2023, Retos, 48, 844-860

Body percussion and selective attention. Interdisciplinary quantitative study through neuromotricity activities BAPNE method based on the dual task in Primary Education

Percusión corporal y atención selectiva. Estudio cuantitativo interdisciplinar a través de actividades de neuromotricidad método BAPNE basado en la tarea dual en Educación Primaria

Francisco Javier Romero Naranjo, Francisco Javier Pujalte-Cantó, Antonio Francisco Arnau-Mollá
Universidad de Alicante (España)

Abstract. The purpose of this research was to test whether the neuromotricity activities of the BAPNE method based on the dual task could improve selective attention and concentration in 5th grade primary school pupils. A quantitative approach was used, with a quasi-experimental design between subjects and with repeated measures before and after the intervention (pretest-intervention-posttest). The research was carried out in two schools in Alicante (Spain). The sample consisted of N=114 students between 10 and 11 years of age with similar socio-economic and cultural characteristics. A non-probabilistic convenience sampling was used, dividing the sample into an experimental group (n=66) and a control group (n=48). The Spanish adaptation of the d2 attention test was used as the assessment instrument. Statistical data were processed using SPSS, JASP and Excel. Statistical decision-making was based on a significance level of alpha=0.05. Samples were tested for normality, parametric and non-parametric tests were applied, and effect sizes were calculated. The main results of the intra-subjects analysis were statistically significant in favour of the experimental group in the variables TRPOST (p=<.001), DifTR (p=<. 001), TAPOST (p=.025), DifTA (p=.021), CPOST (p=<.001), DifC (p=.021), VARPOST (p=<.001), DifVAR (p=.002), TR+POST (p=<.001), and DifTR+ (p=<.001). Three variables that showed differences in the pretest were invalidated. The within-subjects analysis was also favourable for the experimental group. In conclusion, an affirmative answer to the purpose of this research is presented.
Keywords: Neuromotricity, BAPNE, Body percussion, cognitive functions, selective attention, executive functions, dual task

Resumen. El propósito de esta investigación fue comprobar si a través de las actividades de neuromotricidad del método BAPNE basadas en la doble tarea se podía mejorar la atención selectiva y la concentración de los alumnos de 5º de Educación Primaria. Se utilizó enfoque cuantitativo, con un diseño cuasi-experimental inter-intra sujetos y con medidas repetidas antes y después de la intervención (pretest-intervención-postest). La investigación se realizó en dos centros educativos de Alicante (España). La muestra estuvo formada por N=114 estudiantes de entre 10 y 11 años de edad de características socio-económimo-culturales similares. Se utilizó un tipo de muestreo no probabilístico por conveniencia quedando la muestra dividida en grupo expermental (n=66) y grupo control (n=48). Como instrumento de evaluación se utilizó la adaptación española del test de atención d2. Los datos estadísticos se trataron a través del programa SPSS, JASP y Excel. La toma de decisiones estadadísticas se basó en un nivel de significación de alfa=0.05. Se comprobó la normalidad de las muestras, se aplicaron pruebas paramétricas y no paramétricas, y se calculó el tamaño del efecto. Como principales resultados, del análisis intra sujetos fueron estadísticamente significativos a favor del grupo experimental en las variables TRPOST (p=<.001), DifTR (p=<.001), TAPOST (p=.025), DifTA (p=.021), CPOST (p=<.001), DifC (p=.021), VARPOST (p=<.001), DifVAR (p=.002), TR+POST (p=<.001), y DifTR+ (p=<.001). Se invalidaron tres variables que presentaron diferencias en el pretest. El análisis intra sujetos también fue favorable para el grupo experimental. Como conclusión, se presenta respuesta afirmativa al propósito de esta investigación.
Palabras clave: Neuromotricidad, BAPNE, percusión corporal, funciones cognitivas, atención selectiva, funciones ejecutivas, dual task

Fecha recepción: 24-12-22. Fecha de aceptación: 14-03-23
Francisco Javier Romero-Naranjo
bapne.central@gmail.com

Introduction

In the educational field, we observe that the attentional network is becoming smaller and smaller, which is why teachers are continuously searching for new pedagogical and didactic instruments, with the aim of capturing the attentional network of their students (Altenburg et al., 2016). Both from the Physical Education and Sport Sciences (Gall et al., 2018; Kulinna et al., 2018; Páez-Maldonado, 2020; Reigal et al., 2019), and from Music Education (Fernandez et al., 2019; Grispun et al., 2020; Rodríguez-Gómez & Talero-Gutiérrez, 2022), selective attention has been studied both exclusively and within other parameters such as executive functions.

Movement has invaluable health benefits (Aguilar-Herrero et al., 2021; Martínez-Heredia et al., 2021; Pacheco et al., 2022; Padial-Ruz et al., 2022; Palma et al., 2021; Pérez et al., 2022; Romero-Ramos et al, 2021; Zambrano-Pintado et al, 2022) as well as having more notable contributions when the statistical data are correlated and provide new lines to be developed (Luis-de Cos et al., 2019; Mezcua-Hidalgo et al., 2020; Villa de Gregorio et al., 2019). When we perform body percussion from a neuromotricity point of view (Andreu-Cabrera & Romero-Naranjo, 2021; Romero-Naranjo & Andreu-Cabrera, 2023) the biomechanical aspects of the movement play an important role that allow us to demonstrate the suitability of the movements (Aedo-Muñoz et al., 2021; Alonso-Marco & Romero-Naranjo, 2022; Bermejo-Frutos, 2014; Burbano et al., 2021; Cadenas-Sánchez et al., 2015; Romero-Naranjo & Andreu-Cabrera et al., 2023; Romero-Naranjo & Llorca-Garnero, 2023).

Depending on the era being attended to, care can be

classified in various ways. According to Fenández (2014) there are at least thirteen models of attention put forward by different authors. These models come from experimental, clinical and psychometric sources. To these, we can add three more found in Lubrini et al. (2009), as well as ten more found in Londoño's (2009) classification. Many of these models are influenced by each other or are modern reworkings with the introduction of new data and further study due to new neuroimaging techniques. There are commonalities and differences between each type of model. In view of this, Fernández (2014) states that the conceptual similarities between some theoretical models allow us to affirm that at least the elements of focusing, sustaining and alternating attention seem to be accepted as constituent components of attention by most of the theorists in the field. Although some of their concepts coincide, they are not unified and depending on the model that is adapted, one diagnosis or another will be issued. For this reason, Fernández (2014) opts for the need to achieve a more universal model that is theoretically and empirically sound, and that can be used in the clinical setting for the diagnosis and rehabilitation of attention disorders.

In the same way as in attentional models, there is also a large number of psychometric tests to assess selective attention (Raven, Kaufman, TMT, path test, ring test, Tower of Hanoi, Tower of London, Tower of Toronto, Mazes, Phonological fluency, semantic fluency, Wisconsin letters, Stroop, go no go, Iwona Gambling, 5-digit). Many of them are not solely and exclusively for this purpose, but assess different aspects of executive functions or specific aspects of attention, as well as different types of attention (Portellano & García, 2014).

On the other hand, body percussion is an interdisciplinary subject, which can be applied in various subject areas with a wide possibility of being analysed academically after the latest publications (Arnau-Mollá & Romero-Naranjo, 2022a, 2022b; Romero-Naranjo, 2013c; 2020d; Serna et al., 2018). Research has been carried out in the field of Primary and Secondary Education linked to music, physical education, plastic arts and even in the learning of a foreign language where body percussion has been the object of study although we still lack quantitative studies on the latter field (Alonso-Sanz & Romero-Naranjo, 2015; Romero-Naranjo & Sayago et al., 2023). At present, there is no scientific evidence linked to health, because there is still a need for a greater number of studies with a much larger number of subjects, with validated tests and above all with functional magnetic resonance imaging and electroencephalogram (Romero-Naranjo & Romero-Naranjo, 2022). This does not imply that there are some pilot studies carried out by the BAPNE method research group, which is composed of 80 researchers from seven countries and centralised at the University of Alicante. This research group is focused on the use of body percussion under the parameters of neuromotor skills and everything related to cognitive functions, such as memory, language, spatial orientation, visuospatial ability, praxias, gnosias, attentional network, social cognition and executive functions.

In addition, he has published a wealth of ethnographic and anthropological methodological background literature (Di Russo et al., 2022; Di Russo & Romero-Naranjo, 2021a, 2021b; Romero-Naranjo, 2008; 2013b) as well as didactic and practical resources (Arnau-Mollá et al., 2022; Arnau-Mollá & Romero-Naranjo, 2022e; Asurmendi & Romero-Naranjo, 2022; González et al., 2022; González-Sánchez et al., 2021; Romero-Naranjo, 2012; 2013a; 2020c, 2020e, 2022a, 2022b; Romero-Naranjo, Arnau-Mollá, & Di Russo et al. 2022; Romero-Naranjo, Arnau-Mollá, González & Liendo et al. 2022; Romero-Naranjo, Arnau-Mollá, González, & Salerno et al. 2022; Romero-Naranjo & González, 2022a, 2022b; Romero-Naranjo & Sayago-Marínez, 2021a, 2021b; Sayago-Martínez et al., 2021). On the other hand, it has also published works on research design and on the evolution of the methodology (Arnau-Mollá & Romero-Naranjo, 2022c; 2022d), and on pedagogical experiences in Angola (González & Romero-Naranjo, 2022), as well as on cognitive and socioemotional stimulation programmes based on neuromotricity for the elderly in Italy (Salerno & Romero-Naranjo, 2022) and Venezuela (Liendo & Romero-Naranjo, 2022).

Within the executive functions, dual-tasking, in the field of neuromotricity, has a primordial role, so we can contribute new strategies in cognitive stimulation. Neuropsychology provides three classic paradigms in reference to dual-tasking (Fritz et al., 2015; Huang & Mercer, 2001; Koch et al., 2018; Pashler, 1994; Tombu & Jolicoeur, 2003). These are motor-motor, cognitive-cognitive, and cognitive-motor. Subsequently recent research contributes a fourth paradigm called rhythmic-motor (Park & Brünken, 2014; Kim et al., 2017; Park & Kim, 2021). The BAPNE method has already proposed with other studies a possible fifth paradigm called rhythmic-motor-cognitive, which includes gait and movement activities in space with rhythmic aspects while performing cognitive tasks (Romero-Naranjo & Andreu-Cabrera et al., 2023; Romero-Naranjo & Sayago et al., 2023).

Within this classification, some studies have been mainly directed towards the evaluation of executive functions with neuromotricity, dual task and attention, or social competence and the risk of exclusion. It is important to highlight that all the research has a quantitative approach, quasi-experimental design, control and experimental group, repeated measures through validated tests, non-probabilistic sampling by convenience, a sample of between 40 and 105 participants and an intervention that ranges from three to six months with a minimum of two 50-minute sessions per week. Most studies have been conducted with students in Primary Education (Arnau-Mollá & Romero-Naranjo, 2020; Carretero-Martínez et al., 2014; Castelló-Juan et al., 2019; Cozzutti et al.,

2017; Torró-Biosca et al, 2019), and Secondary (Álvarez-Morales & Romero-Naranjo, 2019; Fabra-Brell & Romero-Naranjo, 2017; Latre-Navas et al., 2019; Piqueres-Juan et al., 2019; Romero-Naranjo & Sayago et al., 2023), although also in Conservatories (Moral et al., 2020; Ros-silla et al., 2019) and in elderly people (González et al., 2019) among others. All the studies have revealed statistically significant results, but even so, we consider that we need larger studies with a greater number of subjects to be able to assert that the BAPNE method contributes to an improvement in selective attention.

Thanks to the aforementioned bibliographic foundation, we can clearly explain the difference between motor, psychomotor and neuromotricity.

- Motricity: is the ability to control body movements in a voluntary and coordinated manner involving the motor system. Activities such as walking, jumping, running, rolling, crawling, going up or down stairs, etc. clearly represent motor skills.
- Psychomotricity: It is the set of "cognitive, emotional, symbolic and sensory-motor interactions in the capacity to be and to express oneself in a psychosocial context".
- Neuromotricity: It is the educational and neurorehabilitative procedure that affects cognitive stimulation through the executive functions in which the dual task and mainly the language (spoken, sung, recited, etc.) thus providing a superior function to the stimulation (Romero-Naranjo, 2018; Romero-Naranjo & Llorca-Garnero, 2023).

The purpose of this research was to check whether the neuromotricity activities of the BAPNE method based on the dual task could improve the selective attention and concentration of 5th grade primary school students.

In order to answer the purpose of this study, we posed the following research questions:

1. Will students who practice the BAPNE neuromotricity activities based on the dual-task method have the same level of selective attention and concentration as students who follow the traditional methodology?
2. Can the BAPNE neuromotricity activities based on the dual-task method help to increase selective attention and concentration in 5th grade Primary School students?
3. Will there be the same evolution in selective attention and concentration among students who practice the neuromotricity activities based on the dual-task BAPNE method and those who do not practice them?

In order to solve these unknowns, we proposed the following objectives:

1. To quantitatively compare the initial level of selective attention and concentration between students who practice the neuromotricity activities based on the BAPNE method based on the dual task and those who follow the traditional methodology.
2. To quantitatively compare the effect on students' selective attention and concentration of the practice of the neuromotricity activities BAPNE method based on the double task and the traditional methodology.
3. To quantitatively determine the effect of the practice of the neuromotricity activities BAPNE method based on the double task and the traditional methodology on the selective attention and concentration of students in 5th grade of Primary Education.

Focusing on these research questions and objectives, we proposed a series of null and alternative hypotheses for the inter- and intra-subject analyses:

A) Inter-subject analysis

1. (H0-1) There will be no statistically significant differences in the pretest in the variables that measure selective attention and concentration between 5th grade Primary School students who practiced the neuromotricity activities of the BAPNE method based on the double task and those who used the traditional methodology.

(Ha-1) There will be statistically significant differences in the pretest in the variables that measure selective attention and concentration between 5th grade Primary School students who practiced the neuromotricity activities based on the dual-task BAPNE method and those who used the traditional methodology.

2. (H0-2) There will be no statistically significant differences in the difference variables (pretest minus posttest) and in the posttest of the variables measuring selective attention and concentration between 5th grade Primary School students who practiced the neuromotricity activities based on the dual-task BAPNE method and those who used the traditional methodology.

(Ha-2) Statistically significant differences will emerge in the difference variables (pretest minus posttest) and in the posttest of the variables measuring selective attention and concentration between 5th grade Primary School students who practiced the BAPNE neuromotricity activities based on the dual-task method and those who used the traditional methodology.

B) Intra-subjects analysis

3. (H0-3) There will be no statistically significant differences between pretest and posttest of the variables measuring selective attention and concentration of the experimental group that used the neuromotricity activities based on the dual-task BAPNE method.

(Ha-3) There will be statistically significant differences between the pretest and the posttest of the variables measuring selective attention and concentration of the experimental group that used the neuromotricity activities based on the dual-task BAPNE method.

4. (H0-4) There will be no statistically significant differences between the pretest and posttest of the variables measuring selective attention and concentration of the control group that used the traditional methodology.

(Ha-4) There will be statistically significant differences between the pretest and posttest of the variables

measuring selective attention and concentration of the control group that used the traditional methodology.

Method

A quantitative approach was used, with a quasi-experimental inter- and intra-subject design and with repeated measures before and after the intervention (pretest-intervention-posttest). This is one of the most widely used designs in the field of educational research and is considered one of the most valid due to the fact that it allows reasonable causal inferences to be drawn (Alaminos & Castejón, 2006).

For statistical data processing, version 25 for Windows of the Statistical Package for the Social Sciences (SPSS) developed by International Business Machines (IBM) was used. For the extraction of the biserial rank correlation, version 0.16.14 of the free and open source software for statistical analysis Jeffrey's Amazing Statistics Program (JASP) supported by the University of Amsterdam was used. For the elaboration of Tables and Figures, the 2013 version of the Exel program developed by Microsoft was used.

Statistical decision making was based on a significance level of alpha=0.05. The normality of the samples was tested through Kolmogrov-Smirnov for samples greater than 50 and Shapiro-Wilk for samples less than 50, as well as the homogeneity of variances through Leven's test to determine the type of test (parametric or nonparametric) to be used. As parametric tests, the Student t test was used for independent and paried samples; and as nonparametric tests, the Mann-Whitney U test for independent samples and the Wilcoxon signed-rank test for paried samples.

As a complementary analysis to the significance tests, the effect size was found to represent to what degree the null hypothesis was false, or in other words, to know the magnitude of the differences found (Cárdenas & Arancibia, 2014).

The biserial rank correlation was considered as effect size (Rb) and was interpreted in the same way as Pearson's r for the nonparametric U Mann-Whitney tests for independent samples and for the Wilcoxon signed ranks test for related samples. On the other hand, in parametric t Student tests for independent and related samples, effect size (d) was interpreted based on Cohen's d (Goos-Sampson, 2018). Effect size was provided only in cases where significant differences were found. In Table 1 we can observe the interpretation of the effect size according to the test used (Table 1).

Table 1
Interpretation of effect size for each test according to Goos-Sampson (2018)

Test	Measure effect size	Irrelevant	Small	Medium	Large
U Mann-Whitney (Independent samples) Wilcoxon (Paried samples)	Correlation Biserial-Rank (Rb)	<0.1	0.1	0.3	0.5
t Student (Independent samples) t Student (Paried samples)	Cohen's d	<0.2	0.2	0.5	0.8

Participants

The population of this study was a total of N=114 students between 10 and 11 years of age in 5th grade of primary education from two schools in the province of Alicante and with similar socioeconomic and cultural characteristics, predominantly middle class, in which 48.25% were boys and 51.75% were girls.

A non-probabilistic convenience sampling was used and the sample was divided into two groups. The experimental group (57.89%) was composed of n=66 participants in which 32 were male (48.48%) and 34 were female (51.52%). On the other hand, the control group (42.11%) consisted of n=48 participants. Of these, 23 were male (47.92%) and 25 female (52.08%). The participating students did not present any neurological or psychiatric damage or learning difficulties and were not part of the Special Education classroom.

In order to be included in the study, the participants had to meet the following inclusion criteria:

- Their legal representatives had to have signed the participation consent and data protection document.
- They had to have correctly completed the evaluation test, both pretest and posttest.
- They had to have attended at least 80% of the intervention sessions.

Instruments

The Spanish adaptation of the "d2" attention test (Brickenkamp, 2012) by Nicolás Seisdedos Cubero, published by TEA, was used as an evaluation instrument. It is a finite-time test that aims to assess selective attention and mental concentration through a cancellation task. The test can be applied collectively or individually in children, adolescents and adults, and the total time varies between 8 and 10 minutes, including previous instructions.

The process consists of following instructions and executing the task correctly discriminating visual stimuli. In this test, attention is not presented as a simple aptitude, but offers fourteen different scores that provide information on speed and accuracy, relating them to other aspects such as stability, fatigue and the effectiveness of attentional inhibition.

To perform this test, the individual must review from left to right the contents of 14 lines and mark those letters "d" that have two dashes (regardless of the location of these marks). Each line contains 47 characters, which entails discriminating a total of 658 elements. The participant has 20 seconds per line in which to work as fast as possible trying not to make mistakes. Within these characters there are letters "d" with more and less than two dashes and the same applies to the letters "p". These characters must not be selected in any case, because it will count as an error.

The scores to be measured are: total responses (TR),

which implies the number of items marked in the 14 lines; total hits (TA), which is the number of correct characters; omissions (O), which is the number of correct spellings that the participant has not marked as valid; commissions (C), which is the number of errors made; total test effectiveness (TOT), which is calculated by subtracting the sum of omissions and commissions (TR- (O+C) from the total number of responses; concentration index (CON), which is calculated by subtracting the commissions from the total number of hits (TA-C); line with the highest number of characters attempted (TR+); line with the lowest number of items attempted (TR-); and variance or difference index (VAR), which is calculated by applying the formula (TR +)-(TR-).

Procedure

First, the involvement of the educational centers was requested, explaining to the governing bodies and other members of the educational community the objective of conducting this research within their institution. Access to the center was simple and collaborative.

After obtaining permission from the educational centers, the parents or legal guardians of the students were summoned to an informative meeting on the objective, procedure and inclusion criteria of the research. Subsequently, the participation and data protection document was signed.

Once the pertinent formalities had been completed, during the tutoring sessions, the first evaluation of the "d2" attention test was applied to both groups by the neuropsychologist of the General Hospital of Alicante, Ruth Gasparini, to determine the initial level of selective attention and concentration of the participants.

The intervention applied to the experimental group was carried out for 12 weeks, twice a week, with 2-hour sessions in the subjects of Music and Physical Education on Tuesdays and Thursdays.

As a treatment, the experimental group was given the neuromotricity activity protocols of the BAPNE method based on the double task published in the manuals *Body percussion-programación didáctica, vols. 1 & 2*; *BAPNE method: Body percussion and multiple intelligences. Cognitive, social-emotional and psychomotor stimulation, vols. 1-5*; *Body percussion basic; Handsball change*; y *BAPNE FIT 1 y 2* (Romero-Naranjo, 2014, 2017, 2018, 2019, 2020a, 2020b). These manuals include a large number of justified and sequenced activities with different types of complexity through which it is intended to provide students with a high degree of cognitive and psychomotor stimulation.

A basic example of activities we do with students on the dual task can be seen in our Neuromotricity Chart of the BAPNE method. In Figure 1 we indicate many of the variants and multiple combinations that can be performed with the lower extremities, the upper extremities and the voice (addition, subtraction, capitals of countries, saying opposites, translating words, singing a melody, etc.) (Figure 1).

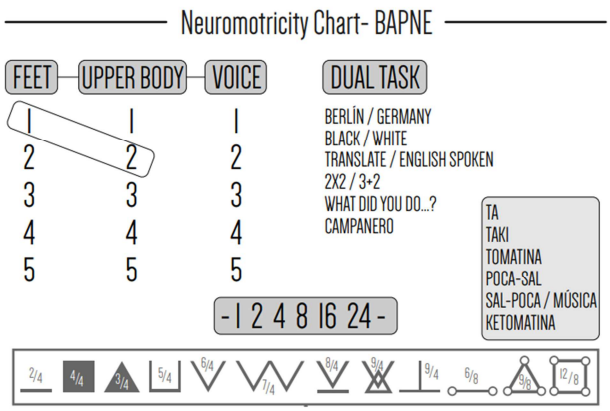

Figure 1. Neuromotricity Chart-BAPNE (Romero-Naranjo, F. J., & Llorca-Garnero, 2023, p.675).

On the other hand, the control group did not receive any type of treatment and continued with its traditional methodology without any change in its didactic program.

After the twelve weeks of intervention, the second evaluation (posttest) was carried out under exactly the same conditions in both groups, using the same evaluation test, and applied by the same neuropsychologist. Finally, the tests performed by both groups were corrected and the data were analyzed in the SPSS and JASP programs.

Results

First, Table 2 shows the descriptive statistics required for each variable used in this study for the inter-subject and intra-subject analyses (Table 2).

Through the results obtained by each group for the variables analyzed and to determine the type of test to be applied in each case (metric or nonparametric), the assumption of homogeneity of the sample was checked by means of the Kolmogorov-Smirnov test in the experimental group and the Shapiro-Wilk test in the control group. On the other hand, the assumption of homoscedasticity or homogeneity of variances was tested in the variables that showed normality of the samples in both groups (TAPRE, TOTPRE and CONPRE) by means of Leven's test of equality of variances. Based on the results obtained, the type of specific test to be used in the comparison between independent groups (inter-subject analysis) and within each group (intra-subject analysis) was assigned.

In the inter-subject analysis, the nonparametric Mann-Whitney U test for independent samples was used in the comparison of variables that did not meet the assumptions of normality and homogeneity, that is, in all comparisons except for TAPRE. On the other hand, for this variable that did meet the assumption of normality (TAPRE), the parametric t Student test for independent samples was used.

In relation to the intra-subjects analysis, the results obtained in the pretest minus the posttest of each variable were compared. After verifying that the sample did not

present a normal distribution in the variables analyzed in the experimental group, the nonparametric Wilcoxon signed-rank test for related samples was used. In contrast, for the control group, the same nonparametric test (Wilcoxon) was used for the variables that did not present normality (TR, O, C, CON, VAR, TR+, TR-) and the parametric t Student test for related samples for the variables that did present normality (TA and TOT). Table 3 shows the type of parametric and nonparametric tests applied to the inter- and intra-subject analyses according to compliance with the assumptions of normality and homoscedasticity (Table 3).

Table 2
Statistics of the variables analysed in the experimental and control groups

	Experimental group							Control group						
	n	Median	Range	Mean	Dev. Error	Std. Deviation	Variance	n	Median	Range	Mean	Dev. Error	Std. Deviation	Variance
TRPRE	66	286.50	305	299.89	7.858	63.838	4075.266	48	270.00	332	280.31	10.230	70.878	5023.666
TRPOST	66	376.50	438	386.64	11.434	92.890	8628.543	48	305.50	303	327.50	11.249	77.937	6074.213
DifTR	66	-91.50	546	-86.74	12.172	98.885	9778.194	48	-48.00	212	-47.19	6.790	47.040	2212.794
TAPRE	66	104.00	102	105.45	2.461	19.997	399.883	48	102.00	90	99.10	3.502	24.261	588.606
TAPOST	66	138.00	222	135.09	5.114	41.549	1726.361	48	123.50	114	120.25	4.516	31.288	978.915
DifTA	66	-36.00	227	-29.64	4.554	36.994	1368.573	48	-25.50	94	-21.15	3.153	21.844	477.148
OPRE	66	10.50	125	22.35	3.682	29.911	894.692	48	10.00	167	20.15	5.050	34.985	1223.957
OPOST	66	14.50	184	29.11	4.959	40.288	1623.112	48	7.50	160	17.63	4.629	32.073	1028.665
DifO	66	-2.00	271	-6.76	4.944	40.165	1613.233	48	1.00	80	2.52	2.089	14.471	209.404
CPRE	66	9.00	75	14.62	2.028	16.476	271.470	48	12.50	94	28.02	4.457	30.880	953.595
CPOST	66	4.00	102	10.85	2.207	17.929	321.454	48	11.00	102	25.38	4.144	28.711	824.324
DifC	66	2.00	143	3.77	2.779	22.577	509.717	48	-1.00	118	2.65	3.883	26.902	723.723
TOTPRE	66	258.50	212	262.92	5.220	42.411	1798.656	48	229.00	251	232.15	9.114	63.142	3986.893
TOTPOST	66	344.00	516	346.68	10.476	85.107	7243.143	48	296.50	331	284.50	11.808	81.806	6692.170
DifTOT	66	-91.50	555	-83.76	9.839	79.929	6388.679	48	-57.00	203	-52.35	5.762	39.918	1593.425
CONPRE	66	96.00	127	90.83	3.385	27.499	756.172	48	66.00	138	71.08	5.883	40.756	1661.014
CONPOST	66	132.00	289	124.24	6.069	49.305	2430.956	48	109.50	168	94.88	7.051	48.850	2386.324
DifCON	66	-39.00	298	-33.41	5.466	44.406	1971.907	48	-22.50	104	-23.79	3.609	25.002	625.105
VARPRE	66	15.00	41	17.27	1.021	8.297	68.848	48	15.00	29	18.35	1.136	7.870	61.936
VARPOST	66	20.00	37	22.48	0.952	7.731	59.761	48	17.00	27	17.63	0.957	6.632	43.984
DifVAR	66	-7.00	51	-5.21	1.353	10.994	120.877	48	-1.50	44	0.73	1.298	8.996	80.925
TR+PRE	66	28.00	28	29.92	0.908	7.374	54.379	48	26.50	36	29.02	1.184	8.204	67.297
TR+POST	66	42.50	33	39.48	0.978	7.943	63.084	48	31.50	28	32.13	1.153	7.991	63.856
DifTR+	66	-12.00	47	-9.56	1.281	10.406	108.281	48	-4.00	34	-3.10	1.168	8.093	65.500
TR-PRE	66	14.00	23	12.65	0.542	4.405	19.400	48	12.00	18	10.67	0.697	4.830	23.333
TR-POST	66	16.50	27	17.00	0.814	6.610	43.692	48	14.50	18	14.50	0.717	4.968	24.681
DifTR-	66	-5.00	36	-4.35	0.912	7.408	54.877	48	-4.50	18	-3.83	0.659	4.563	20.823

Table 3
Parametric and non-parametric tests applied to inter- and intra-subject analyses according to the results of homogeneity and homoscedasticity tests

Variable	Homogeneity test						Homocedasticity test				Test by type of analysis		
	Experimental (n=66) Kolmogorov-Smirnov*			Control (n=48) Shapiro-Wilk			Leven's test***				Inter subjects	Intra subjects	
	Estat.	gl	Sig.	Estat.	gl	Sig.	Estat.	gl1	gl2	Sig.		Experimental	Control
TRPRE	.119	66	.021	.907	48	.001	/	/	/	/	U Mann-Whitney		
TRPOST	.091	66	.200**	.935	48	.010	/	/	/	/	U Mann-Whitney	Wilcoxon	Wilcoxon
DifTR	.169	66	.000	.967	48	.186	/	/	/	/	U Mann-Whitney		
TAPRE	.082	66	.200**	.958	48	.081	2.545	1	112	.113	t Student (Ind.)		
TAPOST	.129	66	.008	.960	48	.105	/	/	/	/	U Mann-Whitney	Wilcoxon	t Student (Paired)
DifTA	.134	66	.005	.956	48	.072	/	/	/	/	U Mann-Whitney		
OPRE	.281	66	.000	.501	48	.000	/	/	/	/	U Mann-Whitney		
OPOST	.273	66	.000	.473	48	.000	/	/	/		U Mann-Whitney	Wilcoxon	Wilcoxon
DifO	.235	66	.000	.837	48	.000	/	/	/	/	U Mann-Whitney		
CPRE	.201	66	.000	.786	48	.000	/	/	/	/	U Mann-Whitney		
CPOST	.323	66	.000	.748	48	.000	/	/	/	/	U Mann-Whitney	Wilcoxon	Wilcoxon
DifC	.200	66	.000	.717	48	.000	/	/	/	/	U Mann-Whitney		
TOTPRE	.091	66	.200**	.979	48	.550	9.506	1	112	.003	U Mann-Whitney		
TOTPOST	.114	66	.033	.973	48	.344	/	/	/	/	U Mann-Whitney	Wilcoxon	t Student (Paired)
DifTOT	.143	66	.002	.960	48	.099	/	/	/	/	U Mann-Whitney		
CONPRE	.094	66	.200**	.954	48	.057	10.931	1	112	.001	U Mann-Whitney		
CONPOST	.155	66	.000	.934	48	.010	/	/	/	/	U Mann-Whitney	Wilcoxon	Wilcoxon
DifCON	.173	66	.000	.950	48	.042	/	/	/	/	U Mann-Whitney		
VARPRE	.169	66	.000	.852	48	.000	/	/	/	/	U Mann-Whitney		
VARPOST	.141	66	.002	.932	48	.008	/	/	/	/	U Mann-Whitney	Wilcoxon	Wilcoxon
DifVAR	.095	66	.200**	.941	48	.018	/	/	/	/	U Mann-Whitney		
TR+PRE	.171	66	.000	.827	48	.000	/	/	/	/	U Mann-Whitney		
TR+POST	.203	66	.000	.937	48	.012	/	/	/	/	U Mann-Whitney	Wilcoxon	Wilcoxon
DifTR+	.114	66	.032	.976	48	.418	/	/	/	/	U Mann-Whitney		
TR-PRE	.244	66	.000	.954	48	.057	/	/	/	/	U Mann-Whitney		
TR-POST	.093	66	.200**	.927	48	.005	/	/	/	/	U Mann-Whitney	Wilcoxon	Wilcoxon
DifTR-	.068	66	.200**	.946	48	.029	/	/	/	/	U Mann-Whitney		

Note: *. Lilliefors significance correction. **. This is a lower bound of true significance. *** Results are presented only in the case where the assumption of normality is met.

Inter-subject analysis

In the inter-subject analysis, the results obtained by each group (experimental and control) at each evaluation time (pretest and posttest) and the differences (pretest minus posttest) were analyzed to compare them and detect the presence or absence of statistically significant differences in each variable.

No significant baseline differences were found in the pretest between the two groups in the variables TRPRE (p=.087), TAPRE (p=.129), OPRE (p=.512), CPRE (p=.051), VARPRE (p=.322) and TR+PRE (p=.349). In contrast, at post-test, statistically significant differences were found in the variables TRPOST (p=<.001), DifTR (p=<.001), TAPOST (p=. 025), DifTA (p=.021), OPOST (p=.007), DifO (p=.039), CPOST (p=<.001), DifC (p=.021), VARPOST (p=<.001), DifVAR (p=.002), TR+POST (p=<.001), and DifTR+ (p=<.001).

En la variable TRPOST las puntuaciones del grupo experimental (Mdn=376.50, Rango=438) fueron significativamente mayores que las obtenidas por el grupo control con un tamaño del efecto medio (Mdn=305.50, Rango=303) U=934, p=<.001, Rb=0.410. Del mismo modo, en la variable diferencias (DifTR) el grupo experimental (Mdn=-91.50, Rango=546) alcanzó de forma significativa mayor puntuación que el grupo control, también con un tamaño del efecto medio (Mdn=-48.00, Rango=212) U=962.50, p=<.001, Rb=-0.392.

In reference to the TAPOST variable, the experimental group obtained scores of Mdn=138.00, and Range=222, while those of the control group were Mdn=123.50, and Range=114, finding a small effect size (U=1194, p=.025, Rb=0.246). In the difference variable (DifTA) the experimental group (Mdn=-36.00, Range=227) presented greater evolution than the control group, and likewise a small effect size (Mdn=-25.50, Range=94) U=1182.50, p=.042, Rb=-0.253).

Regarding the OPOST variable, the experimental group (Mdn=14.50, Range=184) made a greater number of omissions than the control group with a small effect size (Mdn=7.50, Range=160) U=1117, p=.014, Rb=0.295. In the difference variable (DifO) the experimental group scores of the experimental group were Mdn=-2.00, and Range=271, while those of the control group Mdn=1.00, and Range=80, also presenting a small effect size (U=1225.50, p=.039, Rb=-0.226).

Referring to the CPOST variable, the experimental group (Mdn=4.00, Range=102) made significantly fewer errors than the control group with a medium effect size (Mdn=11.00, Range=102) U=812, p=<.001, Rb=-0.487). On the difference variable (DifC) the experimental group (Mdn=2.00, Range=143) reduced errors to a greater extent than the control group, this time with a small effect size (Mdn=-1.00, Range=118) U=1182.50, p=.042, Rb=0.253.

Targeting the variable VARPOST it was found that the experimental group (Mdn=20.00, Range=37) achieved significantly greater variability in the test than the control group, emerging a medium effect size (Mdn=17.00, Range=27) U=972, p=<.001, Rb= 0.386. When analyzing the difference variable (DifVAR) it was significantly observed that the experimental group (Mdn=-7.00, Range=51) achieved greater test variability than the control group also with a mean effect size (Mdn=-1.50, Range=44) U=1050.50, p=.004, Rb=-0.337.

To finish with the variables that did not present statistically significant differences in the pretest, but did in the posttest, we found the variables TR+POST in which the experimental group (Mdn=42.50, Range=33) scored significantly higher than the control group, presenting a mean effect size (Mdn=31. 50, Range=28) U=820, p=<.001, Rb=0.482; and the difference variable (DifTR+) in which again the experimental group (Mdn=-12.00, Range=47) presented significantly higher evolution than the control group, also with a mean effect size (Mdn=-4.00, Range=34) U=932.50, p=<.001, Rb=-0.411.

On the other hand, statistically significant pretest baseline differences were found in the variables TOTPRE (p=.006), CONPRE (p=.008), and TR-PRE (p=.016). Therefore, although in the posttest statistically significant differences were also found in the variables TOTPOST (p=<.001), DifTOT (p=<.001), CONPOST (p=.002), DifCON (p=.010) and TR-POST (p=.020) the analysis of these variables should be invalidated or at least, take into consideration that the results shown below on these variables might not be valid.

In the TOTPOST variable, the scores of the experimental group (Mdn=344.00, Range=516) were significantly higher than those obtained by the control group (Mdn=296.50, Range=331) U=916, p=<.001, Rb=0.422. Similarly, in the differences variable (DifTOT) the experimental group (Mdn=-91.50, Range=555) achieved significantly higher scores than the control group (Mdn=-57.00, Range=203) U=920, p=<.001, Rb=-0.419.

Regarding the CONPOST variable, it was found that the experimental group (Mdn=132.00, Range=289) achieved significantly higher concentration index than the control group (Mdn=109.50, Range=168) U=1035, p=.004, Rb= 0.347. When analyzing the difference variable (DifCON) it was observed that the experimental group (Mdn=-39.00, Range=298) also achieved significantly higher scores than the control group (Mdn=-22.50, Range=104) U=1136.50, p=.020, Rb=-0.283.

To close this section and in reference to the variable TR-POST, it emerged from the results that the scores of the experimental group (Mdn=16.50, Range=27) were higher than those obtained by the control group (Mdn=14.50, Range=18) U=1181, p=.040, Rb=0.254. On the other hand, in the variable differences (DifTR-) no statistically significant differences were found between the experimental group (Mdn=-5.00, Range=36) and the

control group (Mdn=-4.50, Range=18) U=1530.50, p=.758).

As a summary we can observe in Table 4 the results obtained from the inter-subject analysis between the experimental group and the control group, as well as the type of test that was applied for the comparison of each variable (Table 4).

Table 4.
Inter-subject analysis through independent samples U Mann-Whitney and Student's t-tests

		Experimental (n=66)	Control (n=48)			
Variable	Test	Median (Range)	Median (Range)	U	Sig. (Bil.)	Effect size*
TRPRE	U Mann-Whitney	286.50 (305)	270.00 (332)	1286.000	.087	/
TRPOST	U Mann-Whitney	376.50 (438)	305.50 (303)	934.000	.000	0.410
DifTR	U Mann-Whitney	-91.50 (546)	-48.00 (212)	962.500	.000	-0.392
TAPRE**	t Student	105.455 (Mean) 19.997 (SD) 2.46 (Dev.Err. Av.)	99.104 (Mean) 24.261 (SD) 3.50 (Dev.Err. Av.)	/	.129	/
TAPOST	U Mann-Whitney	138.00 (222)	123.50 (114)	1194.000	.025	0.246
DifTA	U Mann-Whitney	-36.00 (227)	-25.50 (94)	1182.500	.021	-0.253
OPRE	U Mann-Whitney	10.50 (125)	10.00 (167)	1470.000	.512	/
OPOST	U Mann-Whitney	14.50 (184)	7.50 (160)	1117.000	.007	0.295
DifO	U Mann-Whitney	-2.00 (271)	1.00 (80)	1225.500	.039	-0.226
CPRE	U Mann-Whitney	9.00 (75)	12.50 (94)	1244.500	.051	/
CPOST	U Mann-Whitney	4.00 (102)	11.00 (102)	812.000	.000	-0.487
DifC	U Mann-Whitney	2.00 (143)	-1.00 (118)	1182.500	.021	0.253
TOTPRE	U Mann-Whitney	258.50 (212)	229.00 (251)	1106.500	.006	0.301
TOTPOST	U Mann-Whitney	344.00 (516)	296.50 (331)	916.000	.000	0.422
DifTOT	U Mann-Whitney	-91.50 (555)	-57.00 (203)	920.000	.000	-0.419
CONPRE	U Mann-Whitney	96.00 (127)	66.00 (138)	1122.500	.008	0.291
CONPOST	U Mann-Whitney	132.00 (289)	109.50 (168)	1035.000	.002	0.347
DifCON	U Mann-Whitney	-39.00 (298)	-22.50 (104)	1136.500	.010	-0.283
VARPRE	U Mann-Whitney	15.00 (41)	15.00 (29)	1412.000	.322	/
VARPOST	U Mann-Whitney	20.00 (37)	17.00 (27)	972.000	.000	0.386
DifVAR	U Mann-Whitney	-7.00 (51)	-1.50 (44)	1050.500	.002	-0.337
TR+PRE	U Mann-Whitney	28.00 (28)	26.50 (36)	1421.500	.349	/
TR+POST	U Mann-Whitney	42.50 (33)	31.50 (28)	820.000	.000	0.482
DifTR+	U Mann-Whitney	-12.00 (47)	-4.00 (34)	932.500	.000	-0.411
TR-PRE	U Mann-Whitney	14.00 (23)	12.00 (18)	1166.000	.016	0.264
TR-POST	U Mann-Whitney	16.50 (27)	14.50 (18)	1181.000	.020	0.254
DifTR-	U Mann-Whitney	-5.00 (36)	-4.50 (18)	1530.500	.758	/

Note: *For the Mann-Whitney U test, the effect size is given by the rank biserial correlation. ** The TAPRE variable was analysed with the parametric Student's t-test. The mean (Mean), standard deviation (SD), mean error deviation (Av. Err. Dev.)

Intra-subjects analysis

In relation to the intra-subjects analysis among participants of the experimental group, it was found that none of the variables analyzed complied with the assumptions of normality. Therefore, the nonparametric test of ranks with Wilcoxon sign for related samples was used to contrast pretest minus posttest results.

Statistically significant differences were observed in all variables, TR (p<.001), TA (p<.001), C (p=.001), TOT (p<.001), CON (p<.001), VAR (p=.001), TR+ (p<.001), and TR- (p<.001) with the exception of the variable O that did not present significant differences when subtracting pretest minus posttest scores (p=.050). The effect size of these differences ranged from medium for the variables C (Rb=0.349) and VAR (Rb=-0.493) to large for the variables TR (Rb=-0.755), TA (Rb=-0.759), TOT (Rb=-0.837), CON (Rb=-0.775), TR+ (Rb=-0.789), and TR- (Rb=-0.605). Table 5 shows the results obtained by the experimental group in the subtraction of pretest minus posttest variables through the Wilcoxon signed-rank test for related samples (Table 5).

Table 5
Intra-subject analysis of the experimental group using the Wilcoxon signed-rank test

		Pretest	Post test				
Variable	Test	Median (Range)	Median (Range)	Z	Sig. (Bil.)	Effect size*	SD Effect size
TRPRE - TRPOST	Wilcoxon	286.50 (305)	376.50 (438)	-5.334	.000	-0.755	0.141
TAPRE - TAPOST	Wilcoxon	104.00 (102)	138.00 (222)	-5.360	.000	-0.759	0.141
OPRE - OPOST	Wilcoxon	10.50 (125)	14.50 (184)	-1.963	.050	/	/
CPRE - CPOST	Wilcoxon	9.00 (75)	4.00 (102)	2.410	.016	0.349	0.144
TOTPRE - TOTPOST	Wilcoxon	258.50 (212)	344.00 (516)	-5.909	.000	-0.837	0.141
CONPRE - CONPOST	Wilcoxon	96.00 (127)	132.00 (289)	-5.475	.000	-0.775	0.141
VARPRE - VARPOST	Wilcoxon	15.00 (41)	20.00 (37)	-3.478	.001	-0.493	0.141
TR+PRE - TR+POST	Wilcoxon	28.00 (28)	42.50 (33)	-5.446	.000	-0.789	0.144
TR-PRE - TR-POST	Wilcoxon	14.00 (23)	16.50 (27)	-4.140	.000	-0.605	0.145

Note: *For the Wilcoxon signed rank test, the effect size is given by the rank biserial correlation.

On the other hand, and in reference to the intra-subjects analysis among the participants of the control group, the variables AT and TOT presented a normal distribution of the data and were analyzed by means of the

Student t-test for related samples. Statistically significant differences and large effect size were found in the pretest minus posttest result in AT (p<.001, d=-0.968) and TOT (p<.001, d=-1.312).

As for the rest of the variables (TR, O, C, CON, VAR, TR+ and TR-), they were analyzed by means of the nonparametric Wilcoxon signed-rank test for related samples because they did not present a normal distribution of the data. Statistically significant differences were found with a large effect size in the variables TR (p<.001, Rb=-0.848), CON (p<.001, Rb=-0.848) and TR- (p<.001, Rb=-0.795) and with medium effect size in TR+ (p=.020, Rb=-0.399). On the contrary, no statistically significant differences were found in the variables O (p=.497), C (p=.309) and VAR (p=.626). Table 6 shows the results obtained by the control group in the subtraction of pretest minus posttest variables through the nonparametric Wilcoxon signed-rank test for related samples and the parametric t Student test for related samples (Table 6).

Table 6.
Intra-subjects analysis of the control group using Wilcoxon signed-rank tests and Student's t-test for related samples.

Variable	Test	Pretest Median (Range)	Post test Median (Range)	Z	Sig. (Bil.)	Effect size*	SD Effect size
TRPRE - TRPOST	Wilcoxon	280.50 (339)	356.00 (438)	-5.009	.000	-0.848	0.168
TAPRE - TAPOST**	t Student (Paired)	99.10 (Mean) 24.26 (SD) 3.502 (Dev.Err. Av.)	120.25 (Mean) 31.288 (SD) 4.516 (Dev.Err. Av.)	-6.707 (t)	.000	-0.968 (Cohen's d)	0.131
OPRE - OPOST	Wilcoxon	10.00 (167)	11.00 (184)	0.677	.497	/	/
CPRE - CPOST	Wilcoxon	10.50 (95)	8.00 (103)	-1.015	.309	/	/
TOTPRE - TOTPOST**	t Student (Paired)	232.15 (Mean) 63.142 (SD) 9.114 (Dev.Err. Av.)	284.50 (Mean) 81.806 (SD) 11.808 (Dev.Err. Av.)	-9.087 (t)	.000	-1.312 (Cohen's d)	0.097
CONPRE - CONPOST	Wilcoxon	88.50 (157)	123.00 (289)	-5.009	.000	-0.848	0.168
VARPRE - VARPOST	Wilcoxon	15.00 (41)	19.00 (37)	0.487	.626	/	/
TR+PRE - TR+POST	Wilcoxon	28.00 (36)	35.00 (33)	-2.331	.020	-0.399	0.17
TR-PRE - TR-POST	Wilcoxon	13.00 (23)	15.00 (27)	-4.692	.000	-0.795	0.168

Note: *For the Wilcoxon signed rank test, the effect size is given by the rank biserial correlation and for the Student t-test by Cohen's d. **.The variables TAPRE-TAPOST and TOTPRE-TOTPOST were analysed with the parametric Student's t-test for related samples. The mean (Mean), standard deviation (SD), mean error deviation (Av. Err. Dev.), standard error of the difference between the two means (t), and effect size (Cohen's d) are presented.

Discussion

Using the BAPNE neuromotricity activities based on the dual-task method, we found five quantitative intervention studies with control and experimental groups and repeated measures (pretest-posttest) that evaluate attentional aspects in the educational setting between 8 and 13 years of age. These contain similarities and differences with the present study in terms of: study purpose, objectives, hypotheses, inclusion criteria, approach, design, type of analysis, statistical instruments, assessment test, population, sample, type of sampling, age of participants, duration, number, periodicity and length of sessions, variables analyzed and results obtained (Arnau-Mollá & Romero-Naranjo, 2020; Cozzutti et al., 2017; Piqueres-Juan et al., 2019; Romero-Naranjo & Sayago et al., 2023; Ros et al., 2019).

Among these we find research with substantial differences but worth commenting on to contextualize the study of different types of attention such as sustained attention (Álvarez & Romero-Naranjo, 2019; Piqueres-Juan et al., 2019; Romero-Naranjo & Sayago et al., 2023) and selective attention (Cozzutti et al., 2017) assessed by other types of tests.

On the one hand, Álvarez & Romero-Naranjo (2019) conducted a pilot study in Ceuta (Spain) with Muslim and Christian students of 1st year of Compulsory Secondary Education to assess executive functions and sustained attention through the neuromotricity BAPNE method. They work with a sample of N=61 participants distributed in experimental group (n=31) and control group (n=30) during six months, two sessions of 50 minutes per week. As in this study, they use a quantitative approach, quasi-experimental design, inter-intra-subjects analysis, and repeated measures, although through the CARAS-R sustained attention test (Thurstone et al., 2012), and treat their statistical data with the SPSS program.

On the other hand, Piqueres-Juan et al., (2019) carry out an investigation on sustained and selective attention in Alicante (Spain) with a sample of N= 57 participants of 1st year of Compulsory Secondary Education distributed in control group (n=29) and experimental group (n=28). They used a quantitative approach with a quasi-experimental between-subjects design, repeated measures through the CARAS-R sustained attention test (also the d2 on selective attention that will be discussed later), and data analysis in SPSS. Treatment was applied to the experimental group for 20 weeks in two 50-minute sessions per week.

Likewise, Romero-Naranjo & Sayago et al. (2023) conducted another pilot study in Alicante (Spain) with students in the 3rd year of Compulsory Secondary Education in the subjects of Physical Education, Music and Audiovisual Communication, in which they evaluated sustained attention and trait and state anxiety in a total of N=105 participants divided into control group (n=52) and experimental group (n=53) during five sessions of 50 minutes per week over 30 weeks. They use a quantitative approach, quasi-experimental design, inter- and intra-subject analysis by gender, and repeated measures by

means of the CARAS-R sustained attention test and also analyze the results with the SPSS statistical program.

Finally, Cozzutti et al. (2017) conducted a study in Friuli Venezia Giulia (Italy) with students aged 8-9 years old in the 3rd year of primary school, assessing executive functions, attention and concentration. They use a quantitative approach and a quasi-experimental design and repeated measures. The experimental group was administered during 2 sessions of 60 minutes each per week for 13 weeks. To assess selective attention, they used a part of the Nuovo attention and concentration test edited by Erickson and validated in Italy. They found statistically significant differences in the selective-visual attention in the experimental group. The control group also evolves significantly in this aspect, but to a lesser extent than the experimental group.

These four investigations substantially coincide in their research questions as to whether the neuromotricity activities BAPNE method can be positive for the possible stimulation of attention, as well as what differences will exist between the control and experimental groups. Likewise, they also coincide in their purposes of studying the effect of the activities and verifying their validity across the groups in which they have been applied. It should be noted that it is with the study by Romero-Naranjo & Sayago et al. (2023) with which we present the greatest coincidence in that they provide in the same work the purpose of the study, the research questions, the objectives and the hypotheses, both null and alternative, and the inclusion criteria. Finally, all these studies coincide in the type of non-probabilistic sampling by convenience and in finding statistically significant differences in favor of the experimental group in the increase of attention, suggesting that the neuromotricity activities of the BAPNE method based on the double task can be positive for the possible stimulation of the different types of attention of the students.

In reference to closely related research regarding the assessment of selective attention through the Brickenkamp (2012) d2 attention test published by TEA, three studies (Arnau-Mollá & Romero-Naranjo, 2020; Piqueres-Juan et al., 2019; Ros et al., 2019). In the first one, Arnau-Mollá & Romero-Naranjo (2020) conduct a study on selective attention in Valencia (Spain) with a total of N=67 participants of 3rd grade of Primary Education between 8 and 9 years old divided into control group (n=31) and experimental group (n=36). They used a quantitative approach, quasi-experimental inter-intra-subjects design, repeated measures, and data analysis in SPSS. They intervened the experimental group during 36 sessions of 50 minutes twice a week for 25 weeks. The second, Piqueres-Juan et al., (2019), has been described in previous paragraphs, but we will shortly contrast their results with ours in the evaluation of selective attention through the d2 attention test. In the third one, Ros et al. (2019) investigate selective attention in Valencia (Spain) with a sample of N=61 participants between eight and ten years old studying 1st and 2nd year of Professional Music Education divided into control group (n=34) and experimental group (n=27). They used a quantitative approach with a quasi-experimental between-subjects design, repeated measures, and data analysis in SPSS. In this case they applied an intervention to the experimental group during 20 sessions of 50 minutes, twice a week for 24 weeks.

As for common results and totally in agreement between our research and the three mentioned above, we found statistically significant differences in favor of the experimental group in the variables TR and TA in which the students to whom treatment was applied worked faster and made a greater number of correct answers in the test. It seems that the methodology applied has a greater effect on these variables than on the others. On the other hand, in the rest of the variables we found similarities and differences to be highlighted between the studies.

In variable O our results disagree with those provided by Arnau-Mollá & Romero-Naranjo (2020) and Ros et al. (2019) since in both cases they find significant differences in favor of the experimental group. In our case, neither of the two groups significantly decreases the number of omissions, although when comparing them a significant difference appears in which the control group makes fewer omissions. On the other hand, in variable C, our results are in agreement with these authors since statistically significant differences are found in favor of the experimental group due to the lower number of errors committed. In our case, the within-subjects analysis was significant for the experimental group, but not for the control group. The same authors found statistically significant differences in the variable TR- in favor of the experimental group in which this group managed to significantly increase the lower number of attempts of each line. In our study, significant differences were observed in the pretest onset between the two groups. This should invalidate this variable in the inter-subject analysis or at least take into consideration that such analysis could yield invalid results on this variable. On the other hand, and with total certainty, in the intra-subject analysis the two groups evolve in a statistically significant way in the variable TR-.

Regarding the TOT and CON variables, in the studies by Arnau-Mollá & Romero-Naranjo (2020) and Piqueres-Juan et al., (2019) statistically significant differences emerge in favor of the experimental group. In our study, once again, significant differences appear in the pretest of both variables in the inter-subject analysis, which would invalidate the result of these variables, or at least, the interpretation that the experimental group obtained greater evolution in the medians of the pretest minus posttest difference variables (TOT: -91.50, -57.00; CON: -39.00, -22.50) may not be valid. On the contrary, and with total certainty, in our intra-subjects analysis, statistically significant differences are found in the two groups in which both groups improve the concentration

index and in the total effectiveness of the test.

Referring now to the VAR variable, we agree with the results of the study by Piqueres-Juan et al. (2019) in which statistically significant differences are found in favor of the experimental group. In our study, moreover, in the within-subjects analysis the experimental group significantly increases the variability of the test while the control group remains stable and does not present significant differences.

Finally, we found two major differences in all the previous studies. The first is that none of them presents results for the variable TR+, which in our case, in the intra-subject analysis, significant differences emerge in both groups, while in the inter-subject analysis the statistically significant differences in the greater number of characters attempted in each line declines in favor of the experimental group. The second major difference is that our study is the only research, among those comparing their results, that presents the effect size of the differences emerged in the hypothesis contrast tests extracted as Biserial-Rank correlation according to Goss-Sapmson (2018) in the statistical program JASP.

Conclusion

The purpose of this study was to check whether the neuromotricity activities of the BAPNE method based on the dual task could improve selective attention and concentration in 5th grade primary school students.

Based on the results obtained in this work, we consider that the research questions have been answered, the proposed objectives have been achieved, and the null and alternative hypotheses have been accepted or rejected.

On the one hand, with respect to the type of inter-subject analysis that compares the results between students in the different groups:

Firstly, the first null hypothesis (H0-1) is rejected and the alternate hypothesis (Ha-1) is accepted, since there are no statistically significant differences in the pretest between the two groups in the variables TRPRE (p=.087), TAPRE (p=.129), OPRE (p=.512), CPRE (p=.051), VARPRE (p=.322) and TR+PRE (p=.349).

Secondly, the first null hypothesis (H0-1) is accepted for the variables TOTPRE (p=.006), CONPRE (p=.008), and TR-PRE (p=.016), since there are statistically significant differences at baseline in the pretest between the two groups. Therefore, these variables should be excluded from the study, since, although the DifTOT (p=<.001, Rb=-0.419) and DifCON (p=.010, Rb=-0.283) difference variables suggest that the experimental group improves statistically significantly more than the control group with a medium and small effect size, these results may not be valid due to the initial difference in the pretest.

After these two presentations, we can consider that the first objective has been achieved, since the initial level of selective attention and concentration has been quantitatively compared between the students of the experimental group that practiced the neuromotricity activities based on the BAPNE method and those of the control group that followed the traditional methodology. Thus, we can answer the first research question by saying that both the students in the experimental group and those in the control group started the pretest with the same level of selective attention and concentration in terms of total responses (TR), total hits (TA), omissions (O), commissions (C), test variability (VAR) and line with the highest number of characters attempted (TR+), but not in the total test effectiveness (TOT), concentration index (CON), and line with the lowest number of characters attempted (TR-).

Third, the second null hypothesis (H0-2) is rejected and the alternate hypothesis (Ha-2) is accepted, since statistically significant differences emerged in the posttest and in the difference variables (pretest minus posttest), in favor of the experimental group with medium effect size in the TRPOST variables (p=<.001, Rb=0.410), DifTR (p=<.001, Rb=-0.392); CPOST (p=<.001, Rb=-0.487); VARPOST (p=<.001, Rb= 0.386), DifVAR (p=.002, Rb=-0.337); TR+POST (p=<.001, Rb=0.482), and DifTR+ (p=<.001, Rb=-0.411); and with small effect size TAPOST (p=.025, Rb=0.246), DifTA (p=.021, Rb=-0.253); DifC (p=.021, Rb=0.253). And in favor of the control group with small effect size in the OPOST (p=.007, Rb=0.295) and DifO (p=.039, Rb=-0.226) variables.

As a result of these findings, we can consider the second objective to be fulfilled after having quantitatively compared the effect of both methodologies on students' selective attention and concentration. The answer to the second research question is that the neuromotricity activities of the BAPNE method based on the dual task can help to increase selective attention and concentration of students in 5th grade of Primary Education, improving, with a medium effect size, the total number of responses (TR), the decrease in commissions or errors (C), the variability of the test (VAR) and the line with the highest number of characters attempted (TR+); and with a small effect size, the number of hits (TA); but it contributes to the decrease in omissions (O).

On the other hand, with respect to the type of intra-subject analysis that compares the results between the pretest and the posttest of the students within the same group:

Fourth, and in reference to the experimental group practicing the neuromotricity activities BAPNE method based on the dual task, the third null hypothesis (H0-3) is rejected and the alternate (Ha-3) is accepted, since there are statistically significant differences between pretest and posttest, with a large effect size in the variables of selective attention and concentration TR (p<. 001, Rb=-0.755), TA (p<.001, Rb=-0.759), TOT (p<.001, Rb=-0.837), CON (p<.001, Rb=-0.775), TR+ (p<.001, Rb=-0.789), and TR- (p<. 001, Rb=-0.605); and with a median effect

size in the variables C (p=.001, Rb=0.349), and VAR (p=.001, Rb=-0.493).

Fifth, and continuing with the experimental group, the third null hypothesis (H0-3) is accepted, since there are no statistically significant differences between pretest and posttest in the variable O (p=.050).

Sixth, and now addressing the students in the control group using the traditional methodology, the fourth null hypothesis (H0-4) is rejected and the alternative (Ha-4) is accepted, because there are statistically significant differences between pretest and posttest, with a large effect size in the variables of selective attention and TR concentration (p<.050). 001, Rb=-0.848), TA (p<.001, d=-0.968), TOT (p<.001, d=-1.312), CON (p<.001, Rb=-0.848), and TR- (p<.001, Rb=-0.795); and with a medium effect size in the variable TR+ (p=.020, Rb=-0.399).

Seventh, and continuing with the control group, the fourth null hypothesis (H0-4) is accepted, since there are no statistically significant differences between pretest and posttest in the attention and concentration variables O (p=.497), C (p=.309) and VAR (p=.626).

Based on the arguments referred to the type of intra-subject analysis, which compares the results between the pretest and posttest of students within the same group, we consider that the third objective has been achieved, given that the effect of the practice of the neuromotricity activities of the BAPNE method based on the double task and the traditional methodology on the selective attention and concentration of students in the 5th grade of Primary Education has been quantitatively known. This reveals a negative answer to the third research question, since we can affirm that there is not the same evolution in selective attention and concentration between the two groups, and we base this on the fact that, although both improve significantly in total responses (TR), total hits (TA), total effectiveness of the test (TOT), concentration index (CON), line with the highest number of characters attempted (TR+), and line with the lowest number of characters attempted (TR-), the experimental group, unlike the control group, also improves statistically significantly in the decrease of commissions or errors (C), and in test variability (VAR).

In view of the above, the purpose of this research is considered to be proven and we express the idea that the neuromotricity activities of the BAPNE method based on the dual task can possibly improve the selective attention and concentration of 5th grade primary school students. Therefore, we believe that this methodology could have a beneficial didactic implication for the cognitive stimulation of the students and for the better professional performance of the 5th grade of Primary Education teachers.

Obviously, this study is not without limitations. It could present the program followed by both groups in order to know more precisely the activities carried out in each session during the intervention, or add the evaluation of other additional aspects such as sustained attention, anxiety, or social relations among peers.

As possible lines for the future, and of course, improving the existing limitations of this study, this research could be replicated in the same centers with new students, or in different centers of the same educational level. On the other hand, the research could also be replicated in the 1st, 2nd, 4th and 6th grades of Primary Education and in the 2nd and 4th grades of Secondary Education, since the BAPNE research group does not have research on selective attention and concentration in these grades. Comparing the results obtained in different studies and having research in all Compulsory Education would give us a much more solid general and panoramic vision, which would help to verify or refute the possible effectiveness of this methodology for the improvement of selective attention and concentration.

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