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The Effect of an Active Breaks Program on Primary School Students' Executive Functions and Emotional Intelligence

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Abstract

Background: Active breaks (ABs) (periods of physical activity during lessons) have demonstrated very positive results on executive functions (EFs) and emotional intelligence (EI). **Method:** A sample of 166 Primary school students (83 students in the experimental group and 83 in the control) was involved in this study. The experimental group received 20 periods of weekly ABs (a period of 5-10 minutes, 3-5 times a day for 17 weeks), where physical activity (PA) was combined with curricular content (CC), cooperative work (CM) and EI. **Results:** The students in the experimental group improved in all the EF variables and the EI mood, stress management and global indices. **Conclusions:** An AB program, along with CM and CC teaching, can be used to improve the primary school students' cognitive functioning as well as to achieve beneficial results in EI. It is important to carry out short ABs regularly instead of sporadic longer ABs.

Keywords: Active learning; cognitive performance; active schools; physical activity; educational methodology.

Resumen

El Efecto de un Programa de Descansos Activos en las Funciones Ejecutivas y la Inteligencia Emocional de Estudiantes de Primaria. **Antecedentes:** los descansos activos (periodos de tiempo de actividad física durante las clases lectivas) han mostrado resultados muy positivos en las funciones ejecutivas y la inteligencia emocional. **Método:** una muestra de 166 estudiantes de Primaria (83 alumnos como grupo experimental y 83 como grupo control) participaron en este estudio. El grupo experimental recibió 20 periodos semanales de descansos activos (de 5-10 minutos, 3-5 veces al día, durante 17 semanas) combinando la actividad física con el contenido curricular y el aprendizaje cooperativo e inteligencia emocional. **Resultados:** el grupo experimental mejoró todas las funciones ejecutivas que fueron analizadas, así como el control del estrés, el estado de ánimo y en el índice global de inteligencia emocional. **Conclusiones:** un programa de descansos activos, unido al aprendizaje cooperativo y a la enseñanza de contenidos curriculares, puede ser válido para mejorar el funcionamiento cognitivo de estudiantes de Primaria, así como lograr unos resultados beneficiosos en la inteligencia emocional, siendo importante realizar periodos cortos de manera frecuente en vez de largos periodos de descansos activos esporádicamente.

Palabras clave: aprendizaje activo; rendimiento cognitivo; escuelas activas; actividad física; metodología educativa.

The active breaks (ABs)-based methodology is designed to increase physical exercise and/or decrease sedentariness (McMullen et al., 2016). Turner and Chaloupka (2017) explain that short-term physical activity (PA) classes are those in which ABs are incorporated into the broader curricular content (CC). In other words, sedentary academic instruction is broken up by ABs. These types of classes are described by several authors as being physically active academic classes conducted in a school learning environment (Norris, Shelton, Dunsmuir, Duke-Williams, & Stamatakis, 2015). In ABs programs, learning objectives are met by incorporating physical, visual and auditory stimuli into the content of an academic lesson, with corresponding benefits (Mullender-Wijnsma et al., 2015).

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Kegel and Bus (2014) maintain that EFs are important during childhood. They are understood as a set of related cognitive processes that play a vital role in the regulation and organization of the information that affects the capacity of children to take advantage of learning experiences. Over the years, EFs have been shown to have a close correlation with attention, inhibition, flexibility of thought and working memory (WM) play a crucial role in academic performance (Destefano & Lefrevre, 2004). This idea is supported by Bresgi et al. (2017), who link WM especially to performance in mathematics, and by Aunio et al. (2019), who test the predictive ability of EFs with regard to arithmetical skills. Also, a longitudinal study conducted with 211 second graders (7-8 years old) at ten different school (Van der Ven et al., 2012) suggests that updating skills play a key role in the maths learning process. However, Frischkorn et al. (2019) were unable to find any relationship between EFs and general intelligence and WM and processing speed. In addition, it is important to note that children born prematurely (< 30 months gestation) may have deficiencies in the domains of executive functions of inhibition, working memory,

switching, verbal fluency and concept generation (Aarnoudse-Moens et al., 2009).

Cognitive development in Primary Education is a fundamental aspect to take into account in the educational field. Thus, the educational process is based on the integral well-being of young students in terms of satisfying their physiological, anatomical, emotional and behavioral needs. It seems that, the child and adolescent stages are sensitive periods in terms of the stimulation of FFEE, being this the main reason for the implementation of methodological proposals such as ABs to favor their development (Chaddock-Heyman et al., 2013; Donnelly et al., 2016; Erickson et al., 2015; Martín-Martínez et al., 2015).

Emotional intelligence (EI) is understood as the capacity of adaptation and interaction of human beings with their environment, which is changing and dynamic, based on their own emotional experience (García-Fernández & Giménez-Mas, 2010). It can reduce anxiety and the frequency of occurrence of negative emotions caused by adverse life events (Fernández-Berrocal & Extremera-Pacheco, 2006). From an early age and in the educational environment, young people can benefit from training in strategies and methods that allow them to improve their self-regulation and to face social–emotional challenges (Kurki et al., 2016). Such training can lead to better social interaction and more social inclusion (Mavroveli & Sánchez-Ruiz, 2011). Finally, there are studies that associate PA with improving both EFs and EI. Specifically, in the study by Zeng et al. (in press), a clear relationship between a lower level of sedentariness, higher levels of PA and EFs was seen amongst primary school students. The same conclusions are reached by Li et al. (in press), where the use of PA with cognitive challenges was linked to a greater development of EFs. As for EI, studies such as Li et al. (2009) confirm that EI is largely predicted by PA, suggesting that more studies should be implemented to determine whether an improvement in the level of PA is indeed linked to higher EI.

Therefore, given the influence and importance of EFs and EI and their link to PA, the aim of this study was to analyse changes in the EFs and EI variables of school children following the ABs intervention. It was hypothesized that the group of school children receiving ABs would see an increase in their cognitive performance in EFs and EI compared with the control group.

Methods

Participants

The research involved 166 primary education students (92 males and 74 females) from 8 classes in 2 primary schools. They were divided into a control group of 83 (47 males and 36 females) and an experimental group of 83 (45 males and 38 females). Both schools had similar socioeconomic characteristics, and they were located in the same town. The participants were aged between 9 and 12 (M = 10.9; SD = .70; 51.2% fifth grade; 48.8% sixth grade). The centers and classes were selected for accessibility and convenience. None of the children had participated in an AB program previously.

Instruments

NIH-EXAMINER battery: For the measurement of EFs, the Spanish version A of the NIH-EXAMINER battery was selected (Kramer et al., 2014), and the tests for the measurement of working memory (WM), inhibition, cognitive flexibility (CF), fluency and planning were used. The test-retest reliabilities ranged from .78 to .93.

Bar-On EQ-i: YVTM: The Youth Version validated into Spanish (Ferrández et al., 2012) aims to assess emotional and social functioning in young people (children and adolescents) aged 7-18, providing a measure or score of their EI and social functioning. A Likert-type questionnaire with four points was used, where (1) corresponds to "never happens to me" and (4) "always happens to me," and which consisted of 60 items grouped into 5 dimensions: the interpersonal, intrapersonal, stress management, adaptability and mood subscale. A total score for EI was derived from the results of both. It was administered in a group setting in the classroom with the help of the tutor. A total of 30 minutes was allocated for its completion. Cronbach's alpha was used to calculate the internal reliability of each element of the questionnaire used in the evaluation of EI (Bar-On EQ-i: YVTM). The pre- and post-test values were .67 and .77 for the interpersonal dimension, .52 and .73 for the intrapersonal dimension, .70 and .77 for stress management, .73 and .78 for adaptability, .78 and .80 for mood, and .87 and .89 for the full scale.

Procedure

A quasi-experimental pre-test/post-test NEG design was used (Cohen et al., 2011). The authorizations required were obtained from the ethics committee of University of Murcia (ID: 2036/2018) and the schools' principals. Informed written consent was obtained from the students and their parents.

With regard to the procedure, the NIH-EXAMINER battery management took place in classrooms that had good lighting, a suitable temperature and the necessary computer support. The Bar-On EQ-i: YVTM and the NIH-EXAMINER battery application were administered on different days. At the end of the test, we proceeded to perform the verbal fluency test, which was recorded for later evaluation. The Bar-On questionnaire was administered in the students' regular classrooms under the supervision of the main researcher and the tutors for each class. All tests were answered individually. The approximate duration for each test was 90-100 minutes (NIH-EXAMINER) and 30 minutes (Bar-On EQ-i: YVTM).

The four teachers applied the ABs program in the experimental group. For the control group (another four teachers), classes were structured in a classic or conventional way, with no PA. The same academic content was delivered to both groups with respect to educational level; printed materials and didactic programs were identical (Organic Law 8/2013, of December 9, for the Improvement of Educational Quality, LOMCE).

Intervention program based on ABs. To guarantee the correct implementation of the program, the main researcher gave prior training (theoretical and practical) to the teachers. Theoretical training and practical training were carried out. The theoretical training consisted of two sessions of approximately 2.5 hours each. The strategies were explained, and the importance of understanding and knowing how to work on EI and EFs was stressed (Kurki et al., 2016). The first training day content comprised the foundations of the program, its basic components (PA, EI and social competence), conceptualization of the Tabata modality as a methodology for the application of PA and the application of social competence through

the "collective marker" (CM). The second session consisted of a presentation of the INTEMO EI program, the sequencing of content and tasks for the school week, teaching strategies, and examples of exercises (eg, squats, burpees, push-ups and so on). The teachers received a dossier containing details of the sessions. The second session consisted of a presentation of the INTEMO EI program, the sequencing of content and tasks for the school week, teaching strategies, and examples of exercises (eg, squats, burpees, push-ups and so on). The teachers received a dossier containing details of the sessions.

The practical training lasted 5 days (from Monday to Friday), during which time the teachers were taught how to introduce the ABs into real situations in their classrooms, how to execute the exercises, how to organize the class and situate the children, how to use the PowerPoint program with the ABs and so on. During this period the main researcher spent an hour per day with each teacher. The sequencing of the training was: first day, high intensity interval training (HIIT) + CC; second day, EI + PA; third day, CM + CC in mathematics; and fourth and fifth day, HIIT work in arts education and resolving any doubts from previous sessions.

Once the training period was completed, the pre-tests were conducted, the data were collected, and the intervention plan was put into operation. In the case of the experimental group, the ABs were applied over 82 days across the 17 weeks, with an average of 4 ABs for each of the days. Each class studied mathematics for seven hours per week, language six hours per week, natural sciences three hours per week, social sciences three hours per week and arts education eleven hours per week. The number of AB periods (of 5-10 minutes' duration each) came to approximately 328. A composite methodology of PA + EI + cooperative learning was used based on the general guidelines proposed by Diamond & Lee (2011), and the specific ones proposed by Oslon (2014) and Tabata et al. (1996) (for the PA), by Ruiz-Aranda et al. (2013) (for EI) and by Fernández-Río (2017) (for the CM). More concrete contents were developed with the intention of achieving the study's objectives.

The intraclass application of the ABs occurred after the class had been running for between 15-20 minutes; this followed the recommendations of Godwin et al. (2016). Each ABs had three options: HIIT + CC; HIIT + EI; and HIIT + CC + CM. The HIIT and Tabata modalities of the entire training program had been endorsed previously by various researchers (Olson, 2014; Tabata et al., 1996). Two sessions of HIIT + CC, a HIIT + EI session and a HIIT + CC + CM session were conducted each day.

The main researcher was responsible for overseeing the implementation of the programme on an ongoing basis. To this end, the execution of the ABs in each class of the experimental group was observed every week, providing feedback to the teachers on the implementation of these periods of PA.

Commitment to implementation. With the intention of controlling the implementation of the intervention, classes of both groups were recorded on video at different times throughout the 17 weeks. The camera was placed in the classroom for six sessions prior to the start of the study to familiarize students with its presence and to prevent non-spontaneous behavior. Teachers' behaviours were evaluated using an observation instrument (check-list) consisting of a number of categories.

Three people participated in the observational analysis (men between 41 and 51 years of age, physical exercise and sports science graduates with experience in HIIT training and working with children). To establish reliability, the total number of agreements (TA) was divided by the agreements plus the disagreements (D): (AT = TA/A + D) (García-López et al., 2012). The agreements reached among the observers for each of the categories were as follows: class interruption (100%), movement of children within class (100%), CC work together with HIIT (100%), inclusion of IE work throughout the session (98.9%), development of emotional content with movement (100%), fostering social interaction (100%) and integrating CM techniques with PA (97.9%).

Data analysis

Firstly, descriptive statistical tests were used (means, standard deviation, kurtosis and asymmetry) (Table 1) and the scores' normal distribution was verified using the Kolmogorov-Smirnov test ($p > .05$). Secondly, the initial homogeneity amongst the groups was assessed using a multivariate analysis of variance (MANOVA).

Subsequently, to assess the impact of the program and the effectiveness of the intervention, in addition to controlling for initial differences in dependent variables that were revealed to be significant, a multivariate analysis of covariance (MANCOVA) was carried out. For this, the independent variable group consisting of two levels (control and experimental group) was taken as a factor. The dependent variables (EFs and EI) represented the values of the post-test variables. The scores obtained for the dependent variables were used as covariables in the pre-test. The magnitude of change in each group was obtained by calculating the effect size using the Eta squared coefficient (η^2). Cohen (1988) indicates that, depending on the results obtained, the effect size may be small ($\eta^2 = .01$), medium ($\eta^2 = .06$) or large ($\eta^2 = .14$).

A MANCOVA was conducted to compare the post-test scores of the groups, as "covariance analyses with the post-test scores (post-test MANCOVA with pre-test as covariate)," allowing the impact of the program to be verified (Garaigordobil & Martínez-Valderrey, 2014; Merino-Barrero et al., 2019). Finally, with the intention of checking the differences in the variables EFs and EI between the pre- and post-test for each group, Student's t-test was applied for related measures. Likewise, the Wilcoxon test was performed for related samples as a non-parametric procedure, obtaining very similar results at the level of statistical significance. All the above analyses were carried out with the statistical package SPSS version 25 for Windows.

Results

Preliminary Analysis

The MANOVA carried out in the pre-test was initially carried out to check the homogeneity of the groups (Table 1). Multivariate normality was verified using the Box statistic, resulting in a significance of .550 ($p > .05$; $F = .974$), indicating that the assumption of equality of the covariance matrices was fulfilled. The null hypothesis was thus rejected. Homogeneity was verified with Levene's test ($p > .05$), with non-significant results except in the variables N-back (NB1) (WM) and stress management (EI).

Multivariate analysis of variance Wilks' Lambda ($\Lambda = .81$, $F_{(13,152)} = 2.82, p = .001$) indicated significant differences between the groups (control and experimental) by combining the independent variables. Specifically, statistically significant differences ($p < .05$) were found at the multivariate level for the independent variables

Shift (CF), with higher values in the experimental group, and in the variables Animals and Vegetables (fluency) and Interpersonal (EI), with higher values in the control group (Table 1). These initial differences in the control and experimental groups could be attributed to the fact that the groups were legally established according to educational regulations, with no possibility of randomization in the sample.

Effects of the Intervention

Subsequently, to analyse the effects of the intervention on each group, a MANCOVA was carried out on the FE and EI variables by including all pre-test measures as covariates (Table 1). Analysis of the post-test data reflected statistically significant differences at the multivariate level for the research group variable, with higher values for the experimental group (Wilks'Λ = .71, $F_{(13,139)}$ = 4.37, p < .001). An examination of the independent results for each dependent variable revealed that significant differences were produced in favor of the experimental group in all the variables used for the evaluation of EFs, except the continuous performance test (inhibition) (p = .96). With respect to EI, no significant differences (p > .05) were observed in any of the variables studied. Specifically, the post-test ANOVAs showed statistically significant differences with higher values for the experimental group in NB1 (WM) ($F_{(1, 151)}$ = 5.85, p < .02; η^2 = .04), Flanker (inhibition) ($F_{(1, 151)}$ = 11.26, p < .00; η^2 = .07), Shift (CF) ($F_{(1, 151)}$ = 11.95, p < .001; η^2 = .07), Planning ($F_{(1, 151)}$ = 10.96, p < .00; η^2 = .07), Animals (fluency) ($F_{(1, 151)}$ = 21.24, p < .001; η^2 = .12) and Vegetables (fluency) ($F_{(1, 151)}$ = 13.08, p < .001; η^2 = .08). The other EF and EI variables did not present any statistical significance (p > .05).

With regard to the comparison of the scores of each group between pre- and post-test, Student's t-test for related samples showed significant results in the experimental group with respect to the variables NB1 (WM) (t = -6.14, p = .001), Flanker (t = -6.96, p = .00), Shift (CF) (t = -9.83, p = .00), Planning (t = -6.92, p = .00), Dot counting (t = -6.39, p = .00), Fluency (animals) (t = -8.86, p = .00), Fluency (vegetables) (t = -5.37, p = .00), Mood (t = -2.33 , p = .02), Stress Management (t = -4.25, p = .00) and total score in EI (t = -2.60, p = .01). In the control group there were significant differences in NB1 (WM) (t = -3.33, p = .00), Flanker (inhibition) (t = -2.93, p = .00), Shift (cognitive flexibility) (t = -5.43, p = .00) and Planning (t = -2.99, p = .00). No significant differences were observed in the other variables (p > .05).

Discussion

The aim of this study was to analyse the influence of an ABs program on primary school students, and in particular its effect on EFs and EI. This program was based on a combination of PA, CC, cooperative work and EI.

Firstly, an improvement in the WM performance of the group of students receiving ABs was confirmed. This contrasted with the findings of Greeff et al. (2016), though the our study involved much longer (but less frequent) ABs (three breaks of 20-30 minutes three times a week).

In terms of inhibition capacity, there were positive effects in only one of the two tests (Flanker) for both groups over time; they were significantly greater in the experimental group. These results are in line with Layne et al. (2020) study, whose AB program for primary school students led to improvements in reaction time and inhibitory control, and the work of Cappelli et al. (2019). Ludyga et al. (2018) delivered an ABs program to adolescents where they too found a significant improvement in inhibition capacity.

Although significant differences were observed in CF and planning in favor of the experimental group in the post-test, it should be pointed out that there were also differences in the pre-test, and

Table 1
Means and Standard Deviations of the Pre-Test and Post-Test Measures in the Experimental and Control Groups and Results of the Pre-Test MANOVAS and Post-Test MANCOVAS

	Pre-test								Post-test								Manova Pre-test			Mancova Post-test		
	Experimental				Control				Experimental				Control									
	M	SD	A	K	M	SD	A	K	M	SD	A	K	M	SD	A	K	F	p	η^2	F	p	η^2
NB1	1.40	.84	.16	-.73	1.38	.67	-.28	-.66	1.98	.80	.14	-.67	1.71	.81	-.02	-.50	.03	.85	.00	7.27	.01*	.05
Flanker	8.58	.78	-1.12	1.46	8.42	.73	-.57	.13	9.04	.61	-1.02	.99	8.64	.78	-1.07	.98	1.87	.17	.01	11.26	.00**	.07
Shift	7.15	.80	-.26	-.30	6.85	.90	-.30	-.09	7.83	.77	-.27	.34	7.29	.96	-.64	.52	5.34	.02*	.03	11.95	.00**	.07
CPT	3.41	2.27	.59	-.13	3.42	1.96	.45	-.26	3.17	2.23	.61	-.47	3.33	2.27	.70	-.07	.00	.97	.00	.00	.96	.00
Planning	105.68	34.69	-.26	-.56	95.59	32.54	-.47	.00	133.41	27.70	-.73	-.29	108.62	40.85	-.77	-.12	3.74	.05	.02	10.96	.00**	.07
Dot counting	16.54	5.18	-.05	-.42	17.40	6.01	-.61	-.24	19.94	4.59	-.52	-.42	18.40	4.99	-.35	-.19	.96	.33	.01	5.85	.02*	.04
Animals	12.06	4.17	.19	-.31	13.66	5.04	.67	-.00	15.87	4.75	-.05	-.52	13.78	5.51	.86	.87	4.98	.03*	.03	21.24	.00**	.12
Vegetables	5.06	2.48	.25	-.22	6.23	2.78	.29	-.15	6.27	2.61	.67	1.27	5.75	2.88	.71	.72	8.17	.00**	.05	13.08	.00**	.08
Mood	3.46	.35	-.94	1.06	3.46	.41	-1.12	1.27	3.56	.32	-1.15	1.92	3.49	.41	-1.46	2.70	.01	.93	.00	1.19	.28	.01
Adaptability	2.95	.43	-.16	-.49	2.98	.46	-.45	-.18	2.94	.47	.08	-.34	3.00	.47	-.06	-.54	.11	.74	.00	.27	.61	.00
Stress management	2.71	.39	-.40	-.28	2.81	.53	-.42	-.33	2.93	.40	-.22	-.10	2.86	.58	-.58	-.07	2.11	.15	.01	2.68	.10	.02
Interpersonal	3.02	.46	.03	-.36	3.17	.45	-.30	-.25	3.10	.51	.26	-.07	3.10	.52	-.01	-.44	4.66	.03*	.03	1.79	.18	.01
Intrapersonal	2.59	.48	.17	-.27	2.49	.55	-.26	.02	2.69	.62	-.30	-.55	2.43	.66	-07	-.64	1.63	.20	.01	2.45	.12	.02
Total EI	11.27	1.07	.05	-.18	11.45	1.37	-.02	.23	11.65	1.31	.01	-.08	11.39	1.50	.19	-.09	.87	.35	.00	2.58	.11	.02

Note: * p < .05; ** p < .01; *M* = mean; S*D* = standard deviation; *A* = asymmetry; *K* = kurtosis; η^2 = size of partial Eta effect squared; NB1 = N-back (WM assessment); Flanker = task to assess response inhibition; Shift = CF task; CPT = continuous performance test (inhibition assessment); Planning = cognitive planning assessment; Dot counting = task to assess WM; Animals and Vegetables = tests to assess fluency; Adaptability, stress management, interpersonal, intrapersonal = dimensions of emotional intelligence (EI) assessment

that there were improvements over time in both the experimental and control groups. Meo et al. (2019) results indicated a relationship between student fitness and PA and its role in preserving the cognitive executive functions, especially CF. More studies should be carried out to corroborate the possible benefits of ABs for CF.

In the case of fluency, pre-test results for the control group in the present study showed statistically significant differences in the variables analysed (animals and vegetables) in favor of the experimental group. In contrast, Daimiel et al. (2020) found a relationship between fitness and verbal fluency in adults, but they did not examine the effect of PA.

These findings are similar to those of Bugge et al. (2014), Egger et al. (2019) and Sánchez-López et al. (2019), who applied a PA and CC intervention in the classroom. They all concluded that it improved EFs. These results mirror a study of preschool children by Mavilidi et al. (2018a). They found EF improvements when PA programs were applied, both with and without CC. Similarly, Crova et al. (2014) showed that improvements in EF (cognitive engagement in particular) were related to PA.

However, Greeff et al. (2016) found no evidence of significant changes in inhibition and WM and CF, though it is important to note that, in addition to the fact that they applied ABs only three times per week, they did not include a HITT-type AP methodology. A similar example occurred in the study by Kvalø et al. (2017), where they used ABs and different methodologies (with and without CC) between two and five times per week (from 10 to 45 minutes), with positive but non-significant results in the experimental group.

Thus, it is particularly important to take into account both the number of ABs throughout the school day and the duration of the program if significant changes in the measured EFs are to be obtained. Van den Berg et al. (2016) reported no benefits when only one AB was performed per day. Mavilidi et al. (2018b), as with Greeff et al. (2016) and Kvalø et al. (2017), used widely spaced ABs (in their case three times per week) and reported no improvement in EFs. The exact duration of the program determines the results obtained, leading Greeff et al. (2018) to conclude in their meta-analysis that the greatest positive effects on EFs are obtained when PA programs are longer and continuous over time.

Finally, the results of the present study with respect to EI indicate that, despite the fact that the control group started out with higher values in interpersonal skills, improvements were only made over time for the experimental group in the mood, stress management, and overall index dimensions of EI. These findings are in line with the studies by Li, Lu and Wang (2009) and Ruiz-Ariza et al. (2019), who obtained benefits in EI for students performing ABs with only PA (without CC).

In any case, we should be careful, since the benefits obtained in this study have only been detected at the time level, and not between the control and experimental group, being one of the possible causes the scarce number of ABs sessions where the EI content was worked on as opposed to the rest of the ABs where the EFs and the CC were worked. This could be due to the adaptation in the present case of the program for a younger population and the implementation of shorter sessions than those suggested by Ruiz-Aranda et al. (2012).

The present study involved an intervention to examine the effects of a school-based AB program on EF and EI. After analysing the results and discussing them in the context of similar research that has examined the behavioral, psychological and emotional consequences of ABs, the following conclusions may be drawn:

- The experimental group students showed improvements in EFs that were manifested in greater inhibitory control, more efficient WM, superior planning ability, fluency, and CF.
- With respect to the EI variable, changes were only observed over time in mood, stress management, and total scores in the experimental group; variations between the experimental and control groups were non-significant.

Active breaks can be an effective methodological and didactic choice, because they have a positive influence on a number of cognitive and emotional processes. Future researchers should therefore consider the use of ABs as a long-term strategy to improve EFs and EI, while taking into account the need for adequate and continuous training for teachers. The ABs should be brief, regular and integrated into the CC.

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