (Bellacicco et al., 2025). The present findings demonstrate contrasting effects on CRF and WMI, with a significant increase in CRF following the six-week intervention, involving six ABs during the school day, but no improvements for WMI.

Effect on CRF

Although CRF is influenced by several factors, including body fatness, age, sex, health status, and genetics, participation in moderate-to-vigorous physical activity is considered an important modifiable factor associated with CRF (Pozuelo-Carrascosa et al., 2018), which is consistent with our findings. Some studies (Eather et al., 2013; Innerd et al., 2019) suggest that school-based physical activity programmes are an effective strategy for improving CRF in children, although the magnitude of the effect is small, which is not in accordance with the present study, since the effect size was large. Our results are consistent with the aforementioned findings, as a six-week intervention of six ABs implemented during class time resulted in enhanced CRF. In terms of daily dose, this is in line with the findings of another study that only applied three ABs per day (Masini et al., 2023). ABs were performed at moderate-to-vigorous intensity, which, according to the literature, is associated with larger effect sizes. The increase in CRF shown in our study is in line with another study (Latino et al., 2021); however, the intervention in this study lasted a year (Masini et al., 2023). Conversely, some studies reported no significant effect on CRF with active AB interventions (González-Fernández et al., 2021; Kvalø et al., 2017), and others do not even consider it a variable, since the low movement volume of ABs suggests that there is no increase in this variable (Fiorilli et al., 2025; Yudanto et al., 2024). The aforementioned study does not concur with our results, where in just six weeks the CRF increased significantly in elementary school students. These findings highlight the discussion on the types of ABs – that is, their timing, activities, and the duration of the interventions – regarding the interventions carried out in different studies aimed at improving CRF (Innerd et al., 2019; Masini et al., 2023; van den Berg et al., 2019). For example, the present study demonstrated an improvement in CRF after ABs lasting four minutes and 30 seconds, whereas other studies have reported improvements following 10 minutes of intervention (Masini et al., 2023), while others have found no significant effects (van den Berg et al., 2019). Clarifying the types of ABs could help to determine which variables have the greatest effect on CRF, thus enabling better adjustments to the methodology (Kvalø et al., 2017; Masini et al., 2020; Reyes-Amigo et al., 2025). Furthermore, the findings of other studies (Graham et al., 2021) align with a recent systematic review, where the evidence indicates that the contribution of ABs to improving CRF is unclear (Peiris et al., 2022; Reyes-Amigo et al., 2025; Xiong et al., 2017).

Effect on WMI

With respect to working memory, the literature reports positive effects on the development of the executive function through different types of physical activity (de Greeff et al., 2018); however, according to our findings on WMI, no significant differences were observed between the EG and the CG in relation to AB intervention. This is in line with other studies (Mazzoli et al., 2021; Ruiz-Ariza et al., 2022) using a similar methodology (sample, time, activities, and duration of the intervention). However, some studies have reported that ABs are an effective strategy for improving working memory following six- (Robinson et al., 2022) or eight-week interventions (Melo et al., 2025). Nevertheless, evidence also suggests that ABs improve working memory when interventions extend for more than 12 weeks (Fiorilli et al., 2025; Masini et al., 2023; Muñoz-Parreño et al., 2021), in contrast to the six-week intervention implemented in the present study. Another factor that may

have contributed to these differences is the daily dose of ABs, as previous studies have reported improvement when three- to four-week AB sessions were implemented per school day (Masini et al., 2023; Ruiz-Ariza et al., 2022); however, our findings did not show any improvement in WMI following doses of six times in a school day. Our study was conducted in a school setting, but it did not report improvements to working memory, unlike a study carried out with participants of a similar age to our sample under laboratory conditions, which reported significant increases in working memory with the application of different types of ABs (Kjellenberg et al., 2024). Another important point is the integration of ABs into the school curriculum. In the present study, the ABs were not related to academic content, and there were no improvements to working memory; however, studies have shown that integrating ABs within the curriculum improves working memory (Masini et al., 2020), and there are also reports of improvements to working memory with ABs that are not connected to the curriculum (Zurita-Ortega et al., 2025). The effect of ABs on working memory is still being studied due to the different methodologies applied in its implementation (Mavilidi et al., 2020; Melguizo-Ibáñez et al., 2025); however, the evidence supports the positive effects of this type of intervention on executive functions (Melguizo-Ibáñez et al., 2025).

Strengths and limitations

The present study has several strengths that should be highlighted: the six daily ABs were implemented over six weeks, representing a considerable volume of movement; the ABs were conducted digitally and did not overburden the teachers; and the study contributes to a topic of scientific interest by establishing a reliable intervention method for specific variables. However, the study also has several limitations that should be considered. These include: the small sample size, which was limited to two schools and may have affected the generalizability of the results; the lack of control over activities performed in other subjects (which could have interfered with the development of working memory); and the lack of control over student motivation during the ABs, which may have affected the intensity of the movements, which is related to the effect on working memory.

Conclusions

There are various barriers to carrying out physical activities in schools, including the limited time teachers have to integrate physical activity into their lessons and reinforce its positive role in the learning environment. The present study suggests that six weeks of six physical activity sessions, implemented using four-minute, 30-second interval training (AB) sessions with basic equipment, can be implemented in the classroom during the school day and constitute an effective strategy for improving CRF in primary school children. However, with this dose of physical activity, no improvements in working memory were observed. Therefore, according to the results obtained, the usefulness and contribution of this study lie in the practical application of integrating physical activity into the school context, offering a strategy that provides evidence reinforcing the importance of incorporating physical activity during school hours. These findings have enormous practical and scientific implications, underscoring the importance of integrating physical activity into learning methodologies. Therefore, it is hoped that these results will contribute to prioritizing the inclusion of physical activity, through short- or long-duration physical activities, in school curricula. Furthermore, the findings reveal an area of research that should be explored further regarding the effects of movement-based learning, specifically ABs, on executive functions such as working memory. As a practical contribution, the study provides a tool that can be immediately applied by the various stakeholders in the educational community to promote the holistic development of students. Finally, policymakers and educational authorities should consider implementing physical activity in schools as a public policy that enables its systematic integration across the curriculum.

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Conflicts of interest: The authors declare no conflict of interest.

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