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PILOT STUDY INTO EXECUTIVE FUNCTIONS WITH MUSLIM
AND CHRISTIAN PUPILS IN THE CITY OF CEUTA USING BODY
PERCUSSION

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Abstract

In this study we present a pilot study based on measuring the executive functions amongst students in their first year of secondary school in the Luis de Comoens School in Ceuta. The protocol of the investigation was based on the possible stimulation of the executive functions using the combination of movement and music using body percussion according to the BAPNE Method. The tests used for this study were Stroop, TMT, FAS, Digits, Animals and CARAS. The study was carried out in a sociocultural and economic area of average characteristics during a period of six months within the school. Both the experimental and the control group come from the same establishment, but are in separate sections of the school, thus avoiding possible contamination. The sample (n=61) was studied quantitatively, by comparing the control group with the experimental group. The results of the post-test with the experimental group show clear improvement compared with the control group. They had clearly developed in terms of their executive functions when primarily considering different types of attention, planning, and working memory.

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Keywords: BAPNE, body percussion, executive functions, motor control, music, working memory.



1. Introduction

Since the start of the 20th century, there have been numerous studies which show the problems faced by schools due to the low achievement of their pupils (Delgado, 1994). We continue to come across a countless number of studies which aim to analyse the problem of school failure (Motari, Ogoma, & Misigo, 2010). The latest PISA report, with data from 2015, shows that Spain is positioned in the middle of the OECD countries, and that general results have decreased.

In studies into school achievement, academics have moved towards accepting a model which shows interacting factors (Delgado, 1994). This model states that school achievement is affected simultaneously by different factors which make up the nature of the variables related to school success or failure. Amongst these variables are ones which have become known as executive functions. These are a series of abilities which allow us to channel information, to plan, to make decisions, and to control our emotions.

When considering the development of these abilities, the cortex or prefrontal cortex can be seen to be the primary motor regarding their use. It is the cortex which regulates a series of functions including decision making, concentration, and emotional regulation. It acts as a nexus of connections between two sets of structures. The first is a series of brain structures which developed earlier in the evolutionary process and make up the mammalian brain, or limbic system. The second is the brain cortex, a set of more recently developed structures which allow more complex abilities such as language, abstract thought, or symbolic function (Damasio, 1994).

Understanding a passage to read, doing homework, taking notes, planning a long-term project or studying for an exam require us to bring together and organise multiple sub-processes simultaneously and to change strategies frequently. Academic success depends on the ability to plan time, to organise and prioritise information, separate the main ideas from the secondary details, and to monitor progress (Meltzer, 2018). School success thus depends to a great degree on the students' executive functions. Therefore, improvement in these functions will determine the improvement in the academic achievement of a study. As such, the BAPNE method involves performing set, formalised and monitored activities involving body percussion. With these activities, it aims to be a classroom tool which can facilitate methodological change and ultimately aim for cognitive, social and moral stimulation.

2. Problem Statement

Having used academic meta-search engines (Web of Science, Eric, Rilm, Scopus, Dialnet, JSTOR), it can be seen that numerous authors talk about the therapeutic benefits of music and movement (Hars, Herrmann, Gold, Rizzoli, & Trombetti, 2014; Arjona, 2011; Hodges, 2000), as well as the reciprocal influence of motor control and cognitive development (Hyde et al., 2009; Catterall & Rauscher, 2008, Gromko & Poorman, 1998).

There are also other studies which confirm that executive functions can be improved through movement (Zatorre, 1998; Erickson et al., 2011; Zatorre, Chen, & Penhune, 2007). The BAPNE® method is a hybrid between music and dance therapy, a means of improvement and a therapeutic tool. It makes use of body percussion and teaching and learning strategies which are focussed on the development of different frontal lobes (Romero-Naranjo, 2013).

Until now, various different studies have been published related to body percussion and its use in teaching. However, very few of these deal with the cognitive improvements possible in adolescents. There are, nevertheless, articles which show by means of quantitative studies that this Method can be effective to improve gross psychomotor skills, attention in older people, and social and emotional competencies.

As a result, it was considered timely and important to carry out a quantitative study to analyse the improvement in executive functions in adolescents using implementation of the BAPNE® method. For this study, a sample of a number of students, both Muslim and Christian in origin, in the city of Ceuta were used. Due to the precise nature of this conference, and the length of this article, we will focus on attention (Sohlberg & Matter, 1987), specifically on sustained attention and divided attention. Two tests were applied – Caras and TMT. In future publications, the results of other tests carried out (Stroop, FAS, Digits and Animals) will be set out.

3. Research Questions

Can we increase the sustained and divided attention of a group of adolescent students and, consequently, improve their cognitive abilities by means of twice weekly sessions of body percussion using the BAPNE® Method?

4. Purpose of the Study

To study the effect of the BAPNE® Method on attentional processes in a pilot group. To check the viability of use of the BAPNE® Method with this pilot group to then use it in significant future investigations.

5. Research Methods

5.1. Participants and context

The city of Ceuta is a geopolitical area which is found in north Africa. It is unusual due to its proximity to the Kingdom of Morocco and the subsequent economic, social and cultural exchange between the populations on either side of the border. The city of Ceuta has a population of 84,959 according to official figures in the electoral roll. It has a birth rate of 12.51.

The Luis de Comoens Secondary School has 1,113 students and is located in the city centre. Its student body is 54% Muslim in origin and 43% Christian. The remaining student body (2%) is made up students of other origin, including Hindus, Jews and Buddhists.

When selecting the sample, therefore, it was important to select a group which reflected the socioeconomic and educational reality of the population of Ceuta. It was important to choose a group which showed a proportional distribution of students from Muslim and Christian backgrounds.

Also considered were other incidental matters, such as the distribution of sessions in the school timetable during which the successive interventions were delivered, and the degree of acceptance of these sessions by the teaching staff. Therefore, in order to carry out the study, the necessary and corresponding permission to comply with personal data protection laws was sought from the relatives or guardians of the students under study.

The current study was carried with a t sample of n=61 participants. The experimental group (n=30) consisted of 12 boys and 18 girls. The control group (n=31) consisted of 20 boys and 11 girls. All of these students were in their first year of secondary school at Luis de Camoens school in Ceuta. 36 of the sample were Muslim, 24 were Christian, and 1 was Hindu. All of them were from Ceuta. The two groups – both the experimental group and the control group – generally came from the same primary school and showed similar socioeconomic and sociocultural characteristics typical of the middle class. There were no close links between the groups. The school has six sections, which means there was no contamination in the study.

5.2. Measurements and tools

To measure sustained and divided attention, the Trail Making Test (TMT) was chosen. This is a test taken with pencil and paper and was created by Partington in 1958 and originally called the Test of Distributed Attention. It is now part of the Halsted Reitan Neuropsychological battery (Reitan y Wolfson, 1993). Part A of the test analyses the motor abilities, visual-spatial skills for searching, scanning, and sustained attention. Part B involves more mental flexibility and divided attention.

Finally, the Caras-R Test, published by TEA, assesses the ability to quickly and accurately notice similarities and differences partially ordered stimulus patterns.

5.3. Process

The experimental group undertook an intervention using the BAPNE® Method during their music lessons, whilst the control group continued to receive their traditional teaching methodology. Given the start of fasting in mid-May, we fixed the start and end dates as 1 September 2017 and 10 April 2018 respectively.

Between 1 and 30 September 2017, the pre-test were carried out. Each test lasted approximately 25 minutes. Once the pre-test had been carried out, the interventions were carried out with the experimental group. Each session of 55 minutes was carried out weekly on: wednesdays from 8:30 to 9:25am and Fridays from 10:20 to 11:15am. The activities used are published in the two manuals in the teaching programme (Body Percussion – Programación didáctica volumen 1 y 2), and the manuals on the foundation of the BAPNE® Method (Body Percussion - Método Bapne Volumen 1- 5).

5.4. Design and data analysis

We decided to use a quantitative method in our study with a basic experimental design with two non-equivalent groups. Measures were taken before and after the treatment (pre- and post-test). We decided on this method as it is one of the most widely used in educational enquiry and is of greater validity since reasonable causal interferences are permitted (Alaminos & Castejón, 2006).

There were three variables in the test: the type of group (experimental, control); the scores in the pre-tests of each participant; and finally the scores in the post-tests of each participant after the interventions were carried out. By using the program IBM SPSS 24, the results were analysed to obtain the difference between the experimental group and the control group.

6. Findings

Firstly, the mean averages of the experimental group in each of the pre- and post-tests were calculated (Table 1).

Table 01. Number of cases and mean averages in the experimental group in the different tests

Experimental group	Mean average	N
Caras pre	42.9333	30
Caras post	51.3000	30
TMT pre	65.8167	30
TMT post	48.1500	30

A t-test was then carried out (Table 2) on related samples for each of the tests carried out by the experimental group. As can be seen in the table, there are significant differences between the results before the treatment and those after. The participants improved their performance on the tests, as can be seen in the table of averages.

Table 02. T-test for the different tests for experimental group

Comparison pre- and post-method	Media	T	gl	Sig. (bilateral)
Caras pre – Caras post	-8,3667	-8.911	29	.000
TMT pre – TMT post	17,6667	8.044	29	.000

Thirdly, the averages of the control group for each of the pre- and post- tests were calculated (Table 3).

Table 03. Number of cases and mean averages in the control group in the different tests

Control group	Mean average	N
Caras pre	41.3226	31
Caras post	45.7742	31
TMT pre	68.2581	31
TMT post	63.0000	31

A t-test was then carried out (Table 4) on related samples for each of the tests carried out by the control group. As can be seen in the table, there are significant differences between the results before the treatment and those after. The participants improved their performance on the tests, as can be seen in the table of averages.

Table 04. T-test for the different tests for the control group

Comparison pre- and post-method	Media	T	gl	Sig. (bilateral)
Caras pre – Caras post	-4,45161	-5,877	30	,000
TMT pre – TMT post	5,25806	3,796	30	,001

Due to the fact that there was an improvement in performance on the tests in both groups, we decided to carry out a variance analysis to compare the control group and the experimental group in terms of their performance on the tests pre- and post-treatment. These findings can be found in tables 5 & 6.

Table 05. Mean Averages Of The Groups In The Different Tests.

Tests	Groups	N	Mean Average
Caras Pre	Experimental Group	30	42.9333
	Control Group	31	41.3226
TMT Pre	Experimental Group	30	65.8167
	Control Group	31	68.2581
Caras Post	Experimental Group	30	51.3000
	Control Group	31	45.7742
TMT Post	Experimental Group	30	48.1500
	Control Group	31	63.0000

Table 06. Analysis of variances in different tests

Tests	gl	F	Sig.
Caras pre	1	.452	.504
TMT pre	1	.238	.627
Caras post	1	6.072	.017
TMT post	1	11.323	.001

As can be seen in the table, there are no differences between the control group in terms of their performance on the tests before the method. However, in the post-treatment tests, there are significant differences in the Caras-F test (1) = 6.072; <.05, and on the TMT F (1) = 11.323; <.05. The subjects in the experimental group performed significantly better than the control group. This can only be attributed to the research process i.e. the BAPNE® Method.

7. Discussion

We must ask ourselves the reason why the two groups both display, at least initially, a significant improvement overall. We might assume that upon sitting the same tests, learning takes place: the brain adapts to the test, and there is a significant degree of improvement influenced by growth in the subjects and stimulation carried out by the teachers in the relevant subjects. However, later on we may realise that the method is effective when we see that there is a difference between the pre- and post-tests only in the experimental group. We may go on to review various matters. One of these is increasing the amount of time

between the two tests, in this case increasing it from six months between the pre- and post-tests (though when considering Ceuta, we must bear in mind the timing of Ramadan, which is important to make allowance for so that our results do not have different conditions). The dates for fasting change annually, so it may be better to choose a different test to measure the same variables and then analyse the results.

Generally, we must ask ourselves which factors need to be considered to explain why this significant improvement takes place. Firstly, we might consider the methods of measurements themselves and whether the type of tests used may have determined the results. Furthermore, the improvement might have been influenced by the growth of the subjects of themselves, stimulation by the teachers in the relevant subjects, or by parents' involvement in their children's education.

Regarding these variables, we can state that the time elapsed between carrying out the pre- and the post-tests was the same for both groups. We can therefore disregard directly its influence in the final result. Additionally, as the time elapsed between the tests was the same, we can also state that the increase in maturity has been similar. Nevertheless, it is true that there were some older students (those taking a year again, and students born at the start of the school year) who might have reached a greater level of maturity given that their age at the start of the programme was older than the rest of the group.

On the other hand, the relevance of the involvement of teachers in terms of the changes in the experimental and control groups cannot be disregarded. However, the same educational institution was studied and for most subjects the same teacher delivers their subject lessons to various groups. It is therefore logical to think that the students' development should coincide.

Finally, it is undeniable that parental involvement is a fundamental issue, but one which is outside the scope of this current study. It would be interesting to include in future investigations other initial variables or an initial sociogram. This would allow maximum identification of each of the participants in the sample and of their personal and social characteristics.

However, we did bear in mind – and therefore include in our data - the sex and the cultural background of each of the participants. Even bearing these circumstances in mind, a significant difference was obtained and a positive change could be seen in the experimental group. This confirms the initial hypothesis that cognitive stimulation by means of the BAPNE® Method would give rise to better results, independently of the sex or cultural background, as has been shown here.

Furthermore, it would be interesting to find out, in addition to the data obtained through the tests carried out, how students progressed in their academic subjects by tracking the scores achieved by the two groups. This would allow us to discover to what extent the implementation of the method has had an influence on their academic results. However, this information was not available when this present study came to an end. It is therefore an additional aspect to consider in future investigations into this subject.

8. Conclusion

The results obtained indicate that in terms of the Caras-R and TMT test, the development of the attentional processes is satisfactory. Using the 50 minute sessions of neuromotricity according to the BAPNE® method at least twice a week, there has been an increase in the attention and working memory skills of the students under study.

It has been shown that the implementation of the BAPNE® Method in young adolescents in secondary education can lead to statistically significant gains in sustained and divided attention. This confirms, therefore, our initial hypothesis. Having analysed the data obtained, it can be confirmed that there are differences between the control and the experimental group between the pre- and the post-test phases in all the variables; there was no homogeneity between the two groups. However, whilst all the students improved, the experimental group improved more significantly. Furthermore, the scores obtained by this group were in themselves better, and some very high results were achieved. These results continually improved in assessments until the end of the school year.

The duration of this programme was 6 months, but it would be useful in future studies to plan for 12 months. This would allow the data to be potentially more significant. This present study sets out the direction for future studies to be carried out to investigate other executive functions, and the important benefits the BAPNE® Method can bring to the educational development of young people, whatever religion they may be.

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