

Effect of the BAPNE neuromotricity method on anxiety levels in university students considering gender differences

ANTONIO FRANCISCO ARNAU-MOLLÁ¹, FRANCISCO JAVIER ROMERO-NARANJO²

^{1,2} Department of Innovation and Didactic Training, University of Alicante, San Vicente del Raspeig, SPAIN.

Published online: July 31, 2024

Accepted for publication : July 15, 2024

DOI:10.7752/jpes.2024.07188

Abstract:

Anxiety disorders are the most prevalent mental health issues globally, disproportionately affecting women, who experience them at rates 50% higher than men. Aerobic exercise has been shown to alleviate anxiety symptoms. During the 2021–2022 academic year in Spain, 97.4% of Early Childhood Education teachers were women. Owing to the limited research on this demographic, this study aims to investigate how traditional teaching methods compare with the neuromotricity BAPNE method in their effects on state and trait anxiety among students enrolled in the Didactics of Musical Expression course within the Early Childhood Education Degree program at the University of Alicante. The goal is to provide evidence-based insights to guide methodological decisions. We used a non-probabilistic convenience sample consisting of N = 307 first-year university students. Participants were divided into an experimental group (n = 182) and a control group (n = 125), with a mean age of 20.10 years and a standard deviation of 4.064. The study used a quasi-experimental design, incorporating both intersubject comparisons (between the experimental and control groups) and intrasubject comparisons (within each group). Three types of analyses were performed: 1) analysis of the entire sample, 2) analysis of females only, and 3) analysis of males only. Repeated measures were performed before and after the intervention (pretest–posttest) using the 8th edition of the *STAI: Cuestionario de Ansiedad Estado-Rasgo*, published by TEA Ediciones. The analysis was performed with a 95% confidence interval and a significance level of 5% ($p < .05$). The intervention consisted of 21 sessions, each lasting one hour and fifty minutes, held twice a week. The experimental group received the neuromotricity BAPNE method, while the control group continued with traditional methodologies based on the pedagogical approaches of the 20th century (Dalcroze, Kodály, Orff, and Willems). Statistical analysis was performed using SPSS v.25, while effect size and statistical power were calculated with G*Power v. 3.1.9.7. The main results indicate that the neuromotricity BAPNE method was more effective than the traditional methodology in reducing state anxiety and significantly lowered trait anxiety in the experimental group.

Keywords: body percussion, higher education, mental health, cognitive stimulation, physical exercise

Introduction

According to the statistical yearbook of the *Ministerio de Educación, Formación Profesional y Deportes* (MEFPD), during the 2021-2022 academic year, 97.4% of Early Childhood Education teachers in Spain were women (MEFPD, 2024). On the other hand, according to the World Health Organization (WHO), within mental disorders, anxiety disorders and depressive disorders are the most common, both in men and women; they are 50% more prevalent in women than in men; they increase with age; and they begin to decrease after the age of 50 (WHO, 2022). In 2019, 301 million people worldwide were suffering from anxiety disorders, with a 25% increase in the first year of the pandemic (WHO, 2022). This increase in mental disorders was also reflected in university students in 2020, who are considered one of the most affected groups (Liu et al., 2022), and are up to six times more vulnerable to depression and anxiety than the general population (Rautela & Panackal, 2024). The lack of physical activity caused by confinement contributed to this worsening (Rogowska et al., 2020; Xiang et al., 2020).

The American Psychiatric Association (APA, 2014) determines that anxiety disorders are disorders that share characteristics of excessive fear and anxiety, as well as associated behavioural disturbances (p.189). The definition of anxiety has had numerous definitions depending on the context in which it manifests itself and both physical and emotional symptoms (Adrianzén, 2021). It is a response that the body emits in anticipation of a future threat, and is most often associated with muscle tension, vigilance in relation to future danger, and cautious or avoidant behaviours (APA, 2014, p.189).

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) lists 11 different types of anxiety and presents core clinical features as well as other criteria for diagnosis (Tortella-Feliu, 2014). These 11 types are: 1) Separation anxiety disorder. 2) Selective mutism. 3) Specific phobia. 4) Social anxiety disorder. 5) Anxiety disorder. 6) Agoraphobia. 7) Generalised anxiety disorder. 8) Substance/medication-induced anxiety

disorder. 9) Anxiety disorder due to other medical illness. 10) Other specified anxiety disorders. 11) Anxiety disorders not specified.

According to Huerta et al. (2020) and Huerta-Ojeda et al., (2021), there are two types of non-clinical anxiety in the literature, state anxiety (SA) and trait anxiety (TA). The authors of the 8th edition of the *STAI: cuestionario de ansiedad estado-rasgo* validated in Spain published by TEA ediciones (Buela-Casal et al., 2011) define them as:

SA: a transient emotional state or condition of the human organism, characterised by subjective, consciously perceived feelings of tension and apprehension, as well as hyperactivity of the autonomic nervous system. It can vary over time and fluctuate in intensity (p.10).

TA: points to a relatively stable anxious propensity whereby subjects differ in their tendency to perceive situations as threatening and to raise their state anxiety accordingly (p.10).

Typically, people with higher levels of TA will also have higher levels of SA, as they perceive many more situations as threatening.

Anxiety, among other disorders, is part of academic stress in university students (Restrepo et al., 2020; Silva-Ramos, 2020), whose main sources are academic overload, lack of time to complete activities, and exams (Castillo, 2016; Chust-Hernández et al., 2021; Fernández-Rodríguez et al., 2019). For Adrianzén (2021), exams are the greatest generators of anxiety among students.

Examination anxiety in students is a very frequent occurrence and has been widely studied since the beginning of the 20th century. Escalona and Miguel-Tobal (1996) carried out a study in which they presented the historical evolution of test anxiety highlighting the variety of reasons of interest that were treated from psychology. Martín and Pérez (2021) conducted a study at the Complutense University of Madrid (Spain) to determine whether anxiety management strategies were needed in their undergraduates, as well as modifications in the learning processes and assessment system. The sample consisted of 1726 students from the humanities, engineering, pure sciences, health sciences, and social and legal sciences. The results showed, on the one hand, a high level of student concern about exams, which was significantly lower in first-year students, on the other hand, a predominance of cognitive symptoms as opposed to physiological and motor symptoms, and finally, that women scored significantly higher than men in 14 of the 15 items in the questionnaire.

Cognitive processes have a significant relationship with anxiety. The presence, high or moderate, of anxiety in students could negatively affect their attentional processes, memory, decision-making, and their ability to solve problems (Adrianzén, 2021; Turriate et al., 2022).

Chust-Hernández et al. (2023) conducted a systematic review in which they analysed non-pharmacological interventions for reducing academic stress in university students. Their inclusion criteria were met by 27 papers focusing on mindfulness programmes; cognitive behavioural therapy; psychoeducation and mind-body relaxation techniques; training in academic, social or coping skills; alternative therapies; promoting physical activity; reading self-help books; and seeking university counselling (p.45). Following their analysis, they point out that although most of them showed positive results in their research, there are, in general, considerable methodological limitations, as well as risk of bias, such as the non-inclusion of a control group, which make it difficult to know their real effectiveness and to determine which therapies would prevail over the others. There is abundant evidence on the benefits of physical exercise in reducing anxiety. For Stonerock et al. (2015), aerobic exercise has a negative relationship with anxiety. In this line, Lin and Gao (2023) evaluate in their meta-analysis interventions through physical exercise for the improvement of anxiety in university students, and state that it has significant effects on the reduction of anxiety, with aerobic exercise and yoga being the most optimal, as well as interventions of greater intensity and duration. Therefore, aerobic exercise is a source of improvement for cognitive performance (Stern et al., 2019), as well as for subjective well-being, mental health, and cognitive control and attention (Pontifex et al., 2019; White et al., 2017).

In the BAPNE method, through movement and motor coordination, participants maintain an average of between 100 and 120 heartbeats per minute during the sessions, reaching peaks of 140, an average consumption of 850 calories, and a high degree of attention and concentration (Crespo et al., 2015). This pulse rate peak, in Physical Education students, rises considerably to 189 in the specific activities of the BAPNE FIT programme that favour an increase in maximum oxygen consumption and heart rate (Romero-Naranjo & Llorca-Granero, 2023). The type of movements used can be used by any type of population, as they are not aggressive or harmful to health (Alonso-Marco & Romero-Naranjo, 2022), and for years, it has been regularly applied at the University of Alicante as part of the content of different subjects in Masters, Degrees and Mentions (Arnau-Mollá & Romero-Naranjo, 2024).

It was created in 1998 by Phd Francisco Javier Romero-Naranjo as a method of cognitive, psychomotor and socioemotional stimulation articulated through body percussion, and evolved progressively through a series of stages, in which it abandons its focus on multiple intelligences to focus on neuromotricity and the possible stimulation of cognitive functions and executive functions (Arnau-Mollá & Romero-Naranjo, 2022c).

Its sessions are structured in a tripartite way, with different objectives for each part. These are called the initiation rite, cognitive stimulation, and closing rite (Arnau-Mollá & Romero-Naranjo, 2023a, 2023b; Romero-Naranjo, Arnau-Mollá et al., 2023). It has an extensive glossary of 35 blocks of music-motor neuromotricity activities, with a strong presence of the dual-task, in which the five paradigms of the dual-task are encompassed:

motor-motor, cognitive-cognitive, cognitive-motor, rhythmic-motor, and rhythmic-motor-cognitive (Andreu-Cabrera et al., 2024; Romero-Naranjo & Andreu-Cabrera, 2023b; Romero-Naranjo, Andreu-Cabrera et al., 2023; Romero-Naranjo et al., 2024). At the neuropsychological level, their activities are based on the attentional model proposed by Sohlberg and Mateer (1987, 1989), and on the models of executive functions provided by Tirapu-Ustarroz and Luna-Lario (2008) and by Akira Miyake (Miyake et al., 2000; Miyake & Friedman, 2012).

Currently, he has an official research group registered at the University of Alicante called Neuromotricity and Motor Literacy (Neuromotricity), and is the leading international exponent in publications related to neuromotricity and the possible stimulation of cognitive and executive functions, both in primary and secondary scientific-academic search engines (Arнау-Mollá & Romero-Naranjo, 2022a, 2022b, 2024).

It has a strong methodological foundation through its four types of publications: foundational, didactic, research protocol, and statistical results (Arнау-Mollá & Romero-Naranjo, 2024), and has more than 50 papers indexed in the Web of Science (Arнау-Mollá et al., 2024). Figure 1 shows the publications of the BAPNE method in Web of Science.



Figure 1. Publications of the BAPNE method in Web of Science

Due to the large number of existing publications on methodology, it is difficult to collect them all, so a small selection of their articles in some lines of research is shown:

- a) Methodological foundation (Romero-Naranjo, 2020a; Romero-Naranjo & Andreu-Cabrera, 2023c; Sayago-Martínez, et al., 2021).
- b) Physical Education (Alonso-Marco & Romero-Naranjo, 2022; Andreu-Cabrera & Romero-Naranjo, 2021; Andreu-Cabrera et al., 2024; Romero-Naranjo, 2024; Romero-Naranjo & Andreu-Cabrera, 2023a; Romero-Naranjo, Andreu-Cabrera et al., 2023; Romero-Naranjo & Llorca-Garnero, 2023).
- c) Bibliometric studies (Arнау-Mollá & Romero-Naranjo, 2022a, 2022b, 2024; Mas-Mas et al., 2023; Morales-Martín, et al., 2024; Penalva et al., 2023; Suárez et al., 2024).
- d) Didactics with practical examples (Arнау-Mollá et al., 2022; Arнау-Mollá & Romero-Naranjo, 2022d; Di Russo et al., 2022; Romero-Naranjo, 2020b).
- e) Jazz music (Navarro-Maciá & Romero-Naranjo, 2024a, 2024b).
- f) Traditional dances (Arнау-Mollá et al., 2022; Di Russo & Romero-Naranjo, 2023).
- g) Band music (Di Russo & Romero-Naranjo, 2021a, 2021b; Di Russo et al., 2024a, 2024b; Di Russo et al., 2023).
- h) Quantitative intervention (Arнау-Mollá & Romero-Naranjo, 2020; Arнау-Mollá et al., 2024; Moral et al., 2020; Romero-Naranjo, Pujale et al., 2023; Romero-Naranjo, Sayago-Martínez, et al., 2023; Torró-Biosca et al., 2019).

In terms of intervention work, the BAPNE method has tested its neuromotricity activities in 22 quantitative intervention studies in different populations and settings, with control and experimental groups, evaluated by means of validated tests and questionnaires, and with statistically significant results. Among them, we will highlight three studies. On the one hand, the only research that exists using this methodology in a university population (Arнау-Mollá et al., 2024), although it evaluated the selective attention of N=294 participants. On the other hand, the research that assessed anxiety as a dependent variable using the same assessment instrument as in this study (STAI), although in Conservatory students (Moral et al., 2020), and Compulsory Secondary Education students (Romero-Naranjo, Sayago-Martínez, et al., 2023).

Purpose

Due to the fact that anxiety is a widespread problem in university students that has serious consequences for their mental health, and that there is no research of these characteristics at an international level, the purpose of this study is, on the one hand, to know the impact of traditional methodology and the neuromotricity BAPNE method on the SA and TA of students of Didactics of Musical Expression at the University of Alicante, and on the other hand, that this research can be used to make methodological decisions based on scientific evidence. To this end, we propose the following research questions (RQ), objectives (OB) and research hypotheses (HI).

Research questions

RQ1: Will the full groups, as well as the females and males in the control and experimental groups, have the same level of SA and TA in the pretest?

RQ2: Which methodology will lead to greater benefits on SA and TA after the intervention, both among the full groups, among females, and among males in the experimental group treated with neuromotricity BAPNE method or in the control group treated with traditional methodology?

RQ3: Will the SA and TA levels of the full group, the females and the males in the experimental group significantly decrease after the neuromotricity BAPNE method intervention?

RQ4: Will the SA and TA levels of the full group, females and males in the control group significantly decrease after the traditional methodology intervention?

Objectives

OB1: To compare the level of SA and TA before the intervention between the full groups, between females, and between males in the control and experimental groups, and to determine whether or not there are significant differences between them.

OB2: To compare the effect of the methodologies on SA and TA after the intervention, both between the full groups, among females, and among males, and to determine whether or not there are significant differences between them in the posttest.

OB3: To compare the level of SA and TA after the intervention for the full group, the females and the males in the experimental group, and to determine whether or not there are significant differences between the pretest and the posttest.

OB4: To compare the level of SA and TA after the intervention of the full group, the females and the males in the control group, and to determine whether or not there are significant differences between the pretest and the posttest.

Research hypotheses

HI1: The entire groups, as well as the females and males in the control and experimental groups, will start from the same level of SA and TA.

HI2: There will be significant differences in favour of the experimental group in SA and TA after the intervention, both between the full groups, between females and between males in both groups.

HI3: The full group, females and males in the experimental group will significantly decrease their SA and TA levels after the intervention.

HI4: The entire group, females and males in the control group will not experience significant changes in their SA and TA levels after the intervention.

Material and Methods

Design

A quasi-experimental design was used, both intersubject (between students in the control group and the experimental group) and intrasubject (between students in the same group).

Since the groups were already determined by the university, a non-probability convenience sampling (non-random) was used. The confidence interval was 95% and the significance level 5% ($p < .005$). Measurements were taken before and after the intervention (pretest-posttest) and three types of analysis were performed: 1) full groups, 2) women only, 3) men only.

Participants

Initially, $N=344$ students of the subject Didactics of Musical Expression at the University of Alicante in the academic year 2022-2023 participated in the research. This subject is taught in the first year of the Degree in Early Childhood Education at the University of Alicante (Spain).

The students had similar socio-cultural characteristics, an age range between 18 and 58 years and a mean age of 20.08 years ($Sd=3.896$). They came from seven different groups with 86.05% female and 13.95% male. Due to absenteeism, 37 students (10.76%) were excluded from the research, of which 33 were female (9.59%) and 4 were male (1.16%).

After exclusions, the final sample was $N=307$ students aged 19-58 years ($md=20.10$, $Sd=4.064$) and divided into experimental group ($n=182$) and control group ($n=125$).

The experimental group consisted of the students from the four morning groups ($n=182$) with a range between 18 and 42 years of age ($md=19.39$, $Sd=3.051$) of which 162 were female (52.77%) and 20 male (6.51%).

On the other hand, the control group included students from the three afternoon groups ($n=125$) with a range between 18 and 58 years of age ($md=21.14$, $Sd=5.034$) of which 101 were female (32.90%) and 24 were male (7.82%). Table 1 shows more detailed information on the participants in the experimental and control groups.

Table 1. Distribution of experimental and control groups

Group	Subgroup	F	%	W	% W	Men	% Men	% Cum.	A-R	Mean age	SD
Experimental	G1	46	14.98	38	12.38	8	2.61	14.98	18-37	19.33	3.113
	G2	46	14.98	42	13.68	4	1.30	29.97	18-33	19.39	2.646
	G3	47	15.31	42	13.68	5	1.63	45.28	18-42	19.70	4.096
	G4	43	14.01	40	13.03	3	0.98	59.28	18-27	19.12	1.917
Total Experimental		182	59.28	162	52.77	20	6.51	59.28	18-42	19.39	3.051
Control	G5	39	12.70	30	9.77	9	2.93	12.70	18-33	20.54	3.762
	G6	45	14.66	38	12.38	7	2.28	27.36	18-38	21.36	4.672
	G7	41	13.36	33	10.75	8	2.61	40.72	18-58	21.46	6.372
Total Control		125	40.72	101	32.90	24	7.82	40.72	18-58	21.14	5.034
General total		307	100	263	85.67	44	14.33	100	18-58	20.10	4.064

Note: F=Frequency. W=Women. % Cum.=Percentage cumulative. A-R=Age range. SD=Standard deviation.

Assessment of anxiety

The 8th edition of the *STAI: cuestionario de ansiedad estado-rasgo* published by TEA ediciones (Buela-Casal et al., 2011), validated in Spain, was used as an assessment instrument. It can be applied individually or collectively and is intended for adolescents and adults and lasts approximately 15 minutes.

It consists of two scales of 20 sentences each assessed by means of a four-choice Likert scale to measure state anxiety (SA) and trait anxiety (TA).

On the SA scale, the subject describes the level of anxiety he/she feels "at a particular time" on the basis of 0=not at all, 1=somewhat, 2=quite a lot, 3=very much. In contrast, on the TA scale, the subject describes the level of anxiety he/she feels "in general" on the basis of 0=almost never, 1=sometimes, 2=often, 3=almost always. The Spanish version has a good internal consistency with a Cronbach's alpha between .89 and .95 in SA, and between .82 and .91 in TA.

Ethics committee

This study was conducted in accordance with the Helsinki Declaration of 1975 (revoked in 2008), and was approved on 21 January 2021 by Juan Mora Pastor, President of the Ethics Committee and Vice-Chancellor of Research of the University of Alicante (CEIUA) with protocol file number 2022CEI005054.

Participation in the research was voluntary and no financial or academic compensation was received. Participants were informed verbally and in writing before signing the following documents: 1) participant information sheet, 2) informed consent, 3) basic clause and extended data protection information.

Inclusion criteria

In order to be included in the research, students had to fulfil all the following inclusion criteria: 1) they had to have read and signed all the documents mentioned above, 2) they had to have attended at least 80% of the intervention sessions, 3) they had to have correctly completed the evaluation tests (pretest-posttest).

Intervention protocol

The intervention was carried out during 21 theoretical-practical sessions of one hour and fifty minutes twice a week between February and May 2023 without taking into account evaluations (pretest-posttest), Easter holidays and local festivities.

The experimental group worked on music-motor neuromotoricity activities BAPNE method of progressive difficulty and based on the dual task for the possible stimulation of cognitive functions and executive functions. These activities are published in the manuals *Bodypercussion. Programación didáctica* vols. 1 and 2 (Romero-Naranjo, 2018a, 2018b).

On the other hand, the control group did not vary its usual programming and worked with musical resources based on the main musical pedagogies of the 20th century (Dalcroze, Orff, Kodaly and Willems).

Procedure

Firstly, approval of the project was requested from the Ethics Committee of the University of Alicante. Secondly, the participants were informed and the requested documents were signed. Thirdly, the first assessment (pretest) was carried out in both groups (experimental and control) on the same day and under the same environmental conditions. Fourthly, the 21 intervention sessions were carried out. In the experimental group, the practical part was carried out by a trainer of the BAPNE method, while the theoretical part was given by the teachers of each group. In the control group, both the practical and theoretical parts were taught by the teachers of each group. Fifthly, the second assessment (posttest) was carried out, also on the same day and in the same environmental conditions. Finally, the data were analysed and the results were extracted.

Statistical analysis

SPSS v.25 was used for statistical analysis of the data and G*Powver v. 3.1.9.7 (Erdfelder et al., 1996; Faul et al., 2007) for calculation of effect size (d) and statistical power (1-β).

The assumptions of normality and homogeneity of variances of the variables SA, TA and the difference variable (Dif) resulting from subtracting the pretest scores from those of the posttest were tested. For this

purpose, Kolmogorov-Smirnov tests were used with samples of more than 50 participants, Shapiro-Wilk for less than 50, and homogeneity of variances with Levene's test.

In the intersubject or between-participant analysis between different groups (full groups, women only and men only), the parametric Student's t-test for independent samples was used for comparisons that were normal and the non-parametric Mann-Whitney U-test for those that were not.

In the intrasubject analysis or between participants in the same group (full groups, women only and men only), the parametric Student's t-test for related samples was used for normal comparisons, and the non-parametric Wilcoxon signed-rank test was used for non-normal comparisons. The significance level was taken as $p < .05$. The magnitude of the effect size (d) was interpreted as .20 small, .50 medium, .80 large, and the statistical power $1-\beta = .80$ with an alpha error (α) .05 (Cohen, 1988, 1992).

Results

General information

Table 2 shows the descriptive values obtained by the experimental and control groups before and after the intervention.

Table 2. Descriptive values of the experimental and control groups before and after the intervention

Group	Variable	n	Median	Range	Mean	Dev. Error	SD	Variance
Full experimental	SAPRE	182	17.00	47	19.17	0.727	9.802	96.076
	SAPOST	182	21.50	50	22.64	0.781	10.540	111.082
	DifSA	182	-3.00	62	-3.47	0.752	10.147	102.969
	TAPRE	182	25.00	49	27.05	0.787	10.611	112.589
	TAPOST	182	24.00	54	25.22	0.777	10.488	110.007
	DifTA	182	2.00	51	1.83	0.551	7.432	55.236
Women experimental	SAPRE	162	18.00	47	19.46	0.782	9.950	98.996
	SAPOST	162	22.00	50	23.15	0.845	10.750	115.568
	DifSA	162	-3.00	62	-3.69	0.801	10.198	103.993
	TAPRE	162	26.00	49	27.46	0.818	10.409	108.349
	TAPOST	162	25.50	54	25.88	0.827	10.525	110.780
	DifTA	162	1.50	47	1.58	0.567	7.222	52.158
Men experimental	SAPRE	20	14.50	30	16.80	1.867	8.351	69.747
	SAPOST	20	17.00	33	18.55	1.719	7.688	59.103
	DifSA	20	-1.50	37	-1.75	2.193	9.808	96.197
	TAPRE	20	21.00	42	23.75	2.661	11.898	141.566
	TAPOST	20	19.00	37	19.90	1.947	8.705	75.779
	DifTA	20	3.00	38	3.85	1.992	8.911	79.397
Full control	SAPRE	125	16.00	42	17.77	0.779	8.706	75.793
	SAPOST	125	27.00	56	25.51	0.982	10.982	120.607
	DifSA	125	-7.00	53	-7.74	0.864	9.662	93.353
	TAPRE	125	22.00	48	23.22	0.915	10.234	104.740
	TAPOST	125	24.00	48	23.82	0.847	9.465	89.582
	DifTA	125	-1.00	44	-0.60	0.673	7.522	56.581
Women control	SAPRE	101	17.00	42	18.41	0.845	8.491	72.104
	SAPOST	101	28.00	45	26.52	1.063	10.687	114.212
	DifSA	101	-8.00	53	-8.12	1.004	10.090	101.806
	TAPRE	101	23.00	42	24.71	1.025	10.300	106.087
	TAPOST	101	26.00	45	24.72	0.966	9.706	94.202
	DifTA	101	0.00	44	-0.01	0.715	7.184	51.610
Men control	SAPRE	24	14.50	37	15.08	1.891	9.264	85.819
	SAPOST	24	19.50	56	21.25	2.329	11.410	130.196
	DifSA	24	-7.00	37	-6.17	1.547	7.580	57.449
	TAPRE	24	17.50	28	16.96	1.482	7.262	52.737
	TAPOST	24	21.00	31	20.04	1.513	7.410	54.911
	DifTA	24	-2.00	39	-3.08	1.740	8.526	72.688

Note: n=Sample. Dev.=Deviation. Sd=Standar Deviation

Intersubject analysis

Full groups

In SA there were no differences between the groups in the pretest ($p = .254$), but there were differences in the posttest ($U = 9556.500$, $p = .017$, $d = .27$, $1-\beta = .61$) and in the variable differences DifSA ($U = 8663.500$, $p < .001$, $d = .42$, $1-\beta = .94$) where the mean of the control group increased more ($md = -7.74$, $Sd = 0.864$) than that of the experimental group ($md = -3.47$, $Sd = 0.752$).

On the contrary, there were differences in TA in the pretest ($U=8969.500$, $p=.002$, $d=.36$, $1-\beta=.86$) where the experimental group showed higher levels ($md=27.05$, $Sd=0.787$) than the control group ($md=23.22$, $Sd=0.915$). In the posttest there were no differences in TA between the groups ($p=.436$), but there were differences in the variable DifTA ($U=9375.500$, $p=.009$, $d=.32$, $1-\beta=.77$) where the experimental group decreased its scores with respect to the pretest ($md=1.83$, $Sd=0.551$) while the control group increased them ($md=-.60$, $Sd=0.673$). Table 3 shows the results obtained in the intersubject analysis of the complete groups, between the control group and the experimental group through the Mann-Whitney U-test.

Table 3. Values of the intersubject analysis full groups

Variable	Group	n	U Mann-Whitney					
			Median	Range	U	Sig. (Bil.)	d	1-β
SAPRE	Exp.	182	17.00	47	10505.000	.254	.15	.24
	Cont.	125	16.00	42				
SAPOST	Exp.	182	21.50	50	9556.500	.017	.27	.61
	Cont.	125	27.00	56				
DifSA	Exp.	182	-3.00	62	8663.500	<.001	.42	.94
	Cont.	125	-7.00	53				
TAPRE	Exp.	182	25.00	49	8969.500	.002	.36	.86
	Cont.	125	22.00	48				
TAPOST	Exp.	182	24.00	54	10780.000	.436	.14	.21
	Cont.	125	24.00	48				
DifTA	Exp.	182	2.00	51	9375.500	.009	.32	.77
	Cont.	125	-1.00	44				

Note: n=Sample. U=Mann-Whitney U-Test. Sig. (Bil.)=Bilateral significance. d=Effect size. 1-β=Statistical power. Exp.=Experimental group. Cont.=Control group.

Women only

In SA there were no differences between the groups in the pretest ($p=.496$), but there were differences in the posttest ($U=6638.000$, $p=.010$, $d=.31$, $1-\beta=.67$) and in the variable differences DifSA ($t(261) 3.443$, $p=.001$, $d=.43$, $1-\beta=.92$), where the mean of the control group increased more ($md=-8.12$, $Sd=1.004$) than that of the experimental group ($md=-3.69$, $Sd=0.801$).

On the contrary, there were differences in TA in the pretest ($U=6913.000$, $p=.034$, $d=.26$, $1-\beta=.53$) where the experimental group showed higher levels ($md=27.46$, $Sd=0.818$) than the control group ($md=24.71$, $Sd=1.025$). In the posttest there were no differences in TA between the groups ($t(261) 0.891$, $p=.374$, $d=.11$, $1-\beta=.15$) and neither in the variable DifTA ($U=7243.500$, $p=.118$; $d=.22$, $1-\beta=.39$). Although the experimental group decreased its levels with respect to the pretest ($md=1.58$, $Sd=0.567$) while the control group remained stable ($md=-0.001$, $Sd=0.715$) these differences were not significant. Table 4 shows the results obtained in the intersubject analysis between the women in the control group and the experimental group using the Mann-Whitney U-test and Student's t-test.

Table 4. Values of the women only intersubject analysis

Variable	Group	n	U Mann-Whitney						t Student						
			Median	Range	U	Sig. (Bil.)	d	1-β	Mean	SD	t	gl	Sig. (Bil.)	d	1-β
SAPRE	Exp.	162	18.00	47	7773.000	.496	.11	.14	/	/	/	/	/	/	/
	Cont.	101	17.00	42					/	/	/	/	/	/	/
SAPOST	Exp.	162	22.00	50	6638.000	.010	.31	.67	/	/	/	/	/	/	/
	Cont.	101	28.00	45					/	/	/	/	/	/	/
DifSA	Exp.	162	/	/	/	/	/	/	-3.69	10.198	3.443	261	.001	.43	.92
	Cont.	101	/	/	/	/	/	/	-8.12	10.090					
TAPRE	Exp.	162	26.00	49	6913.000	.034	.26	.53	/	/	/	/	/	/	/
	Cont.	101	23.00	42					/	/	/	/	/	/	/
TAPOST	Exp.	162	/	/	/	/	/	/	25.88	10.525	0.891	261	.374	.11	.15
	Cont.	101	/	/	/	/	/	/	24.72	9.706					
DifTA	Exp.	162	1.50	47	7243.500	.118	.22	.39	/	/	/	/	/	/	/
	Cont.	101	0.00	44					/	/	/	/	/	/	/

Note: n=Sample. U=Mann-Whitney U-Test. Sig. (Bil.)=Bilateral significance. d=Effect size. 1-β=Statistical power. SE= Standar deviation. t=Test statistic. gl=Degrees of freedom. Exp.=Experimental group. Cont.=Control group.

Men only

In the men only analysis there was no difference between the groups in SAPRE ($p=.485$), SAPOST ($p=.373$), DifSA ($p=.099$), TAPRE ($p=.071$) and TAPOST ($p=.954$). On the contrary, there was a difference in DifTA $t(42) 2.632$, $p=.012$, $d=.75$, $1-\beta=.67$ where the experimental group decreased their scores with respect to the pretest ($md=13.85$, $Sd=1.992$) while the control group increased them ($md=-3.08$, $Sd=1.740$). Table 5 shows the results obtained in the intersubject analysis between the men in the control group and the experimental group through the Mann-Whitney U-test and Student's t-test.

Table 5. Values of the men only intersubject analysis

Variable	Group	n	U Mann-Whitney						t Student						
			Median	Range	U	Sig. (Bil.)	d	1-β	Mean	SD	t	gl	Sig. (Bil.)	d	1-β
SAPRE	Exp.	20	14.50	30	210.500	.485	.20	.09	/	/	/	/	/	/	/
	Cont.	24	14.50	37					/	/					
SAPOST	Exp.	20	/	/	/	/	/	/	18.55	7.688	-0.901	42	.373	.27	.14
	Cont.	24	/	/	/	/	/	21.25	11.410						
DifSA	Exp.	20	/	/	/	/	/	/	-1.75	9.808	1.685	42	.099	.50	.36
	Cont.	24	/	/	/	/	/	-6.17	7.580						
TAPRE	Exp.	20	21.00	42	163.500	.071	.67	.56	/	/	/	/	/	/	/
	Cont.	24	17.50	28					/	/					
TAPOST	Exp.	20	/	/	/	/	/	/	19.90	8.705	-0.058	42	.954	.02	.05
	Cont.	24	/	/	/	/	/	20.04	7.410						
DifTA	Exp.	20	/	/	/	/	/	/	3.85	8.911	2.632	42	.012	.75	.67
	Cont.	24	/	/	/	/	/	-3.08	8.526						

Note: n=Sample. U=Mann-Whitney U-Test. Sig. (Bil.)=Bilateral significance. d=Effect size. $1-\beta$ =Statistical power. SE= Standar deviation. t=Test statistic. gl=Degrees of freedom. Exp.=Experimental group. Cont.=Control group.

Intrasubject analysis experimental group

In the experimental group there was an increase in SA at the end of the intervention being significant in the full group ($p<.001$) and in females ($p<.001$), but not in males $Z=-1.450$, $p=.160$, $d=.18$, $1-\beta=.11$. On the contrary, there was a decrease in TA at the end of the intervention being significant in the full group ($p=.002$) and in women ($p=.006$), but not in men $t(19) 1.932$, $p=.068$, $d=.43$, $1-\beta=.45$. Table 6 shows the results obtained in the within-subjects analysis within the experimental group between pretest and posttest through the Wilcoxon related samples and Student's t-testst.

Table 6. Values of the intrasubject analysis of the experimental group

Group	Variable	n	Wilcoxon									
			Median	Range	Z	Sig. (Bil.)	d	1-β				
Full experimental	SAPRE	182	17.00	47	-4.540	<.001	.34	.99				
	SAPOST	182	21.50	50								
	TAPRE	182	25.00	49								
	TAPOST	182	24.00	54								
Women experimental	SAPRE	162	18.00	47	-4.458	<.001	.36	.99				
	SAPOST	162	22.00	50								
	TAPRE	162	26.00	49								
	TAPOST	162	25.50	54								
Men experimental	SAPRE	20	14.50	30	-1.405	.160	.18	.11				
	SAPOST	20	17.00	33								
	TAPRE	20	(Mean 23.75)	(SD 11.898)					(t) 1,932	.068	.43	.45
	TAPOST	20	(Mean 19.90)	(SD 8.705)								

Note: n=Sample. Z=Wilcoxon test. Sig. (Bil.)=Bilateral significance. d=Effect size. $1-\beta$ =Statistical power.

Intrasubject analysis control group

In the control group there was a significant increase in SA at the end of the intervention both in the full group ($p<.001$) and in females ($p<.001$) and males ($p=.002$). In contrast, there was a non-significant increase in TA at the end of the intervention in both the full group ($p=.404$) and in women ($p=.889$) and men $t(23) -1.772$, $p=.090$, $d=.36$, $1-\beta=.40$.

Table 7 shows the results obtained in the intrasubject analysis within the control group between pretest and posttest by means of the Wilcoxon related samples and Student's t-tests.

Table 7. Intrasubject analysis values of the control group

Group	Variable	n	Wilcoxon					
			Median	Range	Z	Sig. (Bil.)	d	1-β
Full control	AEPRE	125	16.00	42	-7.318	<.001	.80	1.00
	AEPOST	125	27.00	56				
	ARPRE	125	22.00	48	-0.835	.404	.08	.14
	ARPOST	125	24.00	48				
Women control	AEPRE	101	17.00	42	-6.549	<.001	.80	1.00
	AEPOST	101	28.00	45				
	ARPRE	101	23.00	42	-0.140	.889	.001	.05
	ARPOST	101	26.00	45				
Men control	AEPRE	24	14.50	37	-3.152	.002	.81	.96
	AEPOST	24	19.50	56				
	ARPRE	24	(Mean 16.96)	(SD 7.262)	(t) -1, 772	.090	.36	.40
	ARPOST	24	(Mean 20.04)	(SD 7.410)				

Note: n=Sample. Z=Wilcoxon test. Sig. (Bil.)=Bilateral significance. d=Effect size. 1-β=Statistical power.

Discussion

After comparing in the intersubject analysis the level of SA and TA before the intervention between the full groups, among women, and among men in the experimental group (EG) and the control group (CG), and determining whether or not there are significant differences between them (OB1), we can answer PI1, where our data indicate that both the complete groups and the women started from the same level of SA, but not of TA, since the EG had a higher level of TA at the beginning than the CG. In contrast, among males, we found no differences in starting SA or TA. Therefore, we accept HI1 in SA for the full groups, females and males, as well as TA only for males. In contrast, we reject this hypothesis for TA for the full groups and females.

These differences in TA onset could be related to the fact that 85.67% of our sample is made up of women. Furthermore, the greater presence of women in the EG (52.77%) than in the CG (32.90%), as well as the lower presence of men in the EG (6.51%) than in the CG (7.82%), could have contributed to these differences in onset, since anxiety is 50% more prevalent in women than in men (WHO, 2022).

These results partially coincide with the study by Romero-Naranjo, Sayago-Martínez et al. (2022) who evaluated students between 14 and 15 years of age in the 3rd year of Compulsory Secondary Education. They found no differences in the onset of SA and TA between the full groups, between females, or between males in the experimental and control groups. On the other hand, they also partially coincide with Moral et al. (2020), where they also found no differences in the onset of SA and TA between the groups of students in the 1st year of the Professional Music Degree with an average age of 13.53 years. It should be noted that they did not carry out an analysis by gender of the participants. The differences found with these two studies could be due to the fact that anxiety rises with age and decreases after the age of 50 (WHO, 2022). These studies evaluated students between 13 and 15 years old, while in our work, the mean age was higher (md=20.10, Sd=4.064).

Continuing with the intersubject analysis, we address the second objective (OB2). To compare the effect of the methodologies on SA and TA after the intervention, both between the full groups, among females, and among males, and to determine whether or not there are significant differences between them in the posttest. This allows us to answer PI2 and HI2.

Firstly, and in reference to the contrast between the complete groups, differences appeared in AEPOST, where the CG increased their anxiety levels more than the EG. This is more clearly evidenced when the results of the pretest minus the posttest (DifSA) are analysed, where a significant difference is observed for the CG (p<.001, d=.42, 1-β=.94). On the contrary, although in DifTA the GE decreased its level of anxiety while the CG increased it (p=.001, d=.32, 1-β=.77), these differences were not significant in TAPOST. This is the answer to PI2, and leads us, on the one hand, to accept HI2 for SA, where the neuromotricity BAPNE method offers greater benefits than the traditional methodology; and on the other hand, to reject it for TA where no statistically significant differences are reflected between the two methodologies.

Since the posttest was carried out at exam time at the end of the semester, the increase in SA in both complete groups (EG and CG) could be related to academic stress (Restrepo et al., 2020; Silva-Ramos, 2020), with exams, apart from lack of time, and academic overload, being the greatest generators of anxiety among students (Adrianzén, 2021).

In the STAI anxiety assessment questionnaire (Buela-Casal et al., 2011), the questions to assess SA refer to how they feel "right now", "at this moment", while those referring to TA assess how they feel "in general". If we take into account that the EG started with a higher level of TA than the CG in the pretest, with statistically significant differences between them, and that later, in the posttest, no differences were shown, because the EG reduced its TA, we can consider that, if both groups had started with the same level of TA, statistically significant differences would have occurred in favour of the EG. This shows that, after the

intervention, the EG arrived in better SA conditions, and even lowered their TA levels, showing a better anxious self-perception. Even so, the differences in the onset of TA in the pretest should invalidate the results obtained in this variable, or at least be interpreted with extreme caution.

These results are in complete agreement with Romero-Naranjo, Sayago-Martínez et al. (2022) in that they found statistically significant differences in SA, and in the variables resulting from subtracting the posttest from the pretest in favour of the EG (DifSA and DifTA). On the other hand, they differ in that differences also appeared in TA, while in our study this was not the case. On the other hand, they partially agree with Moral et al. (2020), since in their study they found no differences in SA or TA, with SA being significant in our study.

Secondly, with respect to the contrast between the women in the different groups (EG and CG), significant differences appear in SAPOST and DifSA for EG, but not in TAPOST or DifTA. With this we answer PI2, and accept HI2 for SA, and reject it for TA, since the group treated with Neuromotricity BAPNE method showed statistically significant improvements compared to the group treated with traditional methodology in SA, but not in TA.

Again, we make the same reading as in the previous contrast (complete groups). The EG, even when increasing the level of SA, arrive in better conditions at the posttest, and increase their general perception of anxiety (TA), while the CG remains stable in this variable. We should bear in mind that the differences in the onset of TA could invalidate the results of this variable, or at least be interpreted with caution or as a mere indicative indicator. In this case, we found quite a few differences with Romero-Naranjo, Sayago-Martínez et al. (2022), who did not obtain statistically significant differences in SA or TA, but did obtain statistically significant differences in DifSA and DifTA. In other words, we only agree with them in that we did not find differences in TA and did find differences in DifSA.

Thirdly, and to close the intersubject analysis, we addressed the contrast of males in the different groups (EG and CG). In response to PI2, we found no differences after the intervention in SAPOST, DifSA, and TAPOST, but we found differences in DifTA. This leads us to reject HI2 for both SA and TA, since no differences are observed between males who have been treated with neuromotricity BAPNE method and those who used the traditional methodology.

In this case, the EG and CG started with the same initial level of TA. Afterwards, no differences were found in the posttest, although when observing the variable that subtracts the pretest and posttest (DifTA), significant differences did appear. These results are practically in complete disagreement with Romero-Naranjo, Sayago-Martínez et al. (2022), since they found statistically significant differences in favour of the EG in all variables (SAPOST, DifSA, TAPOS, DifTA), while in our study they were only found in DifTA. In contrast, Moral et al. (2020) did not show this type of analysis. Next, we address the intrasubject analysis, where we discuss the results obtained between the pretest and the posttest of the EG. OB3 aims to compare the level of SA and TA after the intervention of the full group, the females and the males in the EG, and to determine whether or not there are statistically significant differences between the pretest and the posttest. This will allow us to answer PI3 and HI3.

Firstly, in reference to the full group, we answer PI3, where a significant increase in SA at the end of the intervention is observed, as well as a decrease, also significant, in TA. This leads us to reject HI3 for SA, and to accept it for TA. From our point of view, we believe that the EG students suffered from academic stress (Adrianzén, 2021; Restrepo et al., 2020; Silva-Ramos, 2020) for the variable SA, related to how they feel "now", that is, at the time of the posttest, which coincided with the exam period. Even so, the interesting fact is that their levels of TA, related to how they feel "in general", decreased significantly. This leads us to think that, since aerobic exercise has a negative relationship with anxiety (Stonerock et al., 2015), and has significant effects on anxiety reduction (Lin & Gao, 2023), the neuromotricity intervention BAPNE method was beneficial in reducing TA in the full group.

These results partially agree with Romero-Naranjo, Sayago-Martínez et al. (2022). In their study, the EG significantly decreased both SA and TA. In our case, the EG also decreased TA, but on the contrary, it increased SA. On the other hand, they disagree with those obtained by Moral et al. (2020), where their EG decreased SA in the posttest, but maintained TA levels. In the authors' opinion, and in relation to what was described by Lin & Gao (2023), the failure to reduce TA in their study could be due to the short intervention period (10 one-hour sessions).

Secondly, with respect to women, we answer PI3, as we also observe a significant increase in SA at the end of the intervention, as well as a significant decrease in TA. Therefore, we reject HI3 for SA, and accept it for TA. Once again, we maintain the opinion reflected in the previous group (full group) that the students suffered academic stress in the posttest, affecting SA, and that decrease in TA was due to the intervention with the neuromotricity BAPNE method, not only for its physical component of aerobic exercise, but also for its cognitive, psychomotor and socioemotional stimulation.

In this case, we cannot compare our results with any of the previous studies (Moral et al., 2020; Romero-Naranjo, Sayago-Martínez et al., 2022) as they did not perform the analysis by gender within each group. Thirdly, for males, we respond to PI3, as no statistically significant differences are found between pretest and posttest in SA and TA. Therefore, we reject HI3 for both SA and TA.

Although the EG males increased mean SA ($md=-1.75$, $Sd=9.808$) and decreased TA ($md=3.85$, $Sd=8.911$) the differences did not reach significance. This indicates that males controlled SA related academic stress better in the posttest, but remained stable in their perception of TA. In this case, we cannot contrast our results either, as previous studies (Moral et al., 2020; Romero-Naranjo, Sayago-Martínez et al., 2022) did not perform the analysis by gender within each group.

Next, we address the intrasubject analysis, where we discuss the results obtained between the pretest and the posttest of the CG. OB4 aims to compare the level of SA and TA after the intervention of the full group, the females and the males in the CG, and to determine whether or not there are statistically significant differences between the pretest and the posttest. This will allow us to answer PI4 and HI4.

Firstly, with reference to the full group, we respond to PI4, since there was a significant increase in SA at the end of the intervention with traditional methodology, while TA remained stable. This leads us to reject HI4 for SA and to accept it for TA. Similarly, we consider that the significant increase in SA in the CG could also be due to the academic stress suffered by the students at exam time. On the other hand, regarding the stability of TA in the posttest, we consider that the traditional methodology does not provide sufficient stimulation at the physical and socioemotional level to bring out changes after the intervention.

Comparing the results of Romero-Naranjo, Sayago-Martínez et al. (2022) observed that their CG, treated with traditional methodology, not only significantly increased their SA levels, but also their TA levels. On the other hand, the CG of Moral et al. (2020) remained stable in both variables (SA and TA) after the intervention. From this, we can deduce that the control groups, treated with traditional methodology, where aerobic exercise and cognitive, psychomotor and emotional stimulation is not as present, tend to maintain or increase their SA and TA levels, but not to decrease them.

Secondly, with respect to CG females, we answer PI4, finding a significant increase in SA, while TA remains stable. Therefore, we reject HI4 for SA and accept it for TA.

Again, we associate the rise in SA to academic stress, and the stability of TA to the lack of physical, cognitive, psychomotor and socioemotional stimulation of the traditional methodology. We cannot compare our results with previous studies (Moral et al., 2020; Romero-Naranjo, Sayago-Martínez et al., 2022), as they did not present this type of analysis. Thirdly, with reference to CG males, we respond to PI4, where the same characteristics are present as in the previous groups (full group, females), a significant increase in SA and stability in TA. Therefore, we reject HI4 for SA and accept it for TA. Therefore, we reiterate our justification of the results and the impossibility of comparing them with previous studies for the same reason.

Based on the results obtained in our study, and taking into account that: a) 97.4% of Early Childhood Education teachers in Spain are women (MEFPD, 2024); b) anxiety affects 50% more women than men (WHO, 2022); and c) aerobic exercise with long-term interventions favours the reduction of anxiety in students (Chust-Hernández et al., 2023; Lin & Gao, 2023). We consider that the neuromotricity BAPNE method can be a methodology to be taken into account to reduce anxiety in university students of Didactics of Musical Expression at the University of Alicante. As limitations to this study we can highlight, firstly, the differences in the onset of TA in the intersubject analysis between the EG and CG between the full groups, and between the women in both groups. These differences in onset could invalidate our results in this variable (TA), or at least, we should take them with extreme caution, as they are only an indication of a trend or a mere guideline. Secondly, the statistical power ($1-\beta$) is often below .80, which is the recommended cut-off (Cohen, 1988, 1992). Thirdly, the impossibility of using a completely random sample with the same number of participants in the EG as in the CG. Fourthly, the posttest was taken at the end of the term, in the middle of the exam period.

Finally, as lines for the future, this research could be replicated in subsequent courses, overcoming the limitations mentioned above. It would also be interesting to carry out an analysis comparing four groups of participants with each other according to gender and the methodology used. That is, women-neuromotricity vs. men- neuromotricity vs. women-traditional methodology vs. men-traditional methodology. In this way, we could find out in which gender and through which methodology the best results are produced.

Conclusions

The purpose of this work is to know the impact of the traditional methodology and the neuromotricity BAPNE method on the trait-state anxiety of the complete groups, women and men of Didactics of Musical Expression of the Degree in Early Childhood Education at the University of Alicante, and that its results can be used to make methodological decisions based on scientific evidence.

To this end, a series of objectives, research questions and research hypotheses were set out. On the one hand, an intersubject analysis was carried out, between the participants of the EG and the CG, addressing objectives, research questions and hypotheses 1 and 2. On the other hand, an intrasubject analysis was carried out, between the participants within each group separately (EG and CG), answering objectives, research questions and hypotheses 3 and 4.

Firstly, in the intersubject analysis (OB1, PI1, HI1), no baseline differences in SA were observed in the participants, nor in TA in males only. In contrast, the full groups and the females in both groups did not start from the same level of TA.

Secondly, and continuing with the intersubject analysis (OB2, PI2, HI2), on the one hand, the neuromotricity BAPNE method has a greater impact than the traditional methodology on SA in the full groups (men and women) and in women, but not in men. On the other hand, due to the differences in the onset of TA in the EG, no statistically significant differences were found that would indicate a better impact on TA of one methodology over the other.

Thirdly, and with reference to the intrasubject analysis carried out on the EG (OB3, PI3, HI3), on the one hand, the neuromotricity BAPNE method did not achieve a statistically significant reduction in SA in any group (full group, women, men), since they increased; nor did it reduce TA in men, who showed no changes. On the other hand, it was statistically significant in the reduction of TA in the full group and in women.

Fourthly, and with reference to the intrasubject analysis carried out on the CG (OB4, PI4, HI4), on the one hand, the traditional methodology did not manage to maintain SA without statistically significant changes, since it increased in all groups (full group, women, men). On the other hand, it did not affect TA in any group, which although it increased its levels in the posttest, these differences were not significant.

With regard to the increase in SA in all groups, both those treated with the neuromotricity BAPNE method and with the traditional methodology (with the exception of the EG males), we consider that the academic stress experienced by the students was a key factor when taking the posttest, given that it was carried out in the middle of the exam period, which, together with the lack of time and academic overload, were the greatest generators of anxiety among the students.

On the other hand, the differences in TA onset found between EG and CG should invalidate the results extracted from the intersubject analysis on this variable, or at least take them with extreme caution and serve only as an indication of trend or as a guideline.

Based on our results, we consider that the use of the neuromotricity BAPNE method can be a very valuable tool for the reduction of anxiety in future teachers, given that: anxiety disorders are the most common mental health disorders in the world and have serious consequences for those who suffer from them, that they affect 50% more women than men, that aerobic exercise significantly reduces anxiety, and that 97.4% of Early Childhood Education teachers in Spain are women.

In addition to improving the mental health of future teachers, this methodology also provides significant results at a cognitive level in this population, and can help us to make methodological decisions based on scientific evidence, increasing its presence in the teaching load, while still dealing with the important content provided by traditional methodology.

On the other hand, future teachers trained with this methodology will be able to use it with their students, providing them not only with significant learning, but also with cognitive, psychomotor and socioemotional stimulation, as well as possible stimulation of cognitive and executive functions.

Finally, it is hoped that this work can serve as a basis for future research that will be the compass guiding the development of knowledge, and that will transform human potential into reality, building a bridge to a better future.

Conflicts of interest. This study was not funded by any public or private organisation.

References

- Adrianzén Segovia, C. S. (2021). Influencia de la ansiedad en el aprendizaje del idioma inglés como lengua extranjera en estudiantes de educación superior. *INNOVA Research Journal*, 6(3), 58-78. <https://doi.org/10.33890/innova.v6.n3.2021.1742>
- Alonso-Marco, M., & Romero-Naranjo, F. J. (2022). Introducción al análisis cinemático de los movimientos básicos de la percusión corporal según el Método BAPNE. *Retos*, 46, 950-971. <https://doi.org/10.47197/retos.v46.94773>
- American Psychiatric Association. (2014). *Manual diagnóstico y estadístico de los trastornos mentales. DMS-5* (5ª ed.). Editorial médica panamericana.
- Andreu-Cabrera, E., & Romero-Naranjo, F. J. (2021). Neuromotricidad, psicomotricidad y motricidad. Nuevas aproximaciones metodológicas. *Retos*, 42, 924-938. <https://doi.org/10.47197/retos.v42i0.89992>
- Andreu-Cabrera, E., Romero-Naranjo, F. J., & Lorenzo Lledó, A. (2024). Motor skills and neuromotricity. Theoretical-Practical justification through the BAPNE method. *Retos*, 52, 338-349. <https://doi.org/10.47197/retos.v52.101707>
- Arнау-Mollá, A. F., Asurmendi Telleria, E., Romero-Naranjo, F. J. & Di Russo, S. (2022). Esku dantza: Creative proposal through neuromotricity, BAPNE method. In Á. Martos Martínez, A. B. Barragán Martín, M. d. C. Pérez Fuentes, M. d. M. Molero Jurado, M. d. M. Simón Márquez & M. Sisto (Comps.), *Acercamiento Multidisciplinar Para la Investigación e Intervención en Contextos Educativos* (pp. 495-505). Dykinson.
- Arнау-Mollá, A. F., & Romero-Naranjo, F. J. (2020). Quantitative study on selective attention in children aged 8-9 years through bodypercussion. *European Proceedings of Social and Behavioural Sciences*, 84(6), 50-60. <https://doi.org/10.15405/epsbs.2020.05.6>

- Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2022a). A bibliometric study on body percussion based on high impact search engines. *Retos*, 45, 679-692. <https://doi.org/10.47197/retos.v45i0.92653>
- Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2022b). Body percussion as a pedagogical resource. Bibliometric study on body percussion based exclusively on secondary search engines. *Retos*, 46, 809–825. <https://doi.org/10.47197/retos.v46.95178>
- Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2022c). Evolution of the bapne method as an innovation method based on its justification in scientific-Academic publications. In M. d. M. Molero Jurado, A. B. Barragán Martín, M. d. M. Simón Márquez, & Á. Martos Martínez (Comps.), *Innovación Docente e Investigación en Educación: Experiencias de Cambio en la Metodología Docente* (pp. 485-496). Dykinson.
- Arnau-Mollá, A. F. & Romero-Naranjo, F. J. (2022d). Urban rhythms and creativity: Proposals for didactic innovation from neuromotricity through the BAPNE method. In Á. Martos Martínez, A. B. Barragán Martín, M. d. C. Pérez Fuentes, M. d. M. Molero Jurado, M. d. M. Simón Márquez & M. Sisto (Comps.), *Acercamiento Multidisciplinar Para la Investigación e Intervención en Contextos Educativos* (pp. 463-474). Dykinson.
- Arnau-Mollá, A. F. & Romero-Naranjo, F. J. (2023a). Foundation and didactics of the main part of the session in the bapne method. Cognitive stimulation. In A. Martos Martínez, M. M. Simón Márquez, J. J. Gázquez Linares, P. Molina Moreno, & S. Fernández Gea (Comps.), *Innovación Docente e Investigación en Educación: Nuevas Tendencias Para el Cambio en la Enseñanza Superior* (pp. 873-888). Dykinson.
- Arnau-Mollá, A. F. & Romero-Naranjo, F. J. (2023b). Structure and foundation for starting a session through bapne's method. The initiation rite. In A. Martos Martínez, M. M. Simón Márquez, J. J. Gázquez Linares, P. Molina Moreno, & S. Fernández Gea (Comps.), *Innovación Docente e Investigación en Educación: Nuevas Tendencias Para el Cambio en la Enseñanza Superior* (pp. 849-862). Dykinson.
- Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2024). Bibliometric evolution of body percussion: Impact and gender in scientific-academic publications. *Retos*, 51, 1025–1054. <https://doi.org/10.47197/retos.v51.101450>
- Arnau-Mollá A. F., Romero-Naranjo, F. J., & Andreu-Cabrera, E. (2024). Comparing the impact of neuromotricity BAPNE method and traditional methodology on selective attention and concentration among future teachers: A gender-Based comparative study. *Journal of Physical Education and Sport @ (JPES)*, 24(5), Art. 140, 1212-1229. <https://doi.org/10.7752/jpes.2024.05140>
- Buela-Casal, G., Guillén-Riquelme, A., & Seisdedos Cubero, N. (2011). *STAI. Cuestionario de ansiedad estado-rasgo* (8ª ed.). Tea ediciones.
- Castillo Pimienta, C., Chacón de la Cruz, T., & Díaz-Véliz, G. (2016). Ansiedad y fuentes de estrés académico en estudiantes de carreras de la salud. *Investigación en educación médica*, 5(20), 230-237. <https://doi.org/10.1016/j.riem.2016.03.001>
- Chust-Hernández, P., Fernández-García, D., López-Martínez, L., García-Montañés, C., & Pérez-Ros, P. (2022). Female gender and low physical activity are risk factors for academic stress in incoming nursing students. *Perspectives in Psychiatric Care*, 58(4), 1281-1290. <https://doi.org/10.1111/ppc.12928>
- Chust-Hernández, P., López-González, E., & Senent-Sánchez, J. M. (2023). Eficacia de las intervenciones no farmacológicas para la reducción del estrés académico en estudiantes universitarios: una revisión sistemática. *Ansiedad y Estrés*, 29(1), 45-62. <https://doi.org/10.5093/anyes2023a6>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. (2nd ed.). Lawrence Erlbaum Associates.
- Cohen, J. (1992). Cosas que he aprendido (Hasta ahora). *Anales de Psicología / Annals of Psychology*, 8(1-2), 3–17.
- Crespo Colomino, N., Alonso Sanz, A., Romero Naranjo, F. J., Moreno Cebrián, C., Pozzo, T., Andreu Guerrero, R., Liendo Cárdenas, A., & Romero Naranjo, A. A. (2015). ¿Para qué sirve la percusión corporal - método bapne? In R. A. Rodríguez Pérez, & M. B. Alfageme González (Eds.), *Innovación y enseñanza en educación primaria* (1st ed., pp. 215-228). Editum.
- Di Russo, S., Gisbert Caudeli, V., Romero-Naranjo, F. J., & Domenico Pelizza, A. (2024a). Body percussion in the band repertoire: Case study of the work La corrida de toros, by Mario Bürki. *Per Musi*, 25, 1-41. <https://doi.org/10.35699/2317-6377.2024.49030>
- Di Russo, S., Gisbert Caudeli, V., Romero-Naranjo, F. J., & Domenico Pelizza, A. (2024b). Body percussion in the band repertoire: The case study of the work Palindromia Flamenca, by Antonio Ruda Peco. *Per Musi*, 25, 1-23. <https://doi.org/10.35699/2317-6377.2024.52694>
- Di Russo, S., Romero-Naranjo, F. J. (2021a). *Body percussion in spanish music: A methodological approximation* [Article]. ERPA 2021 International Congresses on Education, Sakarya, Turkiye.
- Di Russo, S., Romero-Naranjo, F. J. (2021b). *Body percussion in the work of composer Oscar Navarro. *The case of "Libertadores* [Article]. ERPA 2021 International Congresses on Education, Sakarya, Turkiye.
- Di Russo, S., & Romero-Naranjo, F. J. (2023). Body percussion and traditional dances. The case of Ball dels Moretons in Mallorca. *Retos*, 49, 442–458. <https://doi.org/10.47197/retos.v49.97609>

- Di Russo, S., Romero-Naranjo, F. J., Gisbert Caudeli, V., Cantarini, G. (2023). The repertoire for wind band and body percussion. A state of the question from the BAPNE method. In M. d. M. Simón Márquez, J. J. Gázquez Linares, Á. Martos Martínez, S. Fernández Gea, & P. Molina Moreno (Comps.), *Innovación docente e investigación en arte y humanidades: nuevas tendencias para el cambio en la enseñanza superior* (pp.171-184). Dykinson.
- Di Russo, S., Salerno, G., Romero-Naranjo, F. J. & Arnau-Mollá, A. F. (2022). Las panaderas is creativity: From tradition to innovation. In Á. Martos Martínez, A. B. Barragán Martín, M. d. C. Pérez Fuentes, M. d. M. Molero Jurado, M. d. M. Simón Márquez & M. Sisto (Comps.), *Acercamiento Multidisciplinar Para la Investigación e Intervención en Contextos Educativos* (pp. 403-414). Dykinson.
- Escalona, A., & Miguel-Tobal, J. J. (1996). Ansiedad ante los exámenes: evolución histórica y aportaciones prácticas para su tratamiento. *Ansiedad y estrés*, 2(2-3), 195-209.
- Erdfelder, E., Faul, F. & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers* 28, 1–11. <https://doi.org/10.3758/BF03203630>
- Faul, F., Erdfelder, E., Lang, A.G. et al. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods* 39, 175–191. <https://doi.org/10.3758/BF03193146>
- Fernández-Rodríguez, C., Soto-López, T., & Cuesta Izquierdo, M. (2019). Needs and demands for psychological care in university students. *Psicothema*, 31(44), 414-421. <https://doi.org/10.7334/psicothema2019.78>
- Huerta, A., Barahona-Fuentes, G., Galdames, S., Cáceres, P., & Ortiz, P. (2020). Efectos de un programa de Zumba® sobre niveles de ansiedad-rasgo, ansiedad-estado y condición física en estudiantes universitarias chilenas. *Cuadernos de Psicología del Deporte*, 20(3), 1-14.
- Huerta-Ojeda, Á., Barahona-Fuentes, G., Galdames-Maliqueo, S., Cáceres-Serrano, P., Castillo-Hernández, N., & Ortiz-Marholz, P. (2021). Fuerza prensil como factor predictor de ansiedad-rasgo en estudiantes universitarias. *Universidad y Salud*, 23(2), 100-108. <https://doi.org/10.22267/rus.212302.221>
- Liu, H. X., Chow, B. C., Hu, C., Hassel, H., & Huang, W. Y. (2022). eHealth usage among Chinese college students: qualitative findings. *BMC Public Health*, 22(1), Art. 1088. <https://doi.org/10.1186/s12889-022-13521-1>
- Lin, Y., & Gao, W. (2023) The effects of physical exercise on anxiety symptoms of college students: A meta-analysis. *Frontiers in Psychology*, 14, Art. 1136900. <https://doi.org/10.3389/fpsyg.2023.1136900>
- Martín Dobón, E., & Pérez García, E. M. (2021). ¿Tienen ansiedad ante los exámenes los estudiantes de la Universidad Complutense de Madrid?. In L. Carro Sancristobal, M. Carabias Herrero, & V. Morcillo Casas (Eds.), *Buena orientación, buena elección: II Congreso Internacional de Orientación Universitaria* (p. 451). Universidad de Valladolid.
- Mas-Mas, D., Arnau-Mollá, A. F. ., & Romero-Naranjo, F. J. (2023). Dual-Task and movement: A bibliometric study based on high-Impact search engines. *Retos*, 50, 995–1009. <https://doi.org/10.47197/retos.v50.100176>
- Ministerio de Educación, Formación Profesional y Deportes (2024). *Las cifras de la educación en España. Curso 2021-2022*. MEFPD.
- Miyake, A. & Friedman, N. P. (2012). The nature and organization of individual differences in executive functions: Four general conclusions. *Current Directions in Psychological Science*, 21(1), 8-14. <https://doi.org/10.1177/0963721411429458>
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, 41(1), 49-100. <https://doi.org/10.1006/cogp.1999.0734>
- Moral Bofill, L., Vicedo Molla, F., & Romero Naranjo, F. J. (2020). Estudio piloto de variables socioemocionales, ansiedad y flow en alumnos de grado profesional de música mediante actividades BAPNE. *Educatio Siglo XXI*, 38(2), 193-212. <https://doi.org/10.6018/educatio.432971>
- Morales-Martín, I., Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2024). Laterality and education: A bibliometric study based on high-impact search engines. *Journal of Physical Education and Sport @ (JPES)*, 24(7).
- Navarro-Maciá, V., & Romero Naranjo, F. J. (2024a). Jazz and body percussion. A proposal of creative strategies with the BAPNE method. *Retos*, 51, 509–518. <https://doi.org/10.47197/retos.v51.100544>
- Navarro-Maciá, V., & Romero Naranjo, F. J. (2024b). Body percussion and blues. A neuromotor approach through BAPNE method. *Retos*, 51, 970–978. <https://doi.org/10.47197/retos.v51.101238>
- Penalva Martínez, R., Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2023). Traditional dances in Spain. Bibliometric study based on high impact search engines. *Retos*, 51, 18–31. <https://doi.org/10.47197/retos.v51.100338>
- Pontifex, M. B., McGowan, A. L., Chandler, M. C., Gwizdala, K. L., Parks, A. C., Fenn, K., & Kamijo, K. (2019). A primer on investigating the after effects of acute bouts of physical activity on cognition. *Psychology of Sport and Exercise*, 40, 1-22. <https://doi.org/10.1016/j.psychsport.2018.08.015>

- Rautela, S., Sharma, A., & Panackal, N. (2024). Exploring the mental well-being of higher educational institutions students: A bibliometric analysis. *Cogent Education*, 11(1), Art. 2343522. <https://doi.org/10.1080/2331186X.2024.2343522>
- Restrepo, J., Sánchez, O., & Castañeda Quirama, T. (2020). Estrés académico en estudiantes universitarios. *Revista Psicoespacios*, 14(24), 23-47. <https://doi.org/10.25057/21452776.1331>
- Rogowska, A. M., Pavlova, I., Kuśnierz, C., Ochnik, D., Bodnar, I., & Petrytsa, P. (2020). Does physical activity matter for the mental health of university students during the COVID-19 pandemic?. *Journal of clinical medicine*, 9(11), Art. 3494. <https://doi.org/10.3399/jcm9113494>
- Romero-Naranjo, F. J. (2018a). Bodypercussion: Programación didáctica. Volumen 1. (28th ed.). Ramón Torres Gosálvez.
- Romero-Naranjo, F. J. (2018b). Bodypercussion: Programación didáctica. Volumen 2. (28th ed.). Ramón Torres Gosálvez.
- Romero-Naranjo, F. J. (2020a). Body percussion in the physical education and sports sciences. An approach to its systematization according to the BAPNE method. *International Journal of Innovation and Research in Educational Sciences*, 7(5), 421-431.
- Romero-Naranjo, F. J. (2020b). Percusión corporal y “Solfeo cognitivo”. Recursos pedagógicos según el método BAPNE. *Pensamiento Actual*, 20(35), 105-121. <https://doi.org/10.15517/PA.V20I35.44398>
- Romero-Naranjo, F. J. (2024). Neuromyths about movement and the brain: Debunking common misconceptions. *Journal of Physical Education and Sport @ (JPES)*, 24(7).
- Romero-Naranjo, F. J., & Andreu-Cabrera, E. (2023a). Condición física y neuromotricidad. Justificación teórico-práctica según el método BAPNE. *Retos*, 50, 215–227. <https://doi.org/10.47197/retos.v50.98712>
- Romero-Naranjo, F. J., & Andreu-Cabrera, E. (2023b). Neuromotricidad como recurso interdisciplinar. Justificación teórico-práctica a través del método BAPNE. *Retos*, 49, 350–364. <https://doi.org/10.47197/retos.v49.98903>
- Romero-Naranjo, F. J., & Andreu-Cabrera, E. (2023c). The ten pillars of neuromotricity. Theoretical-Practical justification according to the BAPNE method. *Retos*, 50, 357–370. <https://doi.org/10.47197/retos.v50.98333>
- Romero-Naranjo, F. J., Andreu-Cabrera, E., & Arnau-Mollá, A. F. (2023). Neuromotricity and body schema. Bases for the use of body percussion in the sciences of physical education and sport. *Retos*, 47, 615–627. <https://doi.org/10.47197/retos.v47.95922>
- Romero-Naranjo, F. J., Andreu-Cabrera, E., & Arnau-Mollá, A. F. (2024). Neuromotricity in early childhood education. Development tables as an interdisciplinary proposal according to the BAPNE method. *Retos*, 53, 162–177. <https://doi.org/10.47197/retos.v53.101080>
- Romero-Naranjo, F. J., Arnau-Mollá, A. F., & Andreu-Cabrera, E. (2023). Strategies for ending a session in the BAPNE method: The closing rite. In A. Martos Martínez, M. M. Simón Márquez, J. J. Gázquez Linares, P. Molina Moreno, & S. Fernández Gea (Comps.), *Innovación Docente e Investigación en Educación: Nuevas Tendencias Para el Cambio en la Enseñanza Superior* (pp. 901-913). Dykinson.
- Romero-Naranjo, F. J., & Llorca-Garnero, J. (2023). Ergospirometry & body percussion. Case study based on BAPNE FIT method. *Retos*, 48, 674–683. <https://doi.org/10.47197/retos.v48.97928>
- Romero-Naranjo, F. J., Pujalte Cantó, F. J., & Arnau-Mollá, A. F. (2023). Body percussion and selective attention. Interdisciplinary quantitative study through neuromotricity activities BAPNE method based on the dual task in Primary Education. *Retos*, 48, 844–860. <https://doi.org/10.47197/retos.v48.97661>
- Romero-Naranjo, F. J., Sayago-Martínez, R., Jiménez-Molina, J. B., & Arnau-Mollá, A. F. (2023). 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. *Retos*, 47, 573–588. <https://doi.org/10.47197/retos.v47.95595>
- Sayago-Martínez, R., Salerno, G., Di Russo, S., Arnau-Mollá, A., & Romero-Naranjo, F. J. (2021). *Socioemotional aspects of music-Motor activities according to the BAPNE method* [Written submission]. ERPA 2021 International Congresses on Education, Sakarya, Turkey.
- Silva-Ramos, M. F., López-Cocotle, J. J., & Meza-Zamora, M. E. C. (2020). Estrés académico en estudiantes universitarios. *Investigación y Ciencia de la Universidad Autónoma de Aguascalientes*, 28(79), 75-83.
- Sohlberg, M. M., & Mateer, C. A. (1987). Effectiveness of an attention-Training program. *Journal of Clinical and Experimental Neuropsychology*, 9(2), 117–130. <https://doi.org/10.1080/01688638708405352>
- Sohlberg, M. M. y Mateer, C. A. (1989). Theory and remediation of attention disorders. In M. M. Sohlberg y C. A. Mateer (Eds). *Introduction to Cognitive Rehabilitation* (pp. 110-135). Guildford Press.
- Stern, Y., MacKay-Brandt, A., Lee, S., McKinley, P., McIntyre, K., Razlighi, Agarunov, E., Bartels, M., & Sloan, R. P. (2019). Effect of aerobic exercise on cognition in younger adults: A randomized clinical trial. *Neurology*, 92(9), Art. e905-e916. <https://doi.org/10.1212/WNL.0000000000007003>
- Stonerock, G. L., Hoffman, B. M., Smith, P. J., & Blumenthal, J. A. (2015). Exercise as treatment for anxiety: Systematic review and analysis. *Annals of behavioral medicine*, 49(4), 542-556. <https://doi.org/10.1007/s12160-014-9685-9>

- Suárez, P., Arnau-Mollá, A. F., & Romero-Naranjo, F. J. (2024). Bibliometric analysis of cognitive stimulation and movement using primary search engines. *Journal of Physical Education and Sport*® (JPES), 24(5), 811-825. <https://doi.org/10.7752/jpes.2024.04094>
- Tirapu-Ustarroz, J., & Luna-Lario, P. (2008). Neuropsicología de las funciones ejecutivas. *Manual de neuropsicología*, 2, 219-59.
- Torró-Biosca, R., Aparici-Mínguez, F., Arnau-Mollá, A. F., Ulate-Orozco, R. M., Cabrera-Quirós, D. A., & Romero-Naranjo, F. J. (2019). Pilot study into the executive functions of children aged 8-9 BAPNE method. *The European Proceedings of Social & Behavioural Sciences EpSBS*, 60, Art. 94. <https://dx.doi.org/10.15405/epsbs.2019.04.02.94>
- Tortella-Feliu, M. (2014). Los trastornos de ansiedad en el DSM-5. *Cuadernos de medicina psicosomática y psiquiatría de enlace*, (110), 62-69.
- Turriate Chávez, J. J., Torres Ceclén, C. C., & Martos Ramírez, L. C. (2022). Efecto del acompañamiento pedagógico en el estrés académico y la ansiedad ante los exámenes, en el contexto covid 19, en estudiantes de una universidad privada Chimbote – 2021. *Ciencia Latina Revista Científica Multidisciplinar*, 6(1), 4122-4143. https://doi.org/10.37811/cl_rcm.v6i1.1789
- White, R. L., Babic, M. J., Parker, P. D., Lubans, D. R., Astell-Burt, T., & Lonsdale, C. (2017). Domain-Specific physical activity and mental health: A meta-analysis. *American journal of preventive medicine*, 52(5), 653-666. <https://doi.org/10.1016/j.amepre.2016.12.008>
- World Health Organization. (2022). *World mental health report: T ransforming mental health for all*. World Health Organization.
- Xiang, M. Q., Tan, X. M., Sun, J., Yang, H. Y., Zhao, X. P., Liu, L., Hou, X. H., & Hu, M. (2020). Relationship of physical activity with anxiety and depression symptoms in Chinese college students during the COVID-19 outbreak. *Frontiers in psychology*, 11, Art. 582436. <https://doi.org/10.3389/fpsyg.2020.582436>