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Mental abacus training enhance children's creativity

Anas A. El Hussein (*)

Siddig M. Yousif (**)

Abstract: *Mental abacus has many benefits on some cognitive abilities, for example IQ, memory, mental arithmetic, and reaction time. Herewith, we investigated the effect of mental abacus on children's creativity. Executed descriptive casual study included (1116) Sudanese children their age range (11-17), mental abacus trained are (529) they received training for period of (20) months, untrained are (587). Their creative thinking assed by (TTCT- circles), we used T- test to analysis the data. The result indicated that there are significant statistical differences between two groups in creative thinking in favor of mental abacus training. The result clarified according to mental abacus neural basis which shared with visuo-spatial working memory, exciting right and left hemispheres, and viewpoint of Parieto-Frontal Integration Theory (P-FIT).*

Key words: *Mental abacus, Creativity, Mental arithmetic, Parieto-Frontal integration theory.*

تنمية الإبداع لدى الأطفال بالتدريب علي العبق العقلي

أنس الطيب الحسين

صديق محمد أحمد يوسف

الملخص:

إن للعبق العقلي تأثير إيجابي علي العديد من القدرات العقلية مثل الذكاء، والذاكرة، والحساب العقلي، وزمن الرجع. وفي هذه الدراسة تم بحث تأثير العبق العقلي على تنمية التفكير الإبداعي لدى الأطفال من خلال إجراء دراسة سببية مقارنة شملت (1116) تلميذ بمدارس الأساس بمدينة الخرطوم ، وقد تراوحت اعمارهم ما بين (11- 17) سنة. تم تدريب عدد (529) طفل منهم على برنامج العبق العقلي لمدة (20) شهرا، بينما عدد (587) لم يتلقوا تدريبا. وقد تم قياس التفكير الإبداعي للمجموعتين باستخدام اختبار التفكير الإبداعي – الدوائر لتورانس. وتم تحليل البيانات باستخدام اختبار (ت). وقد ابرزت نتائج الدراسة أن هنالك فروق ذات دلالة احصائية جوهرية بين المجموعتين في التفكير الإبداعي لصالح المتدربين على العبق العقلي. وقد تم تفسير النتائج على اعتبار أن الأسس العصبية للحساب بالعبق العقلي تتشابه مع الأسس العصبية للذاكرة البصرية المكانية العاملة، وأن العبق العقلي ينشط الفصين الأيمن والأيسر للمخ مع بعض، وكذلك علي ضوء نظرية تكامل الفصين الجداري والأمامي للمخ.

الكلمات المفتاحية: العبق العقلي، الإبداع، الحساب العقلي، الأسس العصبية، نظرية تكامل الفصين الجداري والأمامي للمخ.

(*) *Depearment of psychology, Al-Neelain unversity, Khartoum P.O. Box, 11121, Sudan, aboazaim222@gmail.com*

(**) *Depearment of psychology Al-Neelain unversity, Khartoum P.O. Box, 11121, Sudan, siddig2011@gmail.com*

Introduction

Many studies indicated that mental abacus had a positive effect on some cognitive abilities, such as increase IQ (Irwing et al, 2006), enhance ability in solving symbolic items, achievement in mental arithmetic (Lean and Lan, 2005), expand digit memory (Hattano, 1983), own exceptional manipulation of math (Stigler, 1984), Extended Digit memory (Hattano and Osawa, 1977; 1983), reducing reaction time (Hishitani, 2006), and improve mental calculation (Stigler, 1984).

Mental abacus Experts tend to perform calculation faster and accurate (Hatano et al., 1977; Stigler, 1984; Miller and Stigler, 1991). Therefore, many brain imagining research investigated the neural basis of this exceptional ability. For example, Tanaka and his colleagues (2002) examined the brain activity of abacus experts and non-experts, in experts, neural activity was greater in cortical areas related to visuo-spatial working memory, including the bilateral superior frontal sulcus and superior parietal lobule, In contrast in non-mental abacus neural activity was greater in cortical areas related to verbal working memory, including Broca's area. The study of Hanakawa and his colleagues (2003) indicated similar result; the posterior superior parietal cortex revealed significantly enhanced activity for experts compared with controls during the numeral mental-operation task. In addition, the study of Chen and his colleagues (2006) proved that the mental abacus experts tended to adopt efficient visuospatial/ visuomotor strategy on bilateral parietal/frontal network during calculation. Whereas, Negishi and his colleagues (2004) found that neural activity of mental abacus is in the Dorsal Frontal Cortex near (BA6). Thus, the abacus experts tended to adopt efficient visuospatial/ visuomotor strategy (bilateral parietal/frontal network) to process and retrieve all the intermediate and final results on the virtual abacus during calculation (Chen et al, 2006). In addition, neural activity takes place in the two hemispheres of the brain, right/left (Chen et al, 2006). Generally, the right hemisphere engages in mental calculation for the abacus experts whereas the left hemisphere contributes to mental calculation in ordinary people having no experience of abacus learning (Hatta and Ikeda, 1988).

Torrance (1993) described creative thinking as the process of sensing difficulties, problems, gaps in information, missing elements, and something askew, then making guesses and formulating hypotheses about these deficiencies, after that evaluating and testing these guesses and hypotheses then possibly revising and retesting them, at last, communicating the results. Creativity requires a confluence of interrelated resources include intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment (Sternberg, 2006). Creativity is vital for innovation, technological progress, and societal evolution. It plays a role in adaptations benefits the individual, providing coping skills and a means for self-expression. Very likely the creativity of individuals determines the creative potential of society. Just as likely, the creative potentials of individuals are dependent on brain structure and process (Runco, 2002). Herein, we investigated the effect of mental abacus training on creative thinking

Method

Research Design

The research is causal comparative design. Included two groups, the first is mental abacus trained group, the second is untrained. The variable understudy is their performance on (TTCT - circles), comprised creativity, fluency, flexibility, and originality of creativity.

Participants:

The study included (1116) students in 7th and 8th class in primary public schools of Khartoum state. Their age rang is between (11 to 17, M 12.7 years and SD 0.88). The number of mental abacus training students are (529), males (44%), females (55%), whereas, untrained students are (587), males (57%), female (42%). The untrained students group is selected according to parity of their school, area, residency, and social and economic status.

Table (1): participates according to variables of mental abacus training and sex.

Group	*Sex*				*Sum*	*%*
	male	%	Female	%		
Trained	235	44%	294	55%	529	47%
Untrained	339	57%	248	42%	587	53%
Sum	564	50%	542	50%	1116	100%

Measures and Procedure:

The mental abacus training group received training for period of (20) month's equal to (80) weeks. The student reached the 4th grade from (10) grades. They trained on mental abacus by UCMAS-Sudan under the auspices of Ministry of Education. Student trained on abacus during the school opening. The mental abacus training consist of two sessions weekly, first is in the class with the abacus trainer extend (2) hours, the second period is extend about (30) it is homework. The creative thinking assed by Torrance Test of Creative Thinking – figure B (circles) at the end of this period, to perceive any significant difference between two groups. Researchers used casual comparative method to study hypothesis of mental abacus training enhance creativity.

Results

The result indicated that there are significant statistical differences between mental abacus group and untrained group in general creativity, fluency of creativity, flexibility of creativity, and originality of creativity at significant level of (0.001). The mean of mental abacus trained group is (44.5) while untrained group is (34.5)

Table (2): the result of t-test two sample analysis for variables of creativity

variable	*group*	*N*	*M*	*SD*	*t-test*	*Significant level*
General creativity	Trained	529	44.6	22.05	7.87	0.001
	Untrained	587	34.5	20.79		
fluency of	Trained	529	20.0	8.32	8.63	0.001
creativity	Untrained	587	19.9	7.41		
flexibility of	Trained	529	6.9	2.86	8.33	0.001
creativity	Untrained	587	5.5	2.41		
originality of	Trained	529	17.6	13.69	5.54	0.001
creativity	Untrained	587	13.0	13.69		

Discussion

The results of this study may explain through three integrated viewpoints: (a) the studies investigated the neural basis of mental abacus, indicated when mental abacus experts calculating they involve the neural correlate of visuo-spatial working memory, they tend to perform calculations with an imaginative abacus and all the computation steps in the mind, all the intermediate and final results were processed and retrieved through virtual abacus. Since, working memory and fluid intelligence (P-IQ) are coextensive, this argued that the mental abacus training may lead to enhance fluid intelligence, confirm with these results of some previous studies argued that mental abacus enhance memory (Bhaskaran et al., 2006), strength solving problem ability (Lean and Lan, 2005) and reducing reaction time (Hishitani, 2006), thereby, supporting imagination. (b) Neural circuit formation is more active in childhood, so the training of the students on progressive tasks like mental abacus may easily change the regular neural circuits of calculating strategy to mental abacus, which excites both student's brain hemispheres, right and left and this may lead to enhance creative thinking. (C) Parieto-Frontal Integration Theory (P-FIT) based on reviewed of (37) brain imaging studies investigated brain location of cognitive tasks (Jung and Haier, 2007). The theory found that the most of neural circuits excited are in the parietal and frontal lobes, these two lobes are play essential role in mental abacus. Moreover, brain areas (Ba 40/7) parietal lobes, and (Ba 6) frontal lobe, are mentioned in most brain imaging of mental abacus studies. These areas engage in many cognitive tasks, e.g., problem solving (Newman et al., 2003) episodic retrieval (Buckner et al., 1998), learning (Delgado et al., 2004), relational reasoning (Goel and Dolan, 2001), sequence representation (Keele et al., 2003), moral judgment (Greene and Haidt, 2002) and telling truth (Langleben et al., 2005), sequentially, enhancing creative thinking. This new finding is base on the technology of brain imaging; the progressive discovery in the future may reveal astonishing facts about mental abacus.

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