

EDUHEM 2018
VIII International conference on intercultural education and
International conference on transcultural health: THE
VALUE OF EDUCATION AND HEALTH FOR A GLOBAL,
TRANSCULTURAL WORLD

EVALUATING EXECUTIVE FUNCTIONS IN PRIMARY SCHOOL
CHILDREN IN ALICANTE USING BODY PERCUSSION

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Abstract

The current pilot study aims primarily to discover if the executive functions of students in their fourth year of primary school can be improved using psychomotor stimulation through the practice of body percussion using the BAPNE® Method. We have carried out a quantitative study over the course of 34 weeks with an experimental group and a control group. The study was based on a research protocol with a total of n=70 subjects, divided between an experimental group and a control group in an area of the Valencian Community (Spain) with above average socioeconomic characteristics and average educational outcomes. Analysis of the results from the post-test of the experimental group shows that there has been a notable improvement in cognitive skills involving attention, as well as working memory. The evaluation tool used to measure attention levels and working memory was the ENFEN test. The methodology used was experimental in its design and used a collection of pre- and post-test sample measurements, before and after the method was implemented. Subsequently, statistical analysis was carried out. This was factorial in design and considered the measurements taken before and after.

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Keywords: BAPNE, body percussion, neuromotricity, pupils in fourth year of primary school, working memory.



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1. Introduction

Music stimulates our brain in a specific way and activates various areas of our brain (Zatorre, 2003; Peretz & Zatorre, 2005; Sibley & Etnier, 2003). There is an increasing number of studies into psychomotor movement which show an improvement in cognitive functions (Gómez-Pinilla, 2013; Cameron et al., 2012; Sulkin, 2010). For this reason, musical motor activities can lead to a possible improvement in certain cognitive functions. According to Norwich & Eaton (2015), in the developmental period of primary school, from 6 to 12 years of age, there are various changes, as proven by authors such as García-Bacete & González-Álvarez (2010) or Palacios, Marchesi, & Coll (2014). These authors show that the description of psychological development in a determined age group and considering certain fields of behaviour should be based on the basic elements which are involved in this development. The development is determined by:

- Recognition of the role of heredity and environment.
- The influence of sociocultural context on the traits described in the phase of development.
- The relativity now used when considering the subject of developmental cycles and critical periods.

According to Wallon (2000), a child's development can be divided into various stages, each one of which corresponds to a specific stage in the developmental system.

We picked out some characteristics of the pupils aged between 9 and 10 years of age and their general developmental aspects when carrying out the ENFEN TEST. In general, these pupils are highly motivated in school and in their relationships with others, including their classmates. This translates into an eagerness to socialise and cooperate. The student-teacher and student-student relationship tends to be very positive. The pupils are generally likeable both to adults and their classmates.

According to the psycho-developmental characteristics of these pupils, we can say that they can: notice and distinguish rhythm; recognise time signatures according to melodies; express their keenness to play instruments and sing as a group. However, best of all is the voice of these pupils. At this age, they are at the best moment for singing. If this skill is worked on at earlier stages, the benefits of this can be seen at this moment.

Our aim is for each pupil to know their bodies and the expressive possibilities they have through its use. The BAPNE® method can be a means of self-fulfilment and coming together and so, for them, can be a non-threatening space in which to communicate. Musical sensitivity is a talent and pupils who have this react positively to musical sounds. All children are sensitive to music, regardless of how developed their abilities may be.

Within the classroom, pupils should acquire appropriate behaviour routines and this should be something automatically understood. It is the task of the teacher to help pupils achieve this and should thus offer up positive constructivist reinforcement until this becomes a routine like any other. It is particularly important that we remove any behaviours which are challenging.

For a long time, there have been different musical methods which have dealt with movement and, in the background, body percussion. Since the 20th century these methods founded in rhythm and movement have developed directly and indirectly, led by the work of Jacques-Dalcroze, Zoltan Kodaly, Carl Orff, Edgar Willems, Maurice Martenot and the BAPNE® method (Trives et al., 2014).

We became aware that by using the BAPNE method, the pupils stimulated their executive functions, cooperative learning and working memory to a much greater degree. It is the only methodology which works on all types of sounds using the body.

BAPNE is a method of cognitive, socio-emotional, psychomotor and neurological rehabilitation stimulation, and is based on neuromotricity. In this study, we wish to show its contribution to inter and intra-personal intelligence.

According to Martí (1990), the main cognitive developments in this stage are as follows:

- Development of attention, memory and knowledge.
- Concrete operational thinking.

In the BAPNE® method, attention is obtained using rhythmical and melodic activities which aim to possibly stimulate the different executive functions (Sholberg & Mateer, 1989).

2. Problem Statement

Aims and hypothesis

When we started our investigation, we set ourselves the following aims:

- measuring the improvement in attention, in inhibition and flexibility of each individual in the school group under study in the investigation.
- measuring the improvement in working memory, in planning and monitoring, in the experimental group compared to a control group, having used the BAPNE Method with them.

Our hypotheses are two-fold:

1. The level of improvement in attention, inhibition and flexibility will stay the same or improve.
2. The level of improvement of working memory, planning and monitoring will stay the same or improve.

3. Research Questions

Method

Through exhaustive searching on different high-impact search engines such as ERIC, Scimago, Thomson and Reuter, Jstor, Scopus, we can see that there are very few academic publications focussed on body percussion and its possible stimulation of executive functions. However, we can cite some individualised studies which deal with body percussion in the BAPNE method, organised into three types.

- A. Basis. Publications focussed on the activities used and the reasoning behind them (Jiménez-Molina, Vicedo-Cantó, Sayago-Martínez, & Romero-Naranjo, 2017; Salerno, Cefaratti, & Romero-Naranjo, 2017).
- B. Protocol. Publications about Research Design, such as Carretero-Martínez, Romero-Naranjo, Pons-Terrés, & Crespo-Colomino (2014).
- C. Publications with Statistical Results (Fabra-Brell & Romero-Naranjo, 2017).

The aim of our investigation is to be able to improve the executive functions using the methodology of the BAPNE® method and to be able to measure this using the ENFEN test.

Our study is novel in that it is based on the results of the ENFEN test. This test is carried out on an individual basis and takes less than 30 minutes to carry out. The test is inspired by classic tests to assess the prefrontal area such as the Tower of Hanoi puzzle or the Stroop Test. It allows us to assess six indices, grouped on four scales: Fluency (Phonological and Semantic) which allows us to assess the verbal fluency of subjects; Trail Making (grey and coloured sets) which aims to assess working memory, speed of locating with sight, attention, mental flexibility and motor function; Rings (the ring test which measures abstract reasoning, working memory and planning); and Interference (which allows us to assess mental flexibility, selective attention, and inhibition ability). The six indices are measured from one to ten, which allows us to observe the strengths and weaknesses of each individual's profile. As well as being valid and reliable, the ENFEN test is enjoyable for children. In particular, the Rings test, in which children have to make models out of coloured rings, is seen by them as a fun activity.

4. Purpose of the Study

To study the effect of the BAPNE® method on the executive functions processes in a pilot group undertaking primary school studies.

5. Research Methods

This study was carried out in the town of San Vicente del Raspeig (Alicante), a locality with a population of 57,145.

The whole study was carried out in the Reyes Católicos, a school with 455 pupils, split between 6 groups in the early-years stage and 12 groups in the primary stage. There are more than 30 members of teaching staff. The sociocultural and socioeconomic level of the families is average to high.

In order to carry out the investigation, we worked with two groups of primary school students in their fourth year of primary school between 9 and 10 years of age. The experimental group consisted of 35 participants and included 16 boys and 19 girls. On the other hand, the control group consisted of 35 pupils and included 16 boys and 19 girls. The total number of subjects was $n=70$. All of the pupils, both in the control and the experimental group, had been receiving music classes in Catalan since the start of their primary phase in the school.

The protocol with the experimental group was to replace the pupils' music lesson twice a week (on Mondays and Wednesdays) for fifty minutes at a time. A total of 34 sessions were delivered. During these sessions, pupils worked using the BAPNE® method, which is a method of cognitive, socio-emotional, psychomotor and neurological rehabilitation stimulation that uses body percussion, music and movement and follows the theory of multiple intelligences. The aim of practically all the activities in the BAPNE® method is to work on multitasking in short activities.

In order to develop these sessions, we followed the academic protocol of other studies (Díaz-Pérez, 2017). This protocol includes a starter activity, developmental activities, and finally a closing activity. An example of one of the activities we used is Clap Change. In this activity, the upper limbs are moved, ideally using handclaps, whilst the individual moves the lower limbs with specific movements such as moving in a square. Furthermore, one can count from 1 to 4, from 1 to 8, work on solfege or mathematics. It is the

teacher who manages and changes the variants. This activity and many others can be found in the books in the BAPNE® Method (Romero-Naranjo, 2014, 2015, 2017).

6. Findings

6.1. Results

Due to the space constraints of this publication, we will focus on the results we obtained concerning working memory and phonological fluency.

The analysis of the data was carried out using the t-Student test to compare the averages of independent samples. A statistical significance of 0.05 was used. The statistical software used was IBM SPSS v24 for Mac. The graphs and tables have been made using Microsoft Excel for Mac for greater aesthetic appeal.

F1. PHONOLOGICAL FLUENCY

In the first stage of the pre-test, there are no statistically significant differences between the experimental and control groups. After conducting the post-test, statistically significant data was obtained that showed a difference in the number of correct answers between the two groups ($p=0.03$). A difference of 0.811 was found (table 01 and figure 01).

Table 01. Independent Samples Test and group statistics

Levene's Test for Equality of Variances		t-test for Equality of Means						Group statistics			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Group	N	Mean	SD
PRE F1-T	Equal variances assumed	2,807	0,098	1,532	68	0,13	0,886	Experimental	35	8,97	2,684
	Equal variances not assumed			1,532	64,53	0,13	0,886	Control	35	8,09	2,12
POST F1-T	Equal variances assumed	3,404	0,069	2,22	68	0,03	1,8	Experimental	35	10,49	3,981
	Equal variances not assumed			2,22	59,52	0,03	1,8	Control	35	8,69	2,676

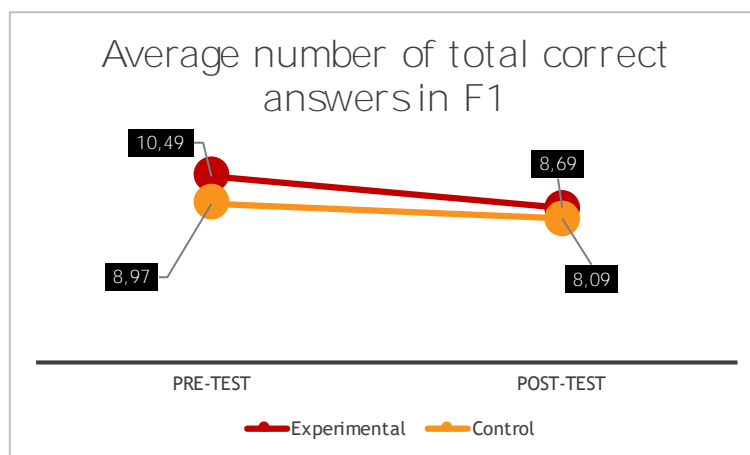


Figure 01. Average number of total correct answer in F1

A: RINGS

Statistically significant differences were found between the averages of the experimental group and the averages of the control group when completing the post-test for the total number of movements ($p=0.008$). The experimental group reduced the number of movements. In the pre-test, no differences were found between the groups (table 02 and figure 02).

Table 02. Independent Samples Test and group statistics

Levene's Test for Equality of Variances		t-test for Equality of Means						Group statistics			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Group	N	Mean	SD
PRE A-M	Equal variances assumed	8,065	0,006	-1,434	68	0,156	-4,857	Experimental	35	122,74	10,65
	Equal variances not assumed			-1,434	57,178	0,157	-4,857	Control	35	127,64	16,974
POST A-M	Equal variances assumed	1,794	0,185	-2,735	68	0,008	-10,943	Experimental	35	124,51	15,868
	Equal variances not assumed			-2,735	67,312	0,008	-10,943	Control	35	135,46	17,562

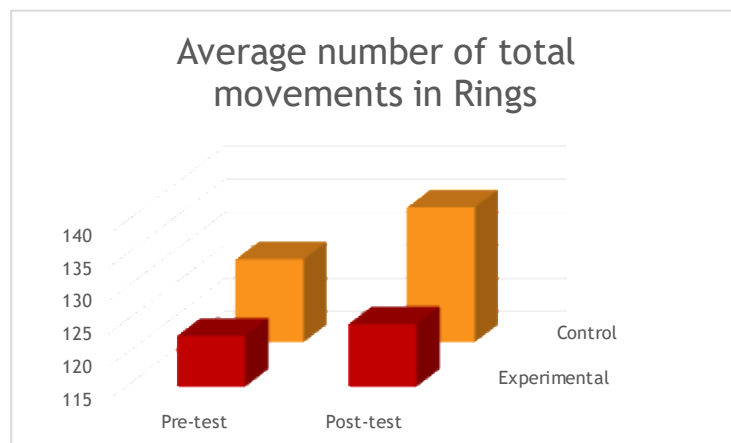


Figure 02. Average number of total correct answer in F1

7. Conclusion

In this pilot study, we observed that the pupils demonstrated specific improvements when we assessed their executive functions. In this study, we assessed their verbal fluency and working memory in particular. The results obtained lead us to think that the BAPNE® Method could be a highly effective tool in the primary school classroom to help improve achievement, especially when used first thing in the morning. Following the quantitative study carried out over the course of 34 weeks, we can state that the experimental group showed improvement in:

- Phonological fluency (which assesses verbal fluency), as the experimental group improved with regards to the total number of correct answers.
- The rings test, which measures abstract reasoning, working memory, and planning, as the experimental group improved significantly and precisely in the number of movements.

This investigation offers a way forward for the use of other tests related to executive functions and to increase the number of subjects to carry out a longitudinal study. This will be of great use since the aim of the BAPNE research group is to be able to prove its validity by use of quantitative studies.

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