

Pilot Study of the Assessment of Anxiety and Attention through Body Percussion and Neuromotricity in Secondary School Students in Physical Education, Music and Visual Arts classes.

Estudio Piloto de la Evaluación de la Ansiedad y la Atención a través de la Percusión Corporal y Neuromotricidad en Alumnado de Secundaria en las clases de Educación Física, Música y Artes plásticas.

Francisco Javier Romero-Naranjo, Roberto Sayago-Martínez, Jesús Baldomero Jiménez-Molina, Antonio Francisco Arnau-Mollá

Universidad de Alicante (España)

Abstract. The aim of this study is to quantitatively measure the effect of the cognitive and socioemotional stimulation programme through the neuromotricity BAPNE method on trait anxiety, state anxiety and the attentional network in students in the 3rd year of Compulsory Secondary Education. The research was carried out in an educational centre in the Region of Murcia (Spain). The participants were N=105 students divided into an experimental group (n=53) and a control group (n=52). An intervention of 50 minutes five times a week for 30 weeks was applied to the experimental group using various programmes of activities of the BAPNE method. The control group continued with their programme without any changes. A quasi-experimental between-subjects design was used with pre- and post-intervention assessment measures. The assessment instruments were the test of anxiety (STAI) and the test of attention (Caras-R). The statistical software SPSS version 25 for Windows and Microsoft Excel were used for the preparation of Tables and Figures. Parametric and non-parametric tests were applied according to the statistical requirement. When comparing the difference between the pretest and the posttest, statistically significant results were observed in favour of the experimental group in state anxiety ($p < 0.001$), trait anxiety ($p < 0.001$), and in the increase in the number of net successes in the attention test ($p < 0.001$). Based on the results, we conclude that the programme of activities of the BAPNE method applied could possibly serve to reduce anxiety and increase the attention of the students in question, both in males and females.

Keywords: Body percussion, BAPNE, anxiety, attention, neuromotricity

Resumen. El objetivo de este estudio es medir cuantitativamente el efecto del programa de estimulación cognitiva y socioemocional a través de la neuromotricidad método BAPNE sobre la ansiedad rasgo, la ansiedad estado y la red atencional en alumnado de 3º de Educación Secundaria Obligatoria. La investigación se llevó a cabo en un centro educativo de la Región de Murcia (España). Participaron N=105 alumnos divididos en grupo experimental (n=53) y grupo control (n=52). Se aplicó una intervención al grupo experimental de 50 minutos cinco veces por semana durante 30 semanas utilizando varios programas de actividades del método BAPNE. El grupo control siguió con su programación sin aplicar ningún cambio. Se utilizó un diseño cuasi-experimental inter-intra-sujetos con medidas de evaluación antes y después de la intervención. Los instrumentos de evaluación fueron el test de ansiedad (STAI) y el test de atención (Caras-R). Se utilizó el programa estadístico SPSS versión 25 para Windows y Microsoft Excel para la confección Tablas y Figuras. Se aplicaron pruebas paramétricas y no paramétricas en función del requerimiento estadístico. Al comparar la diferencia del pretest menos el posttest se observaron resultados estadísticamente significativos a favor del grupo experimental en ansiedad estado ($p < 0.001$), ansiedad rasgo ($p < 0.001$), y en aumento del número de aciertos netos del test de atención ($p < 0.001$). En base a los resultados se concluye que el programa de actividades del método BAPNE aplicado posiblemente pueda servir para la reducción de la ansiedad y el aumento de la atención del alumnado en cuestión, tanto en varones como en mujeres.

Palabras clave: Percusión corporal, BAPNE, ansiedad, atención, neuromotricidad

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Francisco Javier Romero-Naranjo
bapne.central@gmail.com

Introducción

Body percussion is a transversal subject that can be used in physical activity and sport sciences, as well as in music, in the learning of a foreign language or even in the plastic arts (Romero-Naranjo, 2013, 2021a; Arnau-Mollá & Romero-Naranjo, 2022a, 2022b).

The existing literature provides specific and systematic resources for each area from its link to neuromotor skills (Andreu-Cabrera & Romero-Naranjo, 2021), to the historical aspects with its detractors and defenders (Trives-Martínez et al., 2018), its specific vision in each musical methodology (Trives-Martínez & Vicente-Nicolás, 2013) or even specific variants in the form of writing according to each author (Sánchez-González et al., 2018). Due to all this wide range of contributions we can classify the use of body percussion in two major areas that we detail below:

- Recreational body percussion. It is the one that fo-

cuses on the realization of choreographies as well as coordination under a musical base as well as activities without a logical structure and sequence. They are more entertainment activities with the objective of amusing and entertaining than to really form. Several academic sectors do not share this way of proceeding as is the case of speech therapists in which language is vital, as well as neuropsychologists and movement specialists. In a dance conservatory an accompanying pianist is hired (pre-recorded music is not usually played). The research line of the BAPNE method is not in line with this way of working since it is focused on the work of the dual task in which the voice plays a vital role in cognitive stimulation (Romero-Naranjo, 2020c).

- Academic body percussion. These are those activities whose precise and well-founded objective is the possible improvement not only of motor control and learning, but also of cognitive and executive functions. In this case the

learning is systematic and created ex profeso by specific areas. Thus, there are specific programs taught in universities for subjects such as physical activity and sports science, mathematics learning or musical language (Patel et al., 2014). For this reason, 90% of academic publications are along these lines (Arnau-Mollá & Romero-Naranjo, 2022b).

Through all the previous studies on this subject, we wonder if it is possible to evaluate and obtain positive results in which body percussion based on neuromotricity (dual task) can give effective results in relation to attention and anxiety.

The research line of the BAPNE method is linked to the work of the executive functions, and specifically, to the dual task. The existing literature on dual-task work and its benefits is growing after the positive results obtained by several authors (Beauchet et al., 2005; Dubost et al., 2008; Ijmker, & Lamoth 2021; Jacobs, 2021; Kim & Yoo, 2020; Mirelman et al., 2014; Park, & Brünken, 2014; Park, & Kim, 2021; Teixeira, Gobbi, Pereira, Ueno, et al., 2013; Teixeira, Gobbi, Pereira, Vital, et al., 2013; Thornberg et al., 2014; Yogev et al., 2005). For this reason, there is already literature that justifies the line of work proposed in this research, our research being to link it to the attentional network and anxiety in adolescents.

Areas of performance of body percussion

From a theoretical-practical point of view, body percussion can be classified according to the BAPNE method in the following main fields of action (Romero-Naranjo, 2020a):

- Didactic. It is the one that produces books or academic articles for its later application in the classroom in a structured and systematic way with its corresponding graphics. This corresponds to all resources related to physical education and sports sciences, musical language, mathematics, foreign language learning, visual arts or creativity among others.

- Ethnographic - Ethnomusicological. These are publications that deal with the use of the body in other cultures in relation to its use, meanings and functions, where ethnography, anthropology and ethnomusicology play a very important role.

- Neuropsychological. Quantitative publications based on neuromotor skills with a control group and an experimental group in which both cognitive and executive functions are measured.

- Kinesthetic. Publications that offer information on its link with biomechanics as well as the improvement of motor coordination, dissociation, laterality or gross and fine psychomotor skills.

- Socioemotional. Research that provides both proposals and measurements of an improvement in the socioemotional climate.

- Space and Architecture. Educational proposal of suitable architectural spaces for the implementation of this

type of activities.

- Team Building. Studies that propose and systematize the use of body percussion in business or group management.

- Historical. Publications related to historical aspects, with its antecedents and precursors of body percussion.

- Foundation - Justification. Publications that justify in a precise way how to move the body with its purpose and objective at the same time that classify the types of activities through motor control and learning.

- Transversal learning. It is the one that uses the corporal percussion not as main object but as a tool for the learning of another subject like solfeggio or musical language (cognitive solfeggio), a foreign language, mathematics, geography, corporal expression or scenic arts.

- Spectacle. It is the contribution made through the performing arts in which body percussion is the central axis of the show. We highlight companies such as Stomp or Barbatuques among others.

Due to the wide range that body percussion allows, in this research we intend to work in an interdisciplinary way with the department of Physical Education, Music and Visual Arts.

Regarding the visual arts it is worth mentioning the publications of Alonso (2015), regarding the sciences of physical activity and sport, the BAPNE Fit program stands out (Romero-Naranjo, 2022a). In the musical aspect, it is worth mentioning the specific program for learning musical language called cognitive solfeggio (Romero-Naranjo, 2020, 2022a, 2022b; Romero-Naranjo & Sayago-Martínez, 2021a, 2021b) and regarding the learning of a foreign language (Fernández et al., 2020) as well as many other introductory publications.

For this reason, in the physical education classes during this project, activities from BAPNE Fit are used, where Step, elastic bands, Blazepod, visual plates of the BAPNE method, stroboscopic glasses, Penalty Box, among others, are used. As far as the visual arts are concerned, many artistic-historical resources are used, as well as links to plastic arts and video art. In secondary music classes, the program of activities from the cognitive solfeggio is used, thus complementing the activity protocols in both subjects.

Taking advantage of all this bibliographic corpus that offers numerous practical resources, a research design is developed for secondary school where each subject is taught under the same central axis: body percussion through neuromotor skills that has a bridge to various subjects in a transversal way to evaluate anxiety and attention.

State of the question

The benefits of physical activity and sport in human beings are becoming more and more demonstrable thanks to the extensive literature on the subject. Many authors have shown that physical exercise is very positive at the motor, psychomotor, cognitive and socioemotional levels (Aguilar

et al., 2021; Carretero-Martínez et al., 2014; Carretero-Martínez & Romero-Naranjo, 2015; Martínez et al., 2021; Pacheco et al., 2022; Padial-Ruz et al., 2022; Palma et al., 2021; Pérez et al., 2022; Romero et al., 2021; Rosa-Guillamón et al., 2021; Sayago-Martínez, et al., 2021; Zambrano et al., 2022). In the same way, studies have been carried out in which various parameters are analyzed in parallel to see if there is a relationship between them, such as physical activity and anxiety, memory or calculation, finding very positive results (Luis-de Cos et al., 2019; Mezcuá-Hidalgo et al., 2020; Villa et al., 2019). It is also necessary to highlight very specific action protocols such as musicomotricity, play or ludomotricity (Burbano et al., 2021; González, 2022; Muñoz-Arroyave et al., 2020).

With regard specifically to body percussion, it is vital to cite the publication by Arnau-Mollá & Romero-Naranjo (2022a) which, through a bibliometric study based on high-impact search engines, quantifies the number of authors, citations, topics and many other aspects in Web of Science and Scopus.

As discussed above, body percussion has been classified through 11 domains that make up a range of practical as well as research resources. Currently, the BAPNE method is the only methodology that has completely diverse programs according to the areas in which it operates, with their corresponding academic publications. For this reason, its publications serve as support for the elaboration of this research.

There are preliminary publications linked to body percussion in terms of cognitive functions and anxiety (Arnau-Mollá & Romero-Naranjo, 2020; Jiménez-Molina et al., 2017; Moral et al., 2020; Piqueres-Juan et al., 2019; Ros-Silla et al., 2019) and in relation to executive functions (Álvarez-Morales & Romero-Naranjo, 2019; Castelló-Juan et al., 2019; Cozzutti et al., 2017; Fernández et al., 2019; González et al., 2019; Latre-Nava et al., 2019; Torró-Biosca et al., 2019).

The purpose of this study was to test whether the activities of the BAPNE method could improve the attention and anxiety of students in the 3rd year of Compulsory Secondary Education (CSE).

Research questions, objectives, and hypotheses

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

- Can the BAPNE activities help to increase attention and reduce anxiety in 3rd grade CSE students?
- Will students who practice the BAPNE activities improve to the same extent as those who do not practice them?
- Will girls and boys separately who practise the BAPNE activities improve as much as their counterparts who do not practise the activities?

Similarly, in order to find out the answer to these research questions, we set ourselves the following objectives:

- To quantitatively test the impact of practising the

BAPNE method activities on attention and anxiety in 3rd year CSE students.

- To quantitatively compare the impact of the practice of the activities of the BAPNE method versus the traditional methodology in 3rd year CSE students.

- To quantitatively compare the impact of the practice of the BAPNE method activities versus the traditional methodology on girls and boys in both groups of students in the 3rd year of CSE.

Based on these objectives, we proposed a series of null and alternative hypotheses to be tested for each type of analysis carried out:

Inter-subject analysis:

- (H0-1) There will be no significant differences in favour of the experimental group that practised the activities of the BAPNE method compared to the control group that did not practise them in the results of the anxiety variables DifA/S, DifA/T and attention DifH/E.

- (H1-1) There will be significant differences in favour of the experimental group that practiced the BAPNE method activities versus the control group that did not practice them in the results of the DifA/S, DifA/T anxiety and DifH/E attention variables.

Intra-subjects analysis:

- (H0-2) There will be no significant differences in the experimental group that practiced the activities of the BAPNE method in the results of the DifA/S, DifA/T and DifH/E anxiety variables.

- (H1-2) There will be significant differences in the experimental group that practiced the activities of the BAPNE method in the results of the DifA/S, DifA/T and DifH/E anxiety variables.

- (H0-3) There will be no significant differences in the control group that did not practice the activities of the BAPNE method in the results of the DifA/S, DifA/T and DifH/E anxiety variables.

- (H1-3) There will be significant differences in the control group that did not practice the activities of the BAPNE method in the results of the DifA/S, DifA/T and DifH/E anxiety variables.

Inter-subjects analysis divided by sex:

- (H0-4) There will be no significant differences in favour of females in the experimental group who practised the BAPNE method activities versus females in the control group who did not practise the activities in the DifA/S, DifA/T and DifH/E anxiety variables.

- (H1-4) There will be significant differences in favour of the women in the experimental group who practised the BAPNE method activities compared to the women in the control group who did not practise them in the results of the DiffA/S, DiffA/T and DiffH/E anxiety variables.

- (H0-5) There will be no significant differences in favour of the males in the experimental group who practised the BAPNE method activities compared to the males in the control group who did not practise them in the results of the DiffA/S, DiffA/T and DiffH/E anxiety variables.

- (H1-5) There will be significant differences in favour

of the males in the experimental group who practised the BAPNE method activities versus the males in the control group who did not practise them in the results of the DiffA/S, DiffA/T and DiffH/E anxiety variables.

Method

A quantitative approach was used with a quasi-experimental design between subjects and between subjects according to sex, with a control and experimental group, and repeated measures before and after the intervention. SPSS version 25 was used for the statistical analysis and Microsoft Excel was used for the tables and figures.

For the statistical analysis by sex, normality and homoscedasticity tests (Sapiro Wilk, Leven) were carried out and, depending on the results obtained, the relevant parametric (Student's t-test for independent samples) or non-parametric (Mann-Whitney U test for independent samples) tests were subsequently applied. In the inter-subject analysis, on the other hand, normality of the sample was assumed on the basis of the central limit theory and Student's t-tests were applied for independent samples and for related samples.

Participants

The research was carried out in its entirety at the Diego Tortosa Secondary School located in the town of Cieza in the Region of Murcia (Spain) with students in the 3rd year of ESO. A non-probabilistic sampling by convenience was used since the groups were already formed with a sample of N=105 participants divided into a control group and an experimental group of similar socioeconomic and cultural characteristics belonging to a lower-middle social class. 51.43% of the participants were female (54) and 48.57% male (51).

The experimental group (n=53) consisted of 25 females (47.17%) and 28 (52.83) males, of which four boys were of South American origin, one boy from Bulgaria and one Moroccan girl. In addition, four students had previously studied music, three students were repeaters and two students had Special Educational Needs (SEN).

The control group (n=52) consists of 26 girls (50%) and 26 boys (50%). Among them we find four South American girls, one Ukrainian girl, one Moroccan girl, one pupil repeating a year and three female pupils with SEN. Figure 1 shows the distribution of males and females in the samples.

In order to participate in the research, all of the following inclusion criteria had to be met:

- The legal guardians of the pupils had to have signed the consent to participate.
- The students had to have attended at least 80% of the sessions.
- The students had to have correctly completed the tests and questionnaires applied in the two evaluation moments (pre-test-post-test).

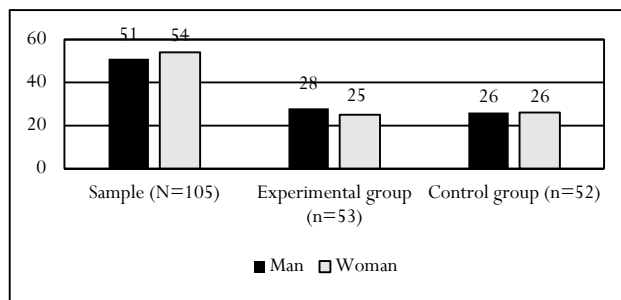


Figure 1. Number of males and females in the samples

Instruments and materials

This section presents, on the one hand, the assessment instruments used to test the attentional processes and anxiety states of the students: a test and a questionnaire published by TEA Ediciones, validated in Spain and adapted to the ages of the participants. On the other hand, we show the types of neuromotricity activities listed in the Glossary of the methodology and which were applied as an intervention treatment to the experimental group, these being specified and detailed sequentially, both in the Didactic Programming volumes 1 and 2, as well as in the manuals Body percussion. Theoretical practical foundation volumes 1 to 5, Bodypercussion basic, and BAPNE Fit (Romero-Naranjo, 2014, 2018a, 2018b, 2019a, 2019b, 2020, 2022b).

In relation to the assessment instruments, the State-Trait Anxiety Questionnaire (STAI) revised in Spain by Buela-Casal (2011) was applied, which stands out as one of the most validated instruments used by researchers and various mental health professionals, being the seventh most used questionnaire in Spain (Muñiz & Fernández-Hermida, 2010). It was created according to the model of Spielberger et al. (1982) and assesses anxiety as a transitory state (State-Anxiety) and as a latent trait (Trait-Anxiety). The authors conceptualise Anxiety-State (A/S) as a transient emotional state or condition of the human organism, which is characterised by subjective, consciously perceived feelings of tension and apprehension, as well as by a hyperactivity of the autonomic nervous system that may vary in time and fluctuate in intensity. The same authors describe Trait Anxiety (TA) as a relatively stable anxious propensity whereby subjects differ in their tendency to perceive situations as threatening and, consequently, to elevate their TA. The scope of application of the STAI ranges from adolescents to adults and consists of an application of approximately 15 minutes. It consists of two Likert-type scales (A/S and A/T) with 20 items each and four response options. The A/S scale contains 20 sentences in which the subject can describe how he/she feels at "a certain moment" on a scale of zero to three ranging from "not at all" (zero) to "very much" (three). In contrast, the A/T scale, also with 20 sentences, can show how the subject feels "usually" with a scale of zero to three ranging from "almost never" (zero) to "almost always" (three).

The other assessment instrument applied was the Fac-

es-R: Perception of Differences-Revised test by Thurstone et al. (2012), which assesses the ability to quickly and correctly perceive similarities and differences in partially ordered patterns of stimuli. It measures perceptual and attentional skills using 60 graphic items, each consisting of three schematic drawings of faces with mouth, eyebrows, eyes and hair with elementary strokes. Two of the faces are the same and the task is to perceive which one is different and cross it out. It is limited to three minutes and can be used individually or in groups. Its scope of application is from 1st Primary Education (6 to 7 years) to 2nd Baccalaureate (17 to 18 years) and in this revised version the scores to calculate are:

- Hits (H). Total number of correct answers. Faces that are correctly crossed out.
- Errors (E). Total number of errors.

- Net hits or hits minus errors (H/E). It is calculated by subtracting the total number of correct answers from the total number of errors, thus obtaining a more accurate measure of the subject's real performance by penalising errors; in other words, it measures the subject's efficiency.

With regard to the activity protocols mentioned above, which were applied as a treatment to the experimental group, numerous activities related to cognitive, psychomotor and socioemotional stimulation were carried out in which the praxias served as the central axis for the work of stimulating cognitive functions and executive functions. Figure 2 shows the Glossary of BAPNE activities, which served as a structure and table of exercises to be followed throughout this research and in which the different types of activities applied to the experimental group are included.

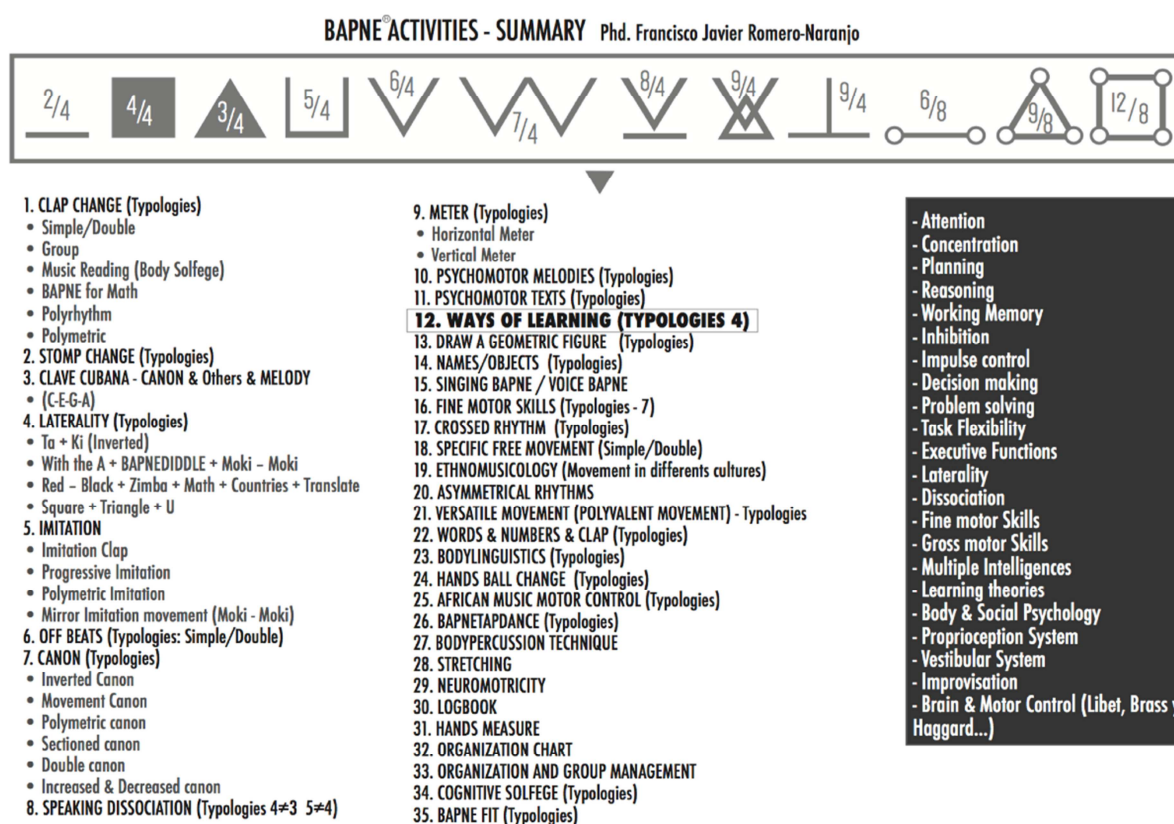


Figure 2. Glossary of activities (Romero-Naranjo, 2018)

Among them, it is worth highlighting an activity of vital importance within the BAPNE method called Hansball Change, which allows neuromotricity to be worked on from all aspects. It has been observed that with the practice of the different types of this activity, in addition to working on praxis, dissociation and limb coordination, it can be a very valuable resource for the stimulation of cognitive functions, executive functions and multiple skills, as well as favouring group cohesion and the creation of bonds through cooperative and inclusive work. Figure 3 shows an example of the great possibilities offered by this type of activity.

The following is an explanation of some of its applications in the classroom, the scientific basis on which it is

based and the possible cognitive and executive functions that are stimulated through its practice.

It is carried out in two concentric circles facing each other and using different objects such as balls, sticks, triangular or square figures, among others. The rhythmic structures used, in their simplest and most accessible version to be applied in the classroom, are based on geometric figures such as the square and the triangle, which are executed with the lower limbs and which correspond to the musical measures 3/4 and 4/4. In its more complex version, other types of geometric figures are used, as well as other types of horizontal metres that correspond to other types of musical measures.

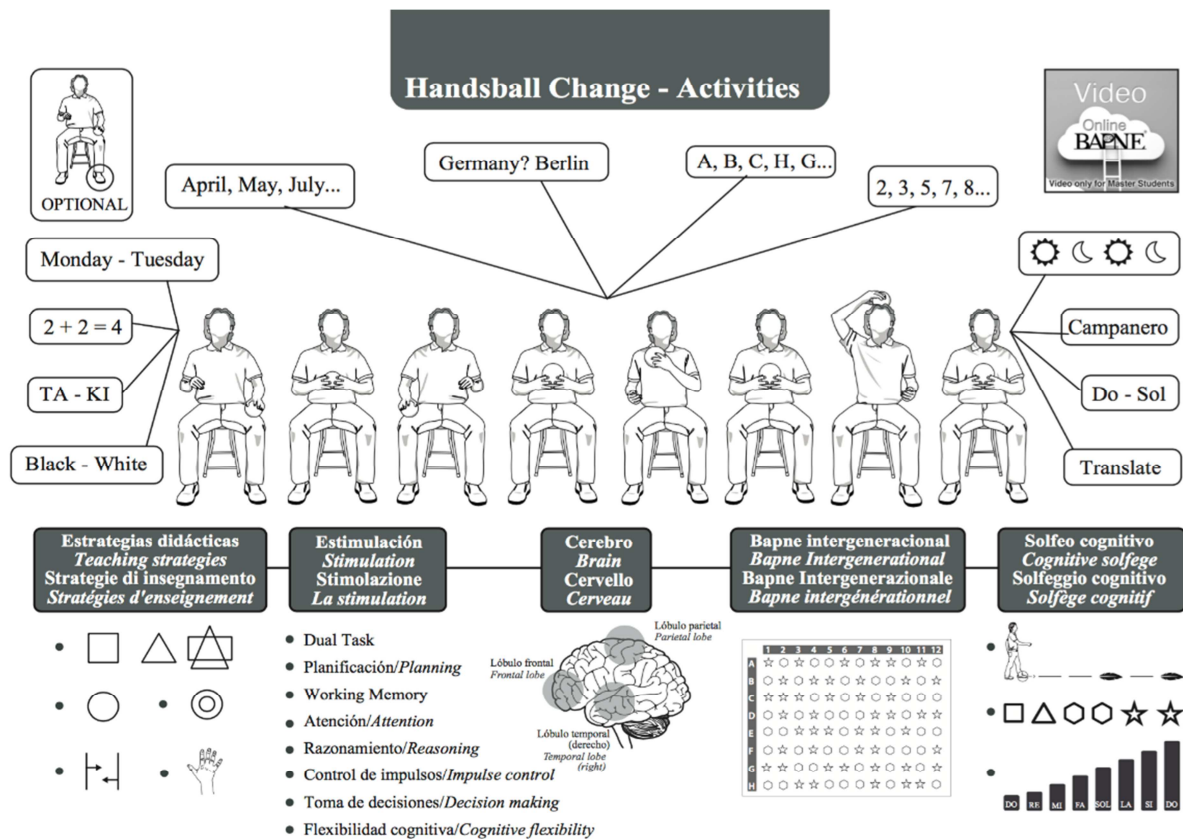


Figure 3. Handsball Change model (Romero-Naranjo, 2019c)

The outer circle moves in a square while counting from one to four by assigning a number to each movement of the feet. At the same time, the inner circle moves in a triangle counting from one to three, also assigning a number to each foot movement. The teacher verbally indicates to pass the ball to the right or left on time or number one.

Maintaining the activity requires great attentional resources, as the distracting stimulus is very strong due to the fact that the circle in front of you performs differently, the movement of the geometric figure (square vs triangle), the counting of beats (one to four vs one to three) and the direction of the ball (the partner in front of you passes it to your right, but you perceive that it passes it to your left). This sequence can be extended once it has been assimilated by changing the geometric figure and the number in which the ball should be passed as you go along, or by singing a melody in a different time signature to the one being performed with the lower limbs, for example a melody in 5/4. The difficulty will increase progressively, always depending on the group, and of course, to the degree necessary so as never to generate learned helplessness.

This activity created exclusively within the BAPNE methodology is within the paradigm of dual-task work. Dual task is the ability to perform two completely different tasks at the same time. There are different classical dual task paradigms such as: 1) motor-motor paradigm, 2) cognitive-motor paradigm, and 3) cognitive-cognitive paradigm.

There is a large scientific base describing the positive use of dual-task while walking or moving in space, both in

healthy individuals and those with a disease or illness (Bååth et al., 2016; Chen, & Pei, 2018; Fritz et al., 2015; Malcolm et al., 2009; Perrochon et al., 2015; Plummer-D'Amato et al., 2011; Silsupadol et al., 2006; Woollacott, & Shumway-Cook, 2002).

In recent years, Korean researchers have studied this line of research extensively, creating a new paradigm whose article entitled *The applicability of rhythm-motor tasks to a new dual task paradigm for older adults* provides a fourth paradigm in which rhythmic aspects are involved, a line in which the BAPNE method has always worked (Kim et al., 2017a, 2017b, 2022). Regarding the performance of rhythmic activities related to the subject's gait, studies have investigated this in more depth (Kim et al., 2017a, 2017b, 2022; Loehrer et al., 2016; Montero-Odasso et al., 2012; Oh & Chong, 2016; Patel et al., 2014; Schrodt, et al., 2004).

For this reason, and after reviewing the literature on the use of the dual task, we proceeded to detail which cognitive functions are possibly stimulated by the Handsball Change activity:

- Sustained attention: by maintaining a specific sequence without varying it for a prolonged period of time, such as moving in a square and passing the ball in time 1 to the right. As the duration increases and after a certain number of repetitions, the level of vigilance drops, so it will require focusing attention on the task to sustain it.
- Selective attention: when the two concentric circles facing each other perform different meters from each other. This implies different displacement, clapping that

diverge and converge in time and different references with the voice (spoken or sung). All these visual and auditory stimuli emitted simultaneously produce interference, so the information must be properly selected, inhibiting that which interferes with the task and attending to that which is relevant (Bååth et al., 2016).

- Alternating attention: when passing the ball in time 1 (to the right or left) while continuously alternating the meter between the square and the triangle. Also by holding a figure and constantly changing which number to pass the ball on, and can increase the difficulty by adding voice. This requires mental flexibility to perform the alternation.

- Divided attention: when moving in square while passing the ball in time 1 and 3, being used the voice when singing or responding to simple mathematical operations. This would be the most complex level of attention.

- Language: involves the spoken, recited, sung and listened aspects. It occurs when counting numbers, reproducing changing syllabic rhythmic structures (TA KI), improvising text, singing songs in different languages (Spanish, African, English or Italian) or elaborating an appropriate verbal response after listening and understanding the information.

- Praxias: these are the motor skills of executing a movement to achieve a goal. When passing with precision and efficiency a ball or object of different size, weight, shape, roughness; if it is to the right, the right hand placed in pronation passes the ball and at the same time another ball is received with the left hand in supination while the participant moves.

- Memory: by evoking both the sequence of kinesthetic movements previously learned in the horizontal and vertical plane (procedural memory), as well as alluding to various general knowledge and remembering the lyrics of songs (semantic memory).

- Visuospatial skills: allow awareness of one's own position in space in relation to other objects, mentally manipulating them, calculating distances and not bumping into each other (sometimes this has occurred during the activity).

- Spatial orientation: this is the ability to orient one's movements in the near space. When performing the determined geometric figure and, for example, changing it, it entails a different performance in the new displacement; modification of the number of times, change in the laterality and directionality that was maintained. The more continuous the change of figures, the more difficulty in orientation (Fritz et al., 2015).

- Social cognition: refers to how the student thinks of himself, of others and their behavior, of social relationships, how he makes sense of this information and acts on the basis of it. A mistake when performing this activity means being exposed to others, since it does not go unnoticed; this becomes a great learning opportunity to see why it happened, what the feeling is and, far from being

penalized by the group, it gives support, helps to recover from the situation and comforts at a socioemotional level since it understands that it is part of the learning process in which everyone is involved.

Within the cognitive functions are the executive functions, which do not point to a unitary system but to a supramodal system in which each author defines them according to his or her starting assumption. The neuropsychologist Lezak (1982) coined the term to refer to a constellation of capacities involved in formulating goals, planning for their achievement and executing behavior effectively. The following are the executive functions that are likely to be stimulated through the dual task se with the Handball Change activity (Romero-Naranjo, 2019c):

- Processing speed: reflects the amount of information that can be processed per unit of time, the speed at which a series of cognitive operations can be performed, or the time elapsed from the appearance of a stimulus until we execute a response. When text is improvised, changing rhythmic figures, questions are asked to be answered quickly in the next measure, mathematical operations are performed verbally.

- Working memory: is the capacity to record, encode, maintain and manipulate information; it is constantly being updated. The use of TA KI syllables offers a rich tool to perform multiple binary combinations and create rhythmic structures, resulting from the simplest to the most complex imaginable.

- Verbal fluency: related to the processes that carry out the appropriate word search strategies and their appropriate response. During the activity, song lyrics are sung by substituting their respective vowels exclusively for "a", for "e", etc. For example, "Campanara, campanara, dánda astás, dánda astás..."

- Inhibition: is the ability to control impulses, interferences or distracters while performing a task. When to pass the ball in the indicated number of time and not before, change the direction, introduce voice at certain times and without voice at others.... (note that the circle in front of you will not be performing in the same way).

- Dual execution: the ability to perform two tasks (of different types) simultaneously while paying constant attention to both. This is usually a verbal and a visuospatial task. By using the spoken or sung word while continuously moving in a geometric figure.

- Cognitive flexibility: allows us to make changes to something that has already been previously planned and thus adapt to the circumstances of our environment. That is, when an indication is given during the activity to be executed next and before executing it, it is changed.

- Planning: is the ability to carry out mental rehearsals on possible solutions and their consequences before trying them out "in the real world". When indications of what is to be done are received, the participant develops action plans to achieve it.

- Decision making: is the process of making a

choice among several possible choices based on needs, evaluating the results and consequences of each. When the pupil takes on the role of teacher and leads the group.

- Branching or multitasking: is the ability to organize and perform tasks optimally simultaneously, interspersing them and knowing where each of them is at any given moment. When the lower limbs perform a geometric figure that will change, the upper limbs pass and receive the ball in one or more beats of the measure and the voice intones, for example, on the 1st beat C, on the 3rd beat E and on the 4th beat G.

Procedure

After the acceptance of the project by the school in September, the legal guardians of the students were informed about the development of the research and the authorisations for participation were signed, followed by the preliminary tests using the STAI and Caras-R assessment instruments, supervised by the neuropsychologist responsible and in charge of evaluating the aspects of the tests.

The intervention sessions began in October and lasted for 30 weeks until May, excluding the Christmas and Easter holiday periods. In the experimental group, an intervention of five weekly sessions of 50 minutes each was carried out in the Music, Physical Education and Audiovisual Communication classes, and the aforementioned protocols of music-motor neuromotoricity activities of the BAPNE method were applied as a treatment.

The structure of the sessions applied to the experimental group was divided into three sections. 1) Start-up rite (5% of the session), through melodies and welcome activities, presentation and contact with classmates. 2) Cognitive, socio-emotional and psychomotor stimulation (85% of the session), through activities with a high level of cognitive stimulation. 3) Closing ritual (5% of the session), with some activities to calm down, with little or no cognitive stimulation, and others of stretching and relaxation.

On the other hand, in the control group, a traditional teaching methodology continued to be applied in all these subjects, without altering the didactic programme at any time.

Once the intervention was completed in both groups, the post-test evaluation was carried out in May and the

questionnaires were corrected and analysed to extract the results. Finally, the tests and questionnaires were corrected and the data were analysed in the SPSS statistical programme to extract the results.

Results

In both the inter-subject analysis (different groups) and the intra-subject analysis (same group), normality of the samples was assumed by the central limit theorem and the Student's t-test was applied for independent samples in the former, and for related samples in the latter.

In the inter-subject analysis, the comparison of means between the experimental group and the control group was carried out and no significant differences were found in the pre-test, but significant differences were found in the post-test for all variables. Statistically significant differences were found in the post-test means for all variables in favour of the experimental group A/S Post ($p=0.004$), A/T Post ($p=0.044$), and H-E Post ($p<0.001$). Likewise, the variables DifA/S, DifA/T, and DifH-E, which measure the difference between the scores obtained in the pretest minus the posttest, were analysed and statistically significant differences were found, also in favour of the experimental group with a prevalence of $p<0.001$ in each of them. Table 1 and Table 2 present the descriptive statistics and the results of the independent samples tests.

Table 1.
Groups statistics

Variable	Group	N	Mean	Dev.	Dev. Err. Average
A/S PRE	Experimental	53	18.13	5.857	0.805
	Control	52	16.56	7.660	1.062
A/S POST	Experimental	53	14.34	5.491	0.754
	Control	52	18.63	8.172	1.133
DifA/S	Experimental	53	-3.79	5.242	0.720
	Control	52	2.08	4.144	0.575
A/T PRE	Experimental	53	18.89	7.111	0.977
	Control	52	17.27	6.817	0.945
A/T POST	Experimental	53	16.08	6.066	0.833
	Control	52	18.92	6.477	0.898
DifA/T	Experimental	53	-2.81	4.407	0.605
	Control	52	1.65	4.279	0.593
H/E PRE	Experimental	53	35.98	3.851	0.529
	Control	52	35.65	3.678	0.510
H/E POST	Experimental	53	47.55	3.154	0.433
	Control	52	38.35	3.870	0.537
DifD/E	Experimental	53	11.57	1.760	0.242
	Control	52	2.69	2.661	0.369

Table 2.
Test of independent samples: Levene's test for equality of variances and t-test for equality of mean

Variable	Group	F	Sig.	t	gl	Sig. (bilateral)	Mean Dif.	SD Err. Dif
A/S PRE	Equal variances assumed	4.857	0.030	1.184	103	0.239	1.574	1.329
	Equal variances not assumed			1.181	95.478	0.240	1.574	1.333
A/S POST	Equal variances assumed	11.650	0.001	-3.166	103	0.002	-4.295	1.356
	Equal variances not assumed			-3.155	89.051	0.002	-4.295	1.361
DifA/S	Equal variances assumed	4.402	0.038	-6.357	103	0.000	-5.869	0.923
	Equal variances not assumed			-6.371	98.567	0.000	-5.869	0.921
A/T PRE	Equal variances assumed	0.070	0.791	1.189	103	0.237	1.618	1.360
	Equal variances not assumed			1.190	102.946	0.237	1.618	1.359
A/T POST	Equal variances assumed	1.380	0.243	-2.326	103	0.022	-2.848	1.224
	Equal variances not assumed			-2.324	102.268	0.022	-2.848	1.225
DifA/T	Equal variances assumed	0.103	0.749	-5.266	103	0.000	-4.465	0.848
	Equal variances not assumed			-5.267	102.989	0.000	-4.465	0.848

H/E PRE	Equal variances assumed	0.027	0.869	0.445	103	0.657	0.327	0.735
	Equal variances not assumed			0.445	102.927	0.657	0.327	0.735
H/E POST	Equal variances assumed	3.179	0.078	13.367	103	0.000	9.201	0.688
	Equal variances not assumed			13.341	98.215	0.000	9.201	0.690
DifH/E	Equal variances assumed	3.540	0.063	20.193	103	0.000	8.874	0.439
	Equal variances not assumed			20.117	88.227	0.000	8.874	0.441

On the other hand, in the within-subjects analysis, pretest-posttest means were compared to see if there were within-group changes between before and after the intervention. Statistically significant differences were found in both groups for all variables when subtracting the pretest minus the posttest means.

The experimental group decreased A/S and A/T ($p < 0.001$) and increased H/E ($p < 0.001$). In contrast, the control group increased more the variables A/S, A/T and by $p = 0.002$, $p = 0.014$, and also increased the variable H/E by $p < 0.001$. Table 3 and Table 4 after comparing the pretest and posttest with the Student's t-test for related samples.

Table 3. Single sample group statistic

Group	Variable	Mean	N	Deviation	Desv. Error average
Experimental	A/S PRE	18.13	53	5.857	0.805
	A/S POST	14.34	53	5.491	0.754
	A/T PRE	18.89	53	7.111	0.977
	A/T POST	16.08	53	6.066	0.833
	H/E PRE	35.98	53	3.851	0.529
	H/E POST	47.55	53	3.154	0.433
Control	A/S PRE	16.56	52	7.660	1.062
	A/S POST	18.63	52	8.172	1.133
	A/T PRE	17.27	52	6.817	0.945
	A/T POST	18.92	52	6.477	0.898
	H/E PRE	35.65	52	3.678	0.510
	H/E POST	38.35	52	3.870	0.537

Table 4. T studen for two paired samples

Groups	Variables	Mean	Deviation	Dev. Error average	t	gl	Sig. (bilateral)
Experimental	A/S PRE - A/S POST	3.792	5.242	0.720	5.267	52	0.000
	A/R PRE - A/T POST	2.811	4.407	0.605	4.644	52	0.000
	H/E PRE - H/E POST	-11.566	1.760	0.242	-47.850	52	0.000
	A/S PRE - A/S POST	-2.077	4.144	0.575	-3.614	51	0.001
	A/R PRE - A/T POST	-1.654	4.279	0.593	-2.787	51	0.007
	H/E PRE - H/E POST	-2.692	2.661	0.369	-7.296	51	0.000

On the other hand, a gender-differentiated analysis of

the variables was carried out. The assumptions of normality were checked using the Shapiro-Wilk test, given that when the groups were segmented they had less than 50 participants each. In addition, homoscedasticity was analysed using Leven's test to check the equality of variances and to determine the statistical technique to be applied. As appropriate, the parametric Student's t-test for two independent samples or the non-parametric Mann-Whitney U-test for two independent samples were applied.

In reference to the analysis between women in the different groups, it was found that in the variables A/S and A/T there were no statistically significant differences in the pretest ($p = 0.262$, $p = 0.50$) or in the posttest ($p = 0.103$, $p = 0.467$), although when analysing the pretest minus posttest variables DifA/S and DifA/T, statistically significant differences appeared in favour of the experimental group ($p < 0.001$, $p < 0.001$).

Finally, the variable H/E was analysed and no statistically significant differences were found in the pretest ($p = 0.164$), but significant differences were found in the posttest ($p < 0.001$) and in the pretest minus posttest variable DifH/E ($p < 0.001$), both in favour of the experimental group. Table 5 shows the results of the normality, homoscedasticity, parametric and non-parametric tests.

In reference to the analysis between males of the different groups, it was found that in the variables A/S and A/T there were no statistically significant differences in the pretest ($p = 0.504$, $p = 0.789$), but there were significant differences in the posttest ($p = 0.025$, $p = 0.012$). The comparison between both groups of boys between the pretest minus posttest variables DifA/S and DifA/T showed statistically significant differences in favour of the experimental group ($p < 0.001$, $p = 0.002$).

Finally, the variable H/E was analysed and no statistically significant differences were found in the pretest ($p = 0.590$), but significant differences were found in the posttest ($p < 0.001$), and in the pretest minus posttest variable DifH/E ($p < 0.001$) in favour of the experimental group. Table 6 shows the results of the normality tests, as well as the scores obtained in the analysis of each variable among the males in the different groups.

Table 5. Results of the analysis of normality, homoscedasticity, parametric and non-parametric tests among women in different groups

Variable	Group	Shapiro-Wilk			Leven's test				Test	Sig. (Bil.)	t student			U Mann-Whitney		
		Stat.	gl	Sig.	Stat.	gl1	gl2	Sig.			Mean	Dev.	Dev. Err. Average	Median	Range	U
A/S PRE	Exp.	0.962	25	0.457	3.438	1	49	0.070	U Mann-Whitney	0.262			17.00	23	265.500	
	Cont.	0.917	26	0.038									15.50	24		
A/S POST	Exp.	0.939	25	0.141	11.617	1	49	0.001	U Mann-Whitney	0.103			15.00	19	238.500	
	Cont.	0.931	26	0.081									16.50	33		
DifA/S	Exp.	0.922	25	0.056	1.880	1	49	0.177	t student	0.000	-4.04	5.969	1.194			
	Cont.	0.956	26	0.312							2.46	4.320	0.847			

A/T PRE	Exp.	0.941	25	0.156	1.031	1	49	0.315	t student	0.50	21.16	6.860	1.372		
	Cont.	0.974	26	0.733										17.19	7.255
A/T POST	Exp.	0.986	25	0.971	3.478	1	49	0.068	t student	0.467	17.60	5.737	1.147		
	Cont.	0.949	26	0.220										18.96	7.394
DifA/T	Exp.	0.920	25	0.050	0.667	1	49	0.418	U Mann-Whitney	0.000			-3.00	20	121.000
	Cont.	0.889	26	0.009											
H/E PRE	Exp.	0.903	25	0.021	0.843	1	49	0.363	U Mann-Whitney	0.164			38.00	11	251.500
	Cont.	0.935	26	0.100											
H/E POST	Exp.	0.857	25	0.002	9.479	1	49	0.003	U Mann-Whitney	0.000			50.00	11	17.000
	Cont.	0.917	26	0.039											
DifH/E	Exp.	0.793	25	0.000	0.013	1	49	0.909	U Mann-Whitney	0.000			10.00	7	0.000
	Cont.	0.888	26	0.009											

Table 6.

Results of the analysis between males of different groups of normality tests, homoscedasticity, parametric and non-parametric tests

Variable	Group	Shapiro-Wilk			Leven's test				Test	Sig. (Bil.)	t student			U Mann-Whitney		
		Stat.	gl	Sig.	Stat.	gl1	gl2	Sig.			Mean	Dev.	Dev. Err. Average	Median	Range	U
A/S PRE	Exp.	0.953	28	0.230	1.687	1	52	0.200	t student	0.504	17.11	5.493	1.038			
	Cont.	0.944	26	0.170												
A/S POST	Exp.	0.923	28	0.042	2.102	1	52	0.153	U Mann-Whitney	0.025				13.00	25	234.500
	Cont.	0.911	26	0.027												
DifA/S	Exp.	0.906	28	0.016	2.455	1	52	0.123	U Mann-Whitney	0.000				-5.50	17	150.500
	Cont.	0.922	26	0.051												
A/T PRE	Exp.	0.958	28	0.304	0.045	1	52	0.833	t student	0.789	16.86	6.819	1.289			
	Cont.	0.942	26	0.147												
A/T POST	Exp.	0.977	28	0.776	0.007	1	52	0.934	t student	0.012	14.71	6.127	1.158			
	Cont.	0.955	26	0.297												
DifA/T	Exp.	0.860	28	0.002	0.044	1	52	0.835	U Mann-Whitney	0.001				-4.00	14	180.000
	Cont.	0.952	26	0.257												
H/E PRE	Exp.	0.933	28	0.074	0.026	1	52	0.872	U Mann-Whitney	0.590				34.50	12	333.000
	Cont.	0.913	26	0.030												
H/E POST	Exp.	0.968	28	0.540	0.420	1	52	0.520	t student	0.000	46.43	3.179	0.601			
	Cont.	0.942	26	0.150												
DifD/E	Exp.	0.897	28	0.010	6.854	1	52	0.012	U Mann-Whitney	0.000				12.00	5	0.000
	Cont.	0.910	26	0.026												

Discussion

After reviewing the literature, we found three studies with similar characteristics to this study that used the same activity protocol with the experimental group. Their objectives were, among others, to know the impact of body percussion BAPNE method on sustained attention, measured through the Caras-R assessment instrument (Álvarez & Romero-Naranjo, 2019; Piqueres-Juan et al., 2019) and anxiety by means of the STAI questionnaire (Moral et al., 2020) of students of ages included within the Compulsory Secondary Education in Spain.

Álvarez & Romero-Naranjo (2019) and Piqueres-Juan et al. (2019) conducted parallel intervention research for six months applying the neurometricity music-motor activities protocol of the BAPNE method for 50 minutes twice a week in students in the first year of Compulsory Secondary Education in the cities of Ceuta and Aspe (Spain) with a sample of N=61 and N=57 respectively. Both studies presented a quantitative approach, quasi-experimental design, control and experimental group, and repeated measures before and after the intervention applying, among others, the Caras-R sustained attention assessment instrument. Álvarez & Romero-Naranjo (2019) used a between-subjects analysis, while Piqueres-Juan et al. (2019) conducted only a between-subjects analysis.

With regard to sustained attention, and except for the differences in age, number of participants and number of

sessions per week, our results are in complete agreement with those obtained by Álvarez & Romero-Naranjo (2019) and Piqueres-Juan et al. (2019). Initially, in the pretest, the experimental group and the control group started from the same attentional level and no statistically significant differences were found between them. Similarly, they agree that later, in the post-test, statistically significant differences were found in the A/S and A/T variables between the two groups in favour of the experimental group, which presented higher levels of attention than the control group. These differences were found after contrasting the variables DifA/S and DifA/T in which the scores obtained in the pretest were subtracted from those obtained in the posttest.

As for the intra-subject analysis (within the same group), our results coincide with the study by Álvarez & Romero-Naranjo (2019), as both groups show a statistically significant increase in sustained attention in the post-test, with this evolution being higher in the means obtained by the experimental group.

In relation to anxiety, we found a study with similarities and differences to this one by Moral et al. (2020). Similarities include the type of activities applied to the experimental group, the quantitative approach, the quasi-experimental between-subjects design, the use of control and experimental groups, and the repeated measures before and after the intervention using, among others, the STAI state anxiety and trait anxiety assessment question-

naire. Regarding the differences, Moral et al. (2020) conducted an intervention of 10 one-hour sessions with first-year students of the Conservatory of Professional Music Education aged between 11 and 17 years.

Unlike our study, in which we found no statistically significant differences between the groups at the beginning of the intervention but did find significant differences at the end in the variables A/S and A/T, Moral et al. (2020) found no significant differences at any time. That is, both groups maintained their anxiety levels stable, although it should be noted that the means obtained in the post-test by the experimental group were higher than those of the control group, but without being statistically significant.

With regard to the intra-group analysis, in our study we found a statistically significant improvement in both variables (A/S and A/T) in which the experimental group decreased their anxiety levels. In contrast, in the work of Moral et al. (2020), statistically significant differences were only found in the A/S variable, while A/T remained stable. On the other hand, we found differences in the results of our control group with those obtained by Moral et al. (2020). Our control group showed statistically significant differences in both variables, but in this case increasing their anxiety levels. In contrast, the control group of Moral et al. (2020) did not show statistically significant differences in both variables, and their anxiety levels remained stable.

The differences between the results of this study and those obtained by Moral et al. (2020) could be due to the difference in the number of intervention sessions applied in both studies, since, as the authors state, 10 sessions of one hour was not enough time for significant changes in A/T to be produced.

Finally, in the analysis between sexes in both groups, we did not find any study with which to compare our results, as none of the studies found carried out this type of analysis.

In our case, we found homogeneity of results between men and women in both groups. On the one hand, in the levels of attention in which no statistically significant differences are found in the pretest, but in the posttest and in the difference between pretest minus posttest in which the experimental group significantly increases its attentional levels with respect to the control group, which also increases them but not in a statistically significant way. On the other hand, in the A/S variable, in which no statistically significant differences were found in both males and females in the pre-test and post-test, although when analysing the differences in the pre-test minus post-test, differences were found in favour of the experimental group.

As for the disparity of results between men and women in both groups, we found that in the A/T variable, no differences were found between pretest and posttest among women, but there were differences in the variable analysing pretest minus posttest scores. In contrast, among males there were no differences at the beginning, but there were differences at the end, and also in the pretest

minus posttest variable.

Conclusion

The purpose of this study was to check whether the activities of the BAPNE method could improve the attention and anxiety of 3rd year CSE students.

Based on the study procedure and the results obtained, we can consider the proposed objectives to have been achieved, reject the null hypotheses or accept the alternative hypotheses, and answer the research questions proposed in this research.

Firstly, in reference to the type of inter-subject analysis between pupils in the different groups, the objective of quantitatively comparing the impact of the practice of the BAPNE method activities versus the traditional methodology in 3rd year CSE pupils was fulfilled. As a result, the first null hypothesis (H0-1) was rejected and the alternative hypothesis (H1-1) was accepted, since there were statistically significant differences in favour of the experimental group that practised the BAPNE method activities compared to the control group that did not practise them in the results of the anxiety variables DifA/S ($p < 0.001$), DifA/T ($p < 0.001$) and attention DifH/E ($p < 0.001$). This gave a negative answer to the research question of whether the experimental group and the control group would improve to the same extent, since it was the experimental group that presented the greatest decrease in anxiety and increase in attention.

Secondly, in relation to the type of intra-subject analysis between students in the same group, again the previously stated objective was achieved. Due to this, the second null hypothesis (H0-2) was rejected and the alternative hypothesis (H1-2) was accepted, since in this case there were statistically significant differences in the experimental group that practised the activities of the BAPNE method in the results of the anxiety variables DifA/S ($p < 0.001$), DifA/T ($p < 0.001$) and attention DifH/E ($p < 0.001$). Similarly, the third null hypothesis (H0-3) was rejected and the alternative hypothesis (H1-3) was accepted, since statistically significant differences were reflected in the control group that did not practice the activities of the BAPNE method in the results of the DifA/S, DifA/T and DifH/E anxiety variables. In this case, the control group did not remain stable as would be expected, but increased its anxious state in a statistically significant way DifA/S and DifA/T ($p = 0.002$, and $p = 0.014$) compared to the experimental group that did decrease them. On the other hand, and also against prognosis, the control group increased the attentional level Dif/HE in a statistically significant way ($p < 0.001$). On this basis, the research question as to whether both groups would improve to the same extent was also answered in the negative, as the control group significantly increased their anxiety levels while the experimental group reduced them. In response to this question, it should be noted that in relation to attention, both groups improved significantly ($p < 0.001$),

although the experimental group presented a greater difference in the means resulting from subtracting the pretest from the posttest (-11.566) than the control group (-2.692).

Thirdly, in relation to the type of inter-subject analysis divided by gender, the objective of quantitatively comparing the impact of practising the BAPNE method activities versus the traditional methodology in females and males in both groups of 3rd year CSE students was achieved. Among females, the fourth null hypothesis (H0-4) was rejected and the alternative hypothesis (H1-4) was accepted, since there were statistically significant differences in favour of the females in the experimental group who practised the BAPNE method activities compared to the females in the control group who did not practise them in the results of the anxiety variables DifA/S ($p < 0.001$), DifA/T ($p < 0.001$) and attention DifH/E ($p < 0.001$). Similarly, in males, the null hypothesis (H0-5) was also rejected and the alternative hypothesis (H1-5) was accepted, since statistically significant differences appeared in favour of the males in the experimental group who practised the activities of the BAPNE method compared to the males in the control group who did not practise them in the results of the DifA/S anxiety ($p < 0.001$), DifA/T ($p = 0.002$) and DifH/E attention ($p < 0.001$) variables. This again gave a negative answer to the research question of whether females and males in both groups would improve to the same extent, as both males and females in the experimental group had statistically significantly lower levels of anxiety and higher levels of attention than their counterparts in the control group.

Based on the above, and after achieving the objective of quantitatively testing the impact of the practice of the BAPNE method activities on the attention and anxiety of 3rd year CSE students, we can conclude that these protocols of rhythmic-motor activities of body percussion based on neuromotricity and the double task applied in an interdisciplinary way in the subjects of Physical Education, Music and Visual Arts can help to increase attention and reduce levels of trait anxiety and state anxiety in 3rd year CSE students.

There is no doubt that this study is not without limitations, since on the one hand, the specific and detailed programming of both groups could have been presented, and on the other, an intra-subject analysis could have been carried out to show the differences in anxiety and attention between males and females within each group.

As lines for the future, this study could be replicated at the same educational level, improving the existing limitations to compare the results obtained and thus verify much more solidly the conclusions drawn in this research.

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