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A Comparative Study on Different Types of Attention in Abacus Users & Non Users

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Abstract

Background: Abacus is an ancient instrument used for calculating numbers through basic arithmetic system. It has become popular among children of small ages as it helps in understanding basic arithmetic system & also helps in expanding brain usage. It activates nerve cells by providing stimuli like moving fingers & talking aloud. However, Increase in concentration of abacus students may be pre-dominating effect of training program. So this study was taken up to see effect of abacus learning on attention of children.

Objectives: To test & compare different types of attention in abacus users & non users.

Materials and Method: A total of 40 abacus users (upto 7 levels of abacus training) and 40 abacus non users who were of 10-15 years were tested for focussed attention by colour trail test, sustained attention by children paced auditory serial addition test and divided attention by symbol digit modality test. Results were statistically analysed using student 't' test.

Results: Abacus users performed better than the controls in colour trail test (p=0.0001), children paced auditory serial addition test (p=0.01) and symbol digit modality test (p=0.01).

Conclusion: Abacus users have better focussed attention, sustained attention and divided attention compared to non abacus users.

Keywords: *Abacus, Focussed attention, Sustained attention, Divided attention.*

Introduction

Abacus is an old and unique arithmetic tool which has been used in many Asian countries like Japan, Korea, China, and India since 1200 AD. In abacus, Arithmetic calculations are performed by altering the configurations of beads that represent numbers called as physical abacus. First, Abacus users learn to calculate with a physical abacus, then gradually they can calculate extraordinary large numbers via an imagined abacus in their minds with unusual speed. Various researchers have demonstrated that Abacus based Mental Calculation training is an effective intervention to improve children's mental arithmetical ability, but it remains unclear whether the training affects high-order math abilities. Neuroimaging studies have indicated that abacus experts perform mental calculation by using motor and visual-spatial resources Arithmetic calculations are performed by altering the configurations of beads that represent numbers. It has become popular among children of small ages as it helps in understanding basic arithmetic system & also helps in expanding brain usage. It activates nerve cells by providing stimuli like moving fingers However, Increase in concentration of abacus students may be pre-dominating effect of training program. So this study was taken up to see effect of abacus learning on attention of children.[1, 2]

Objectives: To test & compare different types of attention in abacus users & non users

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Materials and Method

A total of 40 abacus users (up to 7 levels of abacus training) and 40 abacus non users who were of 10-15 years were tested for focussed attention by colour trail test, sustained attention by children paced auditory serial addition test and divided attention by symbol digit modality test. [3, 4] The subjects where from elementary school of age group 10-15 years & where excluded by taking history of any psychiatric disorders, including mood, anxiety, psychotic, substance abuse, developmental, or behavioral disorders.

The study protocol was fully explained to the children and their legal guardians (parents or caregivers). All participants and guardians provided informed consent. Ethical clearance was taken from the institution

Focussed attention was tested by colour trail test in which numbers from 1 to15 were randomly arranged in alternate pink & yellow colours on sheet of paper & students were supposed to draw lines starting from 1 to 15.

Sustained attention by children paced auditory serial addition test (CHIPASAT) in which they were asked to add 2 succeeding numbers & tell the results loudly.

Divided attention by symbol digit modality test in which numbers were represented by different symbols & subjects were asked to place numbers below different symbols. Time taken by them to complete each task was noted & score was given according to time taken by each subject.[3, 4]

Results were statistically analysed using student 't' test. P value =0.01 was considered significant and p value =0.0001was considered highly significant.

Results

Table 1: Comparison between Abacus & Abacus Users

	Abacus Users (Score)	Abacus Non Users (Score)	P Value
Color Trail Test	45.25±9.1	51.8±5.21	0.0001**
Symbol Digit Modality Test	252.45±44.97	281.525±62.2	0.01*
Chipasat	56.3±2.48	54.05±5.09	0.01*

Data are presented as the mean ± standard deviation* p value significant, ** p value highly significant

40 abacus users and 40 abacus non users who were of 10-15 years were tested for focussed attention by colour trail test, sustained attention by children paced auditory serial addition test and divided attention by symbol digit modality test. Scores in abacus users for colour trail test is less that means that the focussed attention was better in abacus users than non abacus users. Scores for symbol digit modality test was more in abacus non users which means abacus non users took more time for the task and divided attention is better in abacus users compared to non abacus users. CHIPASAT scores are more in abacus users that in non abacus users which means that the sustained attention was better in abacus users than non abacus users

Abacus users performed better than the controls in colour trail test (p=0.0001) which was highly significant, children paced auditory serial addition test (p=0.01) and symbol digit modality test (p=0.01) which was significant.

Discussion

This study was done to assess whether children trained to use an abacus differed from controls in terms of different types of attention. As we know that abacus can increase calculating ability, children trained to use an abacus performed better in arithmetic tasks than the controls. And also, abacus-trained children committed fewer mistakes, suggesting that they exhibited better focussed attention, sustained attention and divided attention.

Several studies suggest that the inferior and posterior superior parietal cortices areas are involved in abacus training. [1]Neuroimaging studies have indicated that abacus experts perform mental calculation by using motor and visual-spatial resources and that abacus training enhances white matter tracts integrity related to visual-spatial processing. Therefore, we can say that abacus training might help children improve math abilities in visual-spatial domain.

Some recent studies have also shown that abacus users have advantages other cognitive abilities, such as numerical processing efficiency, memory spans, simple working memory, and general intelligence. [2] In an EEG study they found that the neural substrates of magnitude processing were modified during the course of Abacus training.[5]

In a neuroimaging study, they found the important role of visual imagery in mental arithmetic operations and also for its underlying neural correlates, the superior parietal cortex. [6]

The possible neural mechanisms by which abacus training improves neurocognitive functions, including all types of attention may feature neurogenesis & synaptic plasticity.

Mental training such as abacus training, can change brain structures & induce neuroplasticity. Repeated practice and learning may trigger various neuroanatomical changes, such as neurogenesis, gliogenesis, & synaptic plasticity-enhance neurocognitive functioning.

Hence we can say Repetitive & sustained abacus training leads to neuronal changes in frontal & parietal lobes which improves arithmetic ability & attention.

Conclusion

The current study for the first time suggested that Abacus users have better focussed attention, sustained attention and divided attention compared to non abacus users. So children from age 7-10 years should be given abacus training as it may improve their mathematical calculation and also improve different types of attention.

Few limitations of the study were that we have not assessed intelligent quotient (IQ) of the students. And other cognitive functions can also be assessed in these children.

Ethical Clearance: Taken from institutional committee

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Conflict of Interest: Nil

References

1. Kyoung-Sae Na, Soyoung Irene Lee, Jun-Ho Park, Han-Yong Jung et al. Association Between Abacus Training and Improvement In Response Inhibition: A Case-Control Study. Clinical Psychopharmacology and Neuroscience 2015; 13 (2):163-167
2. Wang C, Geng F, Yao Y, Weng J, Hu Y, Chen F Abacus Training Affects Math and Task Switching Abilities and Modulates Their Relationships in Chinese Children. PLoS ONE 2015; 10 (10):1-15
3. Strauss E, Sherman E, Spreen O. A Compendium Of Neuropsychological Tests Administration Norms And Commentary 3rd ed
4. Rao SL, Subbakrishna DK, Gopukumar K. NIMHANS neuropsychology battery. 2004.
5. Huang J, Du F, Yao Y, Wan Q, Wang X, Chen F. Numerical magnitude processing in abacus-trained children with superior mathematical ability: an EEG study. J Zhejiang Univ-Sci B (Biomed & Biotechnol) 2015 16 (8):661-671
6. Tanaka S, Seki K, Hanakawa T, Harada M, Sugawara S K., Sadato N et al. Abacus in the brain: a longitudinal functional MRI study of a skilled abacus user with a right hemispheric lesion. 2012, 3 (1): 1-11