

Effects of the daily practice of zhìnéng qìgōng on immediate and working memory, attention level, impulsiveness control, general state of health, energy levels and brain response of children of the Montessori San José Insurgentes school in Mexico City.

Summary - The practice of zhìnéng qìgōng 5 times a week for 30 minutes over 3 months resulted in statistically significant increases in the attention level, and in immediate and working memory in 33 children aged 7 to 11 years. Impulsivity control improved but did not show statistically significant changes. The general state of health increased in most children and less than half of the children maintained the same levels of energy and brain response. In the oral interviews, the children reported feeling calmer, stronger, healthier, happier, more energetic, better concentration, better test performance, less impulsiveness and less anger. The results of the present study demonstrate that zhìnéng qìgōng is an effective tool to increase attention levels, and immediate and working memory in children. It is suggested to improve the measurement of health, energy and brain response of children with complementary methods to that of Ryodoraku, as well as to carry out studies with a greater number of participants.

Keywords - Children, Zhìnéngqìgōng, Memory, Attention, Impulsivity.

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INTRODUCTION.

Zhìnéng qìgōng is a Chinese science that works with qì to potentiate the capabilities and abilities of the human being. The term that refers to the smallest particle that makes up everything in the universe, and the great Chinese masters discovered that working the qì of the human being through sounds, body movements and meditations were able to obtain great physical and mental benefits (Pang, 2019, 2016 and 2014; De 2018; Ooi, 2010).

Scientific research with qìgōng, in China and around the world, has shown that the constant practice of this discipline has the property of improving bodily, emotional and intellectual functions in people of all ages preserving health and prolonging life (Alvarez et al. 2022; Alvarez and Becerril, 2018; Eisen, 2011 and 2010, Chinese Health QiGong Association, 2009; Sancier, 2001; Zhao and Donghui, 1996; Chen, 1989; Zhang, no date).

It is for this reason that the implementation of qìgōng in schools is a common practice in China and is beginning to be introduced in European and American countries.

Some of the factors studied in the investigations have been: the intellectual level of the students, the ability to memorize, the relationships between the students, the behavior in the school, the level of fatigue and recovery when playing sports and the ability to overcome healthily moods such as: anger, anxiety, confusion, depression, hostility and stress, significantly improving in all aspects measured (Duarte et al. 2019; Eisen, 2011; Terjestam et al. 2010; Feng, 1998; Wu et al. 1993; Sufang and Peiqi, 1990; Chen, 1989).

Duarte and collaborators (2019) worked with adolescents aged 12 to 14 years integrating a type of qìgōng in their physical education classes for a period of 4 weeks; At the end of the study, they concluded that young people significantly increased their attention levels.

Eisen (2011) refers to a study by researcher Wang where it was observed that after practicing qìgōng, the cognitive performance of people in certain tests improved compared to performance in the same tests without people previously practicing qìgōng. The indexes measured were speed, accuracy, recite a series of numbers from back to front and vice versa, and errors in reading words with color interference. The results showed that practicing qìgōng can improve the functions of perception, attention, memory and thinking. Wang believes that qìgōng can increase children's intelligence and can even prevent their deterioration over the years; It also concludes that qìgōng can improve emotion, humor, self-control, patience, attention, observation, willpower, memory, quick thinking, logic and reaction speed. Wang concluded that the more people practice, the better the results.

Sufang and Peiqi (1990) conducted an investigation at the University of Beijing, China, with 170 fourth-year elementary students. The results obtained showed that students who practiced qìgōng for 6 months improved, on average, 11.9% in the grades of the 3 exams that were applied to them: mathematics, geography and Chinese. In turn, the average grades of students who did not practice qìgōng did not change significantly.

The objectives of the present study were: to implement the daily practice of zhìnéng qìgōng in a basic education school and to evaluate its impact on immediate and working memory, the level of attention, impulsiveness control, the general state of health, levels of energy and the cerebral response of the students.

METHODOLOGY.

At Montessori San José Insurgentes Elementary School in Mexico City, an informative talk was given to the parents and they signed the informed consent letter for their children to participate in the project. The participation of the children was completely voluntary, and their data was treated confidentially as required by law.

The initial group was made up of 35 children, 22 girls and 13 boys, in an age range of 7 to 11 years.

Before starting the protocol, the following measuring instruments were applied to children to obtain baseline measurements.

1. Difference Perception Test-Revised:

The Difference-Revised Perception Test known by the name of CARAS-R by the author L.Thurston, and Spanish adaptation of Yela, allows to measure the perceptual and attention aptitudes through 60 graphs with drawings of schematic faces; Each item contains 3 faces and you must identify the one that is different in a time of 3 minutes. It is an easy and fast application test that can be applied individually and in a group without losing its reliability (Thurstone, 2012).

This instrument can be applied from 6 to 18 years old. Through the perceptual exercises of similarities and differences the levels of attention are measured both sustained (process that allows to keep the focus of attention and remain alert) and selective (where only part of the information is processed to respond to stimuli) (Castillo, 2009).

For the assessment, both the number of successes and the number of errors made by the person are taken into account, with these two indices the “net successes” are obtained, which allows to know the real effectiveness of the person assessed; With this test, the impulsiveness control index (ICI) is also obtained, which allows the performance evaluation to be assessed with the response style, this impulsivity index allows the cognitive style to be deduced in the impulsive-reflexive polarity (Thurstone, 2012).

2. Wechsler children's intelligence scale digit retention test (WISC-IV):

The Wechsler Intelligence Scale for Children (WISC-IV) is a neuropsychological test for children and adolescents aged between 6 and 16 years. It is easy to apply individually and attractive to the evaluated; The whole test has a duration of 1 hour 50 minutes. It is an instrument that allows to know the global intellectual capacity, as well as general abilities and gives a specific profile of specific cognitive areas through 4 subscales: Verbal comprehension, perceptual reasoning, working memory and processing speed (Wechsler, 2011).

For this investigation, we worked only with cognitive processing skills, specifically with the Working Memory subscale and the Digit subtest. The Digit subtest works through the skills of sequencing, planning, alertness and cognitive flexibility, which allows you to measure immediate memory and working memory. This Index allows to know a measure of the child's working memory capacity, since the test involves starting concentration, attention, control and reasoning, immediate memory and working memory (Wechsler, 2011).

3. Ryodoraku method:

The Ryodoraku method allows, through a very simple, non-invasive evaluation, performed with an apparatus, to measure the electrical conduction of the meridians (channels through which the qi flows) to know how balanced the body is. According to traditional Chinese medicine when there is an organic dysfunction, it is reflected in the electrical conductivity of the corresponding meridian (Nakatani and Kumio, 2000).

The measurements are made bilaterally at 24 specific points, the electrical flow is recorded, and a graph is drawn showing a snapshot of health. In general terms, measurements below a mean indicate deficiency or "cold" and above fullness or "heat" and make it easy to understand the corresponding symptoms (Nakatani and Kumio, 2000).

With the Ryodoraku method you can obtain specific information on the functioning of each of the meridians, as well as the process of a disease, in the present study, it was used as a measurement system to obtain information on the general state of health, levels of energy and children's brain response.

As part of the project, interviews (videotapes) of the children were also carried out and the parents were asked to answer a questionnaire.

After the initial evaluations, the children were taught the theory and practice of the following methods: zǔ chǎng fǎ (the method for organizing the qi field), lǎ qì fǎ (method for gathering qì), dūn qiáng fǎ (wall squat method) and pēng qì guàn dǐng fǎ (method to lift and pour the qì by the head). Additionally, different games and activities were carried out, including an experiment to send good and bad information to 2 oranges and 4 garlic (Figs. 1-5). All students received a notebook of activities and audiovisual material to reinforce concepts and practice at home if they wanted to.

The instruction of zhènég qìgōng was carried out from Monday to Friday, during class hours, for 30 minutes, for a period of 3 months discounting holidays and vacations.

At the end of the three months, the measuring instruments and interviews with the children were again applied to obtain the final measurements, analyze and compare the results.



Figure 1. Students practicing zǔchǎngfǎ, the method of organizing the qi field.



Figure 2. Students learning acupuncture points.



Figure 3. Students practicing pengqi guandingfa, the method to lift qi up and pour qi down.



Figure 4. Experiment where children sent good and bad information to 2 oranges and 4 garlic.



Figure 5. Group photo.

RESULTS.

Of the 35 children who started in the project, two stopped participating, so initial and final tests were obtained from 33 students (21 girls and 12 boys).

Test of perception of similarities and differences

In this case, two test results were compared. On the one hand, the real successes that account for the effectiveness of the participant in the test of perception of similarities and differences and, on the other hand, the Impulsivity Control Index (ICI) which provides information on whether the participant is impulsive or not (impulsive or reflexive) when executing the task and allows to clarify the differences on its performance.

In the first application of the test of perception of similarities and differences the children obtained an average of real successes of 22.76 and in the second application, that is, after the workshop of *zhìnéng qìgōng* they obtained an average of 27.58 (Table 1, Fig. 6).

To assess whether there are statistically significant differences in the effectiveness of children's level attention before and after the *zhìnéng qìgōng* workshop, a "student's *t*" test (Coolican, 2013), was applied for two related samples. The results indicate that there are statistically significant differences, so it can be concluded that there was an increase in the level of effectiveness of attention in children after the workshop [$t(32) = 3.91, p < .000$] (Table 2).

Table 1. Descriptive statistics of the net successes of the paired samples.

<i>Net successes</i>	<i>Mean</i>	<i>N</i>	<i>Standard deviation</i>	<i>Std. error mean</i>
Pretest	22.76	33	6.57	1.14
Posttest	27.58	33	8.02	1.40

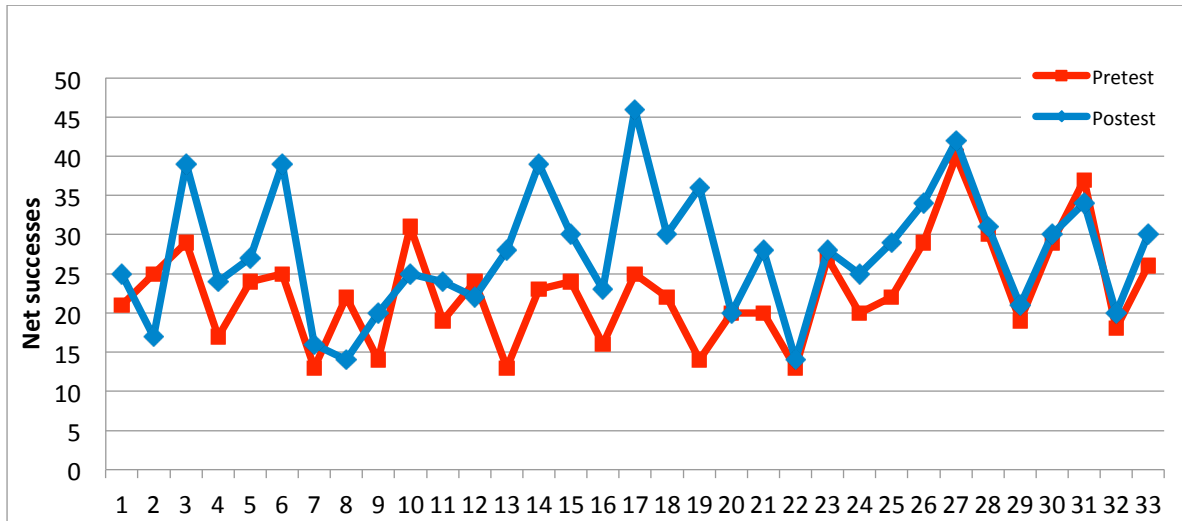


Figure 6. Comparison of the net successes in the pretest and posttest of the Perception Test Similarities and Differences.

Table 2. Differences between the means of the net successes of the paired samples.

Net successes	Paired differences				<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>	
	<i>Mean</i>	<i>Standard deviation</i>	<i>Std. error mean</i>	Confidence interval 95% of the difference				
				<i>Lower</i>				<i>Upper</i>
Pretest-posttest	-4.82	7.07	1.23	7.33	-2.31	-3.91	32	.000

Regarding the ICI, it was observed that from one application to another the children presented an increase in impulsiveness control, however, when applying the student t test, no statistically significant differences were found [$t(32) = 1.23, p < .229$] (Tables 3 and 4, Fig. 7).

Table 3. Descriptive statistics of the impulsivity control index of the paired samples.

ICI	<i>Media</i>	<i>N</i>	<i>Desviación Estándar</i>	<i>Err.Est.Mediana</i>
Pretest	78.81	33	11.67	2.03
Posttest	75.48	33	14.77	2.57

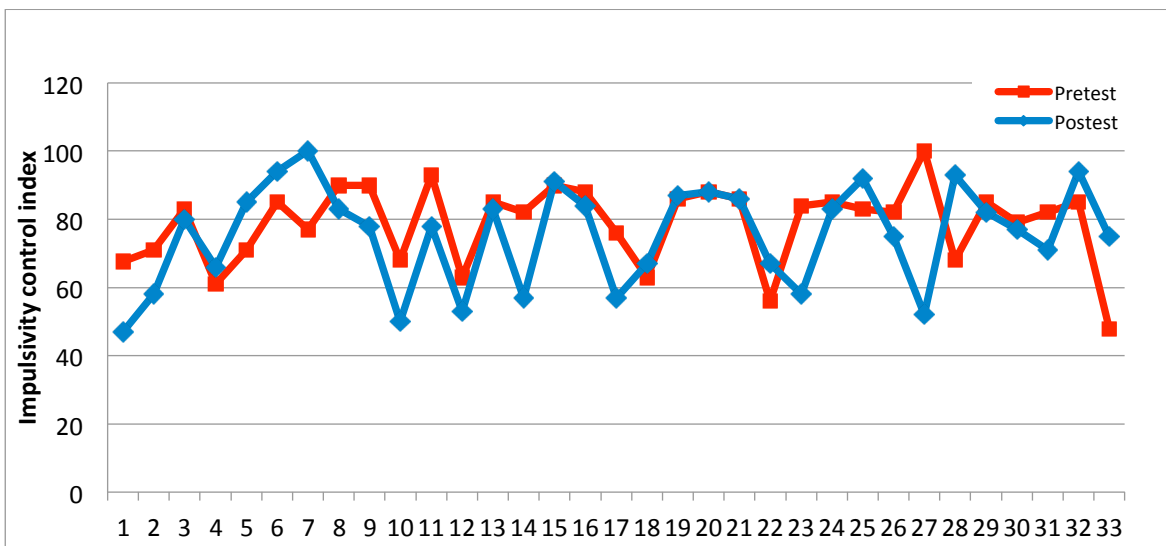


Figure 7. Comparison of the impulsivity control index (ICI) in the pretest and posttest of the Perception Test Similarities and Differences.

Table 4. Differences between the means of the Impulsivity Control Index.

ICI	Paired differences					<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>
	<i>Mean</i>	<i>Standard deviation</i>	<i>Std. error mean</i>	Confidence interval 95% of the difference				
				<i>Lower</i>	<i>Upper</i>			
Pretest-posttest	3.32	15.56	2.71	-2.19	8.84	1.23	32	.229

Sub-test of retention of digits of the intelligence scale for children Weschler (WISC-IV).

In this case, the total score of each of the children was obtained to know their capacity for immediate and working memory.

As seen in Table 5, this test also showed an increase in the scores of children between one application and another.

Table 5. Descriptive statistics of the total natural score in the digit span test of the paired samples.

Total natural score	<i>Mean</i>	<i>N</i>	<i>Standard deviation</i>	<i>Std. error mean</i>
Pretest	14.88	33	3.00	.52
Posttest	16.12	33	3.57	.62

When analyzing the difference between the means, $t(32) = 3.21$, $p < .003$ was obtained, so there are statistically significant differences between the two measurements; Based on the above, it is inferred that there was an improvement in the immediate and working memory of the children after having participated in the workshop of zhìnéng qìgōng (Table 6 and Fig. 8).

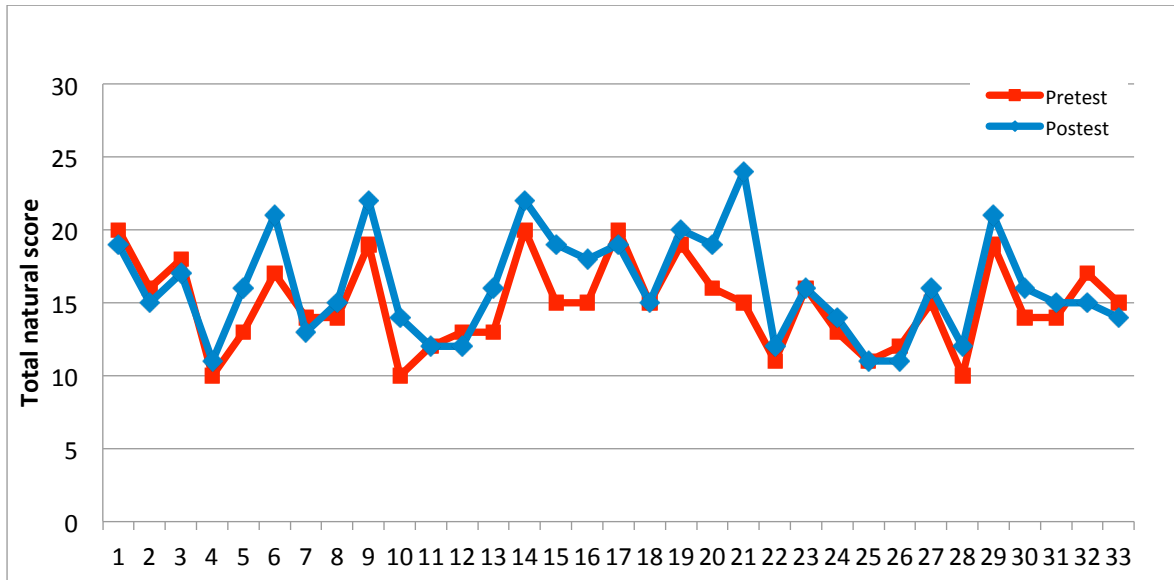


Figure 8. Total natural score comparison of the digit span test.

Table 6. Differences between the means of the total natural score in the digit span test.

ICI	Paired differences				<i>t</i>	<i>df</i>	Sig. (2-tailed)	
	<i>Mean</i>	<i>Standard deviation</i>	<i>Std. error mean</i>	Confidence interval 95% of the difference				
				<i>Lower</i>				<i>Upper</i>
Pretest-posttest	-1.24	2.22	.39	-2.03	-.45	3.21	32	.003

Ryodoraku method.

1. General health.

A general analysis of the Ryodoraku chart was carried out taking into account the evolution of the 12 main channels as a whole and in relation to each other.

After 3 months of practice it was obtained that 76% of the children finished the study more balanced than at the beginning, with a strong immune system and a higher general state of health. 6% maintained the same general state of onset without showing significant changes and 18% finished the study showing imbalance and a lower state of health (Fig. 9).

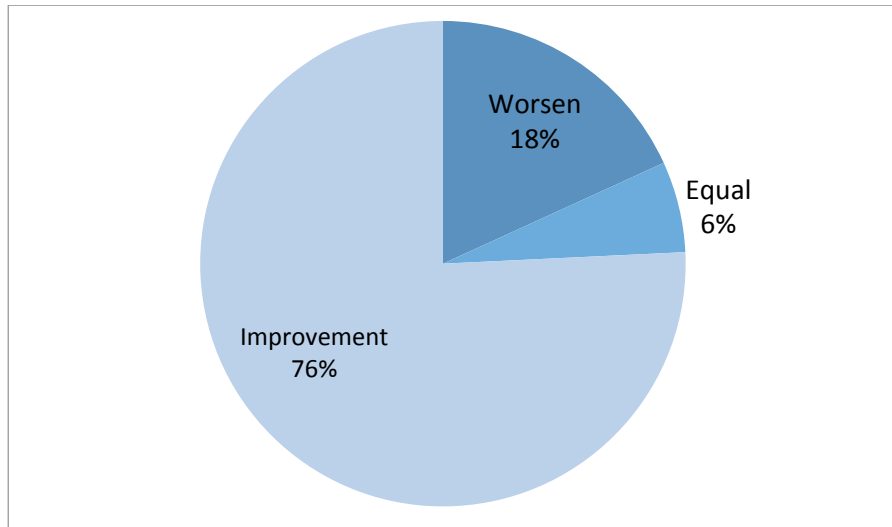


Figure 9. Percentage of evolution of the general state of health of the students.

2. Energy level.

Initially considering that children naturally manage good energy levels, 36% of children raised their overall energy level even further, which determines less physical and mental fatigue levels and an increase in their general physical responses. 42% showed similar levels to the initial ones and 21% showed a decrease in these levels, translating as greater physical and mental fatigue, although in some cases this level of vitality was low in children who initially found themselves with too high levels showing hyperactivity, nervousness and a lot of stress can be interpreted as a positive response (Fig. 10).

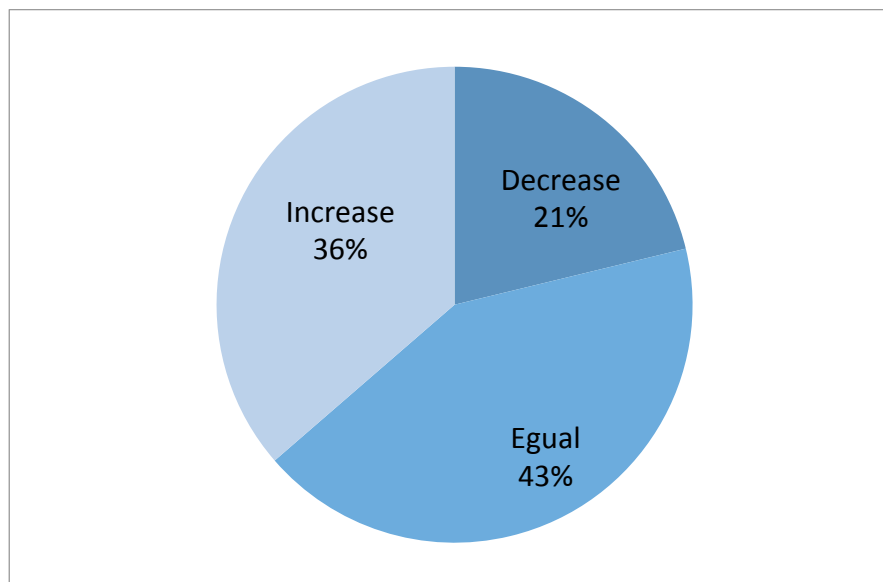


Figure 10. Percentage of evolution of students' energy levels.

3. Brain response.

The results obtained in the measurement of the cerebral axis with the Ryodoraku apparatus, showed that 39% of the children had an improvement in their cerebral response which is interpreted as a more balanced functioning of brain activities such as memory, concentration, response to problems and decreased levels of stress among others.

18% had a negative result with a tendency to brain acceleration, this being understood as irritability and nervous hyperactivity, impulsivity and difficulty in concentration.

Another 3% also had a negative result, but with a tendency to decline, understood as lack of concentration, poor memory and attention, and slow thinking.

Finally, 40% showed a similar result to the initial one (Fig. 11).

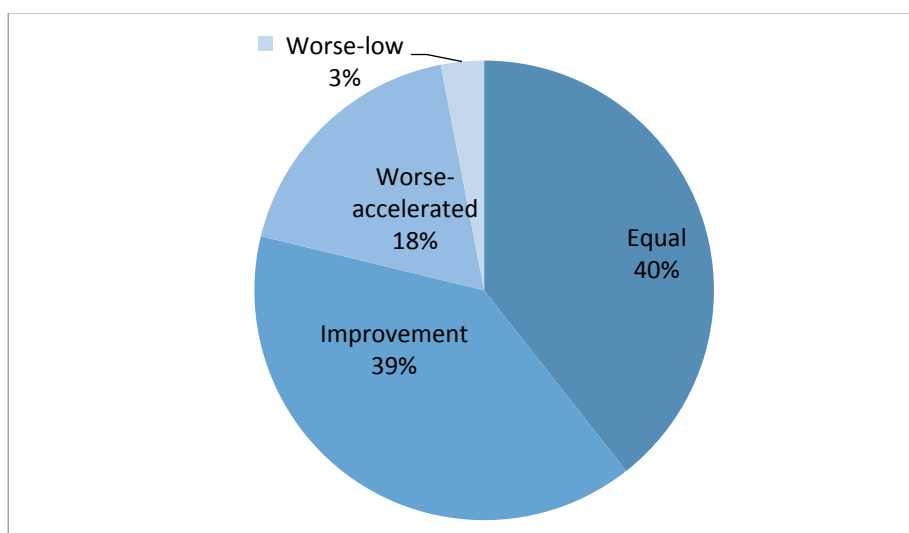


Figure 11. Percentage of evolution of brain functioning evaluated in students.

Report of interviews with children.

Of the 33 students, one did not attend school on the day of the final interviews, so below are the answers reported by 32 children to 4 of the total interview questions:

1. In these 3 months that you have practiced *zhìnéng qìgōng* have you noticed any changes?
2. Have you had any sensations or reactions when practicing *zhìnéng qìgōng*?
3. Did you like the experiment of sending good and bad information to garlic and oranges?
4. Would you like to continue the *zhìnéng qìgōng* workshop in your school?

For the first question, the answers were grouped into physical, behavioral, emotional, cognitive changes and in a general area where broader answers are located that could include one or more of the aspects indicated in the other items (Tables 7-10 and Fig .12). Students reported one or more of the following changes.

Table 7. Physical changes reported by students after practicing 3 months zhìnéng qìgōng.

Physical changes	number of children
They get sick less or feel healthier.	20
They feel stronger, with more energy, less tiredness or less sleepiness.	9
They have fewer nightmares or sleep better.	4

Table 8. Behavioral changes reported by students after practicing 3 months zhìnéng qìgōng.

Behavioral changes	number of children
They are kinder.	1
They communicate better.	1
They are less impulsive.	3

Table 9. Emotional or emotional changes reported by the students after practicing 3 months zhìnéng qìgōng.

Emotional or sentimental changes	number of children
They get less angry.	17
They feel happier.	17
They feel calmer or more relaxed (less stress and anxiety).	21
They feel more confident in themselves.	2

Table 10. Cognitive changes reported by students after practicing 3 months zhìnéng qìgōng.

Cognitive changes	number of children
They concentrate better, are less distracted or have better attention	16
Read faster or solve problems faster	6
They have better performance on exams, they feel smarter or smarter	8

Table 11. General changes reported by students after practicing 3 months zhìnéng qìgōng.

General changes	number of children
They use their mind better (they are better people, better in different aspects).	5
They feel better or less bad.	10
They feel different.	2
They have greater clarity.	1

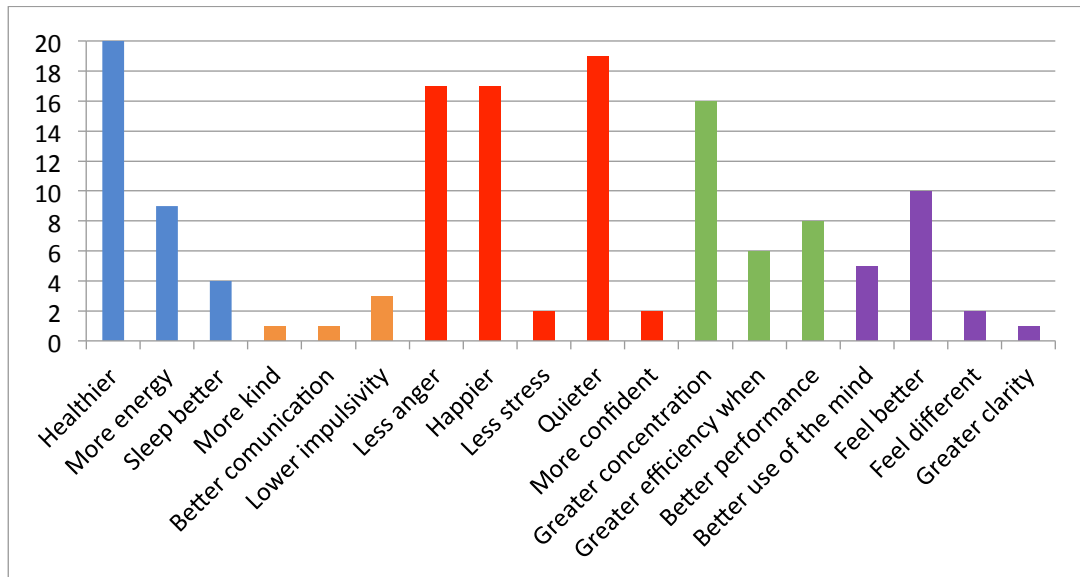


Figure 12. Changes reported by students for practicing zhìnéng qìgōng.

For the second question, the answers are listed in Table 12 and Fig. 13.

Table 12. Sensations and reactions reported by the students practicing zhìnéng qìgōng.

Sensations and reactions	number of children
See lights or colors.	11
See images.	1
Feel hot.	16
Feel to inhale and to exhale through the hands.	1
Feeling tingling.	9
Not feel feet.	4
Feel something in your hands or not be able to close your hands.	15
Tremble.	2
Feel something around.	1
Feel sleepy.	3
Stop feeling sleepy (don't feel sleepy, wake up).	2
Feel hungry.	4

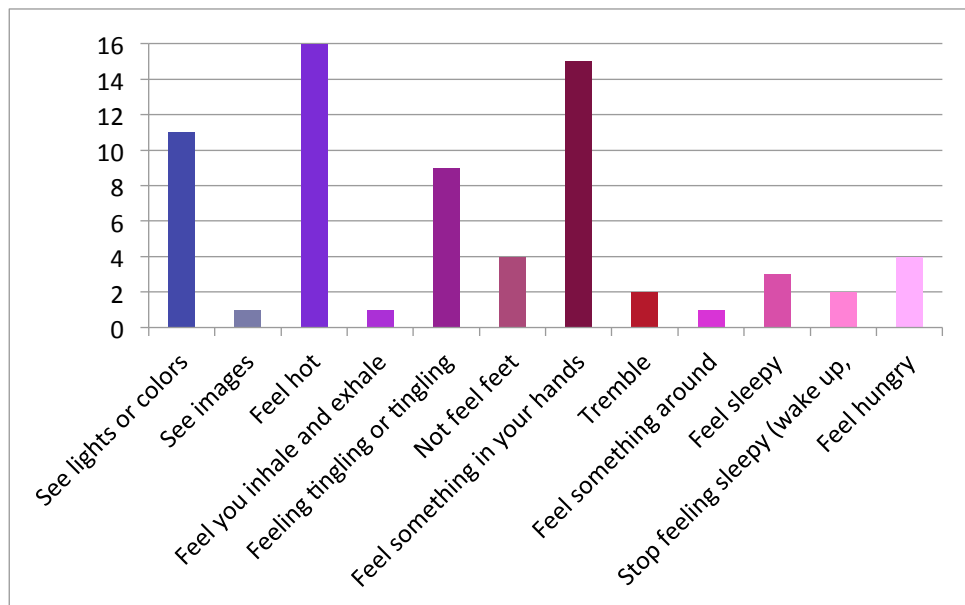


Figure 13. Sensations and reactions reported by students when practicing zhìnéng qìgōng.

For the third question 97% of the children answered having enjoyed doing the experiment of sending good and bad information to garlic and oranges (Fig. 14).

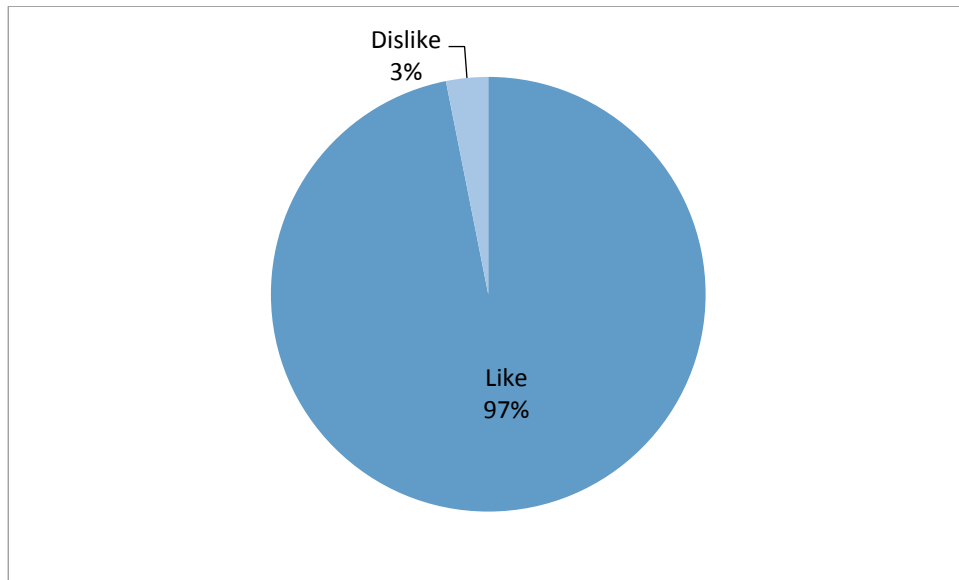


Figure 14. Percentage of students who enjoyed the experiment of sending good and bad information to garlic and oranges.

Finally, for the fourth question 94% of the children answered that if they would like to continue with the zhìnéng qìgōng workshop at school (Fig. 15).

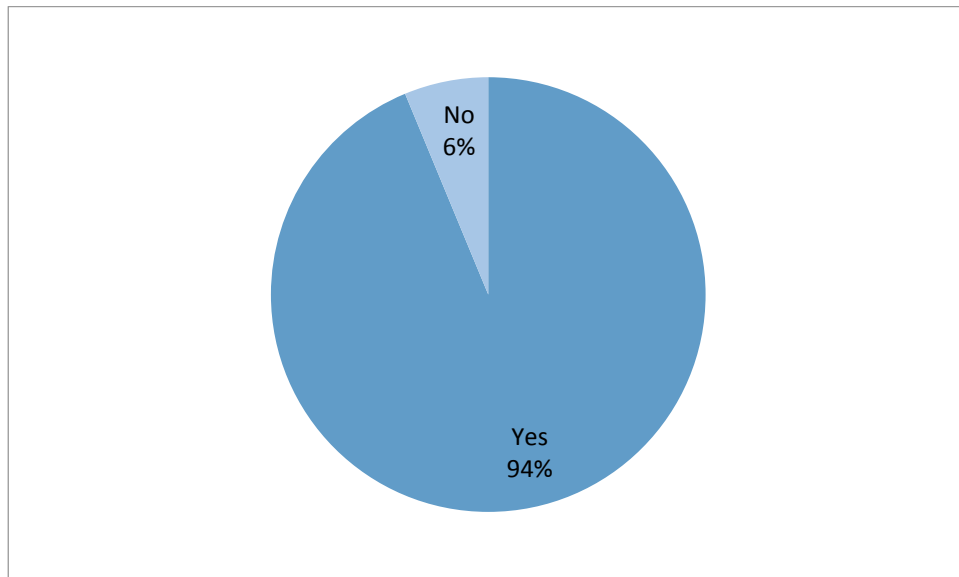


Figure 15. Percentage of students who would like to continue with the zhìnéng qìgōng workshop at school.

Parents Report.

Parents reported different types of changes in their children. Regarding physical changes, they pointed out that children improved their sleep in addition to their health; As for the changes that we can identify as behavioral, they indicate that after the workshop the children had more initiative, were more independent, responsible, orderly, had better emotional relationships and showed greater interest in the activities they were doing. Regarding the changes related to feelings or emotions, they pointed out that their children were more relaxed and calmer, less anxious, with better character, that they managed their emotions better, were more understanding, tolerant and cheerful. Finally, regarding cognitive changes, they noticed that children improved their reading performance.

CONCLUSIONS.

According to the results of the tests of perception of similarities and differences and of retention of digits, the practice of zhīnéng qìgōng 5 times a week for 30 minutes for 3 months resulted in statistically significant increases in the level of attention, and in immediate and working memory in 33 children aged 7 to 11 years. Impulsivity control improved, however, there were no statistically significant changes.

According to the results of the Ryodoraku method, the general state of health increased in most children, although less than half maintained the same levels of energy and brain response.

In the oral interviews, the children reported feeling calmer, stronger, healthier, happier, more energetic, better concentration, better test performance, less impulsiveness and less anger.

The results of this study demonstrate that zhīnéng qìgōng is an effective tool to increase levels of attention and immediate and working memory in children. Although there are no statistically significant differences in impulse control, both children and their parents noticed changes in that aspect.

It is suggested to improve the measurement of health, energy and brain response of children with complementary methods to that of Ryodoraku, as well as to carry out studies with a greater number of participants.

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