

# BRAIN DEVELOPMENT OF CHILDREN – A REVIEW OF ABACUS TRAINING

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**Abstract:** An attempt has been made through this research paper to understand the science behind the Abacus training as a method of brain development by reviewing the available literature and experiments conducted. Brain development classes have become so popular nowadays in India as the expectation of the parents with their children has been increased and every parent wanted his child to perform well in academic activity. Students were also facing serious problems in academics as their memory power and concentration has been decreased due to continuous usage of mobiles, video games, other electronic gadgets and due to watching TV from the very early childhood. This research paper throws a light behind the science of Abacus training, its importance and impact on the performance of child. The result of the study shows that there is enhancement in skill development of abacus learners when compared with non-abacus learners.

**Index Terms – Brain Development, Abacus, Performance, Memory, Skill, Children**

## I. INTRODUCTION

The word Abacus has been derived from a Greek word ‘abax’ or ‘abakon’ which means ‘tabular form’ that is possibly derived from a Semitic word ‘abq’ which means ‘sand’. Abacus was invented by Chinese in 500 BC (while some indications argue on its invention by Babylonians in 300 BC) and was used as one of the most primitive calculators (or counting device to be precise). The first century sources have also given evidence on abacus being used by Indians with a separate column that counted digits with ‘shunya’ (zero). Although the history still searches for facts that can give a confirmed statement on the invention of abacus.

From ancient time Abacus was used by Chinese, Japanese Malaysians and Koreans to improve the mathematical skills. Abacus is a calculating instrument, a mechanical aid which is performed by moving beads along rods, using both hands. In India from last 15 years abacus started first at metropolitan city in massive manner and then in small town for last 6-8 years. There are different levels in abacus. At the end of the level II, Abacus learners solve mathematical problems without using abacus instrument but by visualization of beads in the brain. It has been well documented that along with mathematical skills there is an increase in concentration, learning power, grasping power, memory, listening skills, observation skills, analytical skills in Abacus learners when compared to Non-Abacus learners of the same age. Abacus learner’s uses co-ordination of light, sound and finger movements thus increases the synaptic connections. The abacus learner tries to coordinate visual, auditory and sensory inputs simultaneously analyses the problems and solves them. Abacus based learning and abacus students have a staggering advantage over traditional learning and non-abacus students. Their test scores are higher, their confidence is greater, and their opportunities in school and life outweigh their peers. With all this amazing success and nearly unbelievable results, we have to wonder: what is the science behind the abacus? It’s 2018 and the abacus and abacus-based learning is still giving students a leg up in school. Many people and parents ask how is this old tool helping modern children who are increasingly surrounded by technology rise to success in their academics?

## II. THE MENTAL ABACUS

Children who use the mental abacus have shown remarkable progress. This progress has even extended beyond mathematics. Abacus students have a growing sense of confidence and self-worth. They also excel in many other subjects, inside and outside of the classroom. Published research has been done on the effects of the mental abacus since the 1970s. These studies look at cognitive development, social behaviors, memory retention, and reversal of cognitive impairment. A recent research publication, entitled Abacus in the Brain, followed the case of a mental abacus expert who suffered a stroke and had rebuilt her mental abacus and advanced calculations over a 2-year span. The study commented on how “abacus users not only manipulate the tool skillfully in its physical form, but also gain the ability to mentally calculate extraordinary large numbers, often more than 10 digits at the expert level, with unusual speed and accuracy.”

## III. INDIAN ABACUS

Abacus and its usage in calculations to develop image memory became popular in India, post-2001. Though efforts were there earlier on, the speed in mental calculations done by the children made the Abacus and its usage in calculations touch its initial peak in the year 2006, after which abacus skills became known to almost every parent in the country. Abacus based calculation skills were initially offered in dedicated private centres and this trend continued for a few years, thereafter, after the schools also started showing interest in implementing the training in Abacus skills, it became much more popular, and today the situation is, there is no institution for young children where the subject of Abacus skills training is not talked about, since major percentage of schools offer abacus training.

Soroban and Zhusuan types of Abacus tools were in popular use ever since the Abacus tool was found to be useful in learning and practicing to calculate worldwide. Soroban and Zhusuan - both similar in having one upper bead and four lower beads each – have been in active use for close to two centuries, before which a number of other types of Abacus Tools were getting evolved progressively one after the other in different countries. The Soroban and Zhusuan stayed longer and were in active use without any alternate tool to rival them.

The emergence of Indian Abacus tool, which is advanced in its features, advantages & benefits over its predecessors – as a better alternate to these popular Abacus types, raised questions about the quality of visualization skills that results from using of the Soroban & Zhusuan. Visualization being one of the two major skills responsible for the ability to perform mental arithmetic calculations by image of the Abacus, the efficacy of the Soroban and Zhusuan types of Abaci in delivering to children the visualization skills in comparison to the contemporary tool Indian Abacus, stands at lower ebb. The primary reason for such a query to come up is since the beads of Soroban and Zhusuan tools positioned to reckon values do not project colour images and they further form a confusing matrix of beads – value and non-value beads (those touching the bar and those not touching it). In every individual manipulation of beads during calculations this problem keeps daunting the user of these abaci with beads. The challenge is that the beads positioned for values have to be read with an effort isolating them from other non-positioned beads. This exercise with the challenge in reading the images in lesser and lesser time has been leading to poorer perception / higher stress for the children. The argument may be that this is a challenge only up to the time the child uses the physical abacus. When the child moves on to mental arithmetic mode it may be argued that it would be a non-issue. But the fact to be considered is that speed and accuracy in mental arithmetic skills by the image of abacus depends on the proper initial learning, practicing and mastering of each concept based calculations. But it is at this stage these abaci with beads pose challenges which most of the children find it difficult to overcome. Proper visual/image registry is essential for the recalling of the right image/s of the beads during the calculations done mentally involving working memory mode. Adequate skills for this are delivered by the usage of Indian Abacus which is supported by its features matching the requirement. This is found to be sadly inadequate with the usage of the abaci with beads.

Hence the training in the initial levels which is basic and foundation in nature has to be that much easier for the children to perceive, understand and have the images registered in the brain. Indian Abacus tool with its advanced features advantages and benefits delivers it in the best possible manner, drawing strength from its product-feature to project colour images during manipulation of the sliders. The initial image registry with effortless ease and the speed goes to strengthen the memory in a stress free manner. Indian abacus tool thus brought-in a big changeover in abacus skills training thus creating a place for itself by moving out of shadow of its predecessors to take the 'Training in Abacus skills' to the next level.

#### IV. ABACUS AND BRAIN

The brain consists of two hemispheres, the left and the right. The left side of the brain is used for logical processing, mathematic functions, sequencing, and linear processes. The left side of the brain is what is trained first when children are taught math traditionally. The right side of the brain is used for imagination, visualization, intuition, and rhythm. When children are taught the abacus, they are training the right side of their brain. The abacus taps into the need for visualization, imagination, (mental abacus) and intuition. According to Abacus in the Brain, "previous behavioral work has shown that skilled abacus users perform rapid and precise mental arithmetic by manipulating a mental representation of an abacus, which is based on visual imagery." The numbers on the abacus have to behave in the same way every time no matter which operation is used on them. That type of consistency is the glue needed to solidify a child's understanding of math. The abstract nature of numbers is hard to grasp for a child, but with the abacus, abstract becomes intuitive and confusion turns to delight. The abacus works because the abacus makes sense.

#### V. RESULTS FROM ABACUS

Children should have their right side of the brain developed as soon as possible. Much of early childhood education is "left brain oriented" repetition, practice, testing, and repeat. The overload of facts without proper balance of intuition and imagination will not allow the child's brain to develop and many important concepts will not be understood. For example, something as simple as subtraction can be shown in many ways but if it is not explained in a way that is intuitive to the child, the abacus way, it will not sink in. The abacus shows children how to visualize problems. It does this by using a simple concept such as arithmetic, which is the basis of math and science. This then allows children to foster intuition and imagination. Intuition and imagination are vital for understanding literary analysis, learning new languages, mastering geometry, calculus, and other high-level mathematics, and much more. Abacus students have an entirely developed and engaged right side of the brain so that their left side of the brain is much more open to taking in new ideas, retaining short term memory, and collaborating with the right side to solve logic problems found inside and outside of the classroom.

#### VI. BEYOND MATHEMATICS

As mentioned above, the science behind the abacus points to success beyond mathematics. Here are some important benefits of the abacus:

- **Higher sense of spatial reasoning** – The abacus is a multi-sensory tool. Because it can behave in many different, yet controlled ways, it shows children how to equate physical object with abstract thinking. This builds both their imagination and spatial reasoning. Numbers they once thought were too big to imagine become understandable and they realize that some concepts they might have thought were not a big deal turn out to be a bit larger than they thought.
- **Highly developed long-term memory** – When children learn the abacus, they learn how to solve a problem. This technique is applied to problems outside of arithmetic. They will know the steps to solve geometry problems, algebra problem, and word problems. They will also learn new languages easier as they remember vocab and grammar better.
- **Easily accessed short-term memory** – The short-term memory in most students is filled with how to solve many different problems. However, with the abacus, these solutions do not have to be memorized because they are already known. This frees space in short-term memory for other essentials like schedules and important to-dos.
- **Critical thinking skills** – Because the abacus is taught through system knowledge, it teaches children how to critically and analytically think about a problem. For more about how the abacus teaches critical thinking click [here](#).

- **Independence** – When a child learns how to solve a problem, their sense of confidence grows. They want to try the next problem and the next one. They want to show you what they have done all on their own. Even if they do not understand the problem or do not get the right answer, the feeling of independence is everything to them. It is how they show themselves they are growing up.

The science is there and the research backs it up. The abacus is the way to go. The students studied in these research papers were not high school or college students, but rather elementary school students. Can you imagine your 7 or 8-year-old calculating 10 or more numbers in their head, in just a matter of seconds? Now is the time to get involved in the biggest advantage in childhood education. Now is the time for your child to become a Math Genie.

## VII. SCOPE & ADVANTAGE OF ABACUS TRAINING

- Abacus Based method of teaching the number makes the learning interesting and develop image memory.
- Visualisation (Photographic Memory) is the first and major skill to be developed by the child.
- Colour images go deep into the memory of the Children.
- These colour images are easily recalled from memory. Hence colour images are converted back as Numbers.
- Memorisation becomes easier and Kids easily remember the numbers.
- Each image represent a number.
- Kids learn the numbers with fun.
- Learning becomes easier and stress free.
- This becomes strong foundation for number based mathematics.
- When kids moves to 1ST Standard, numbers are not nightmares to them and children are able to do simple arithmetic easier and faster.
- Simple additions and subtractions become fun for them.
- It becomes easy for the play school Teachers TO TEACH in the regular stream.
- Children becomes stronger in arithmetic calculations in the regular stream because of strong foundation laid in numbers / Maths
- The proficiency in numbers, makes them good at other ares of learning also.

## VIII. EXAMPLE

**Tiwari & Patil (2017)** conducted a study to assess the growth of skills after using abacus in each level such as confidence development, ability & positivity approach in children between age of 7 and 12 years who have been trained in abacus for one year. Children between 7–12 years and between standard II – VI were selected for the study from Genius brain Academy Bhusawal and ICD Abacus Bhusawal. A total of 4 batches were prepared which consists of 20 students each.

**Table 1: Progress of abacus training**

N = 20		Max	Min	Avg.	St. Dev.
<i>Before starting abacus training</i>		39	17	28	6
<b>Level I</b>	On abacus	57	37	49	5
	Dictation	10	5	5	2
	<b>Overall view</b>	<b>96</b>	<b>61</b>	<b>80</b>	<b>9.8</b>
<b>Level II</b>	On abacus	48	21	37	7
	Visualization	40	20	30	5
	Dictation on abacus	10	4	7	2
	<b>Overall view</b>	<b>98</b>	<b>45</b>	<b>74</b>	<b>12.8</b>
<b>Level III</b>	On abacus	29	17	23	3
	Dictation on abacus	19	9	15	3
	Visualization sums	27	10	22	4
	Dictation on visualization	18	7	13	5
	<b>Overall view</b>	<b>92</b>	<b>43</b>	<b>72</b>	<b>12</b>

- **Group I:** (n=20) 7–12 years of age of non-abacus learners of average IQ acted as control.
- **Group II:** (n=20) Children between 7–12 years of age of average IQ who had completed level I.
- **Group III:** (n=20) Children between 7–12 years of age of average IQ who had completed level II
- **Group IV:** (n=20) Children between 7–12 years of age of average IQ who had completed level III

On analyzing the results in table 1 shows statistical data collected before starting abacus programme and after each level up to level III. In Level I analysis is based on abacus sums and dictation sums, whereas level II is continued with visualization sums (without abacus) and in level III along with sums of addition, subtraction, multiplication is carried on abacus along with dictation on the same, not only this visualization (without abacus) sums of addition, subtraction, multiplication are also taken along with dictation. In level III students concentrate on the verbal communication sums and perform on it without abacus simply visualizing it. It clearly predicts that abacus learners are more superior to non-abacus learners. At the starting the learners showed the mathematical solving capacity was increased in each level along with the development of different skills. Table1 measures the gradual max. Increase from 39 to 96 in L-I, from 39 to 98 in L-II and from 39 to 92 in L-III. The lower range (min.) has also increased from 17 to 61, 17 to 45 and 17to 43 in L-I, L-II and L-III respectively. Increase in lower range makes a major output predicted as increase in the different skills.

**IX. CONCLUSION**

This paper is an attempt to understand the science behind the Abacus training as a method of brain development by reviewing the available literature and experiments conducted. Today, brain development classes in India is gaining so much popularity among the parents as they wanted to improve the mental efficiency and academic performance of their children due to increasing competition in every part of life whether it is related to admissions or career of the child. It was observed that memory and concentration power of today's child were very low as they were indulge in playing with electronic gadgets or watching TV from the early childhood. These habits are the result of the busy schedule of the parents as they did not given enough time to care their child and engage them in TV or electronic gadgets to stop them from crying. Such habits have lower down their memory power. Brain development techniques or abacus training helps children to concentrate and allow both the part of brain to function well. Results from several studies has proven that child undergo abacus training becomes more active, perform well in academics, due to strong memory as compared to the non-abacus child. Results from previous experiments shows that there is enhancement in skill development of abacus learners when compared with non-abacus learners. The skill development not only develops the personality of young generations and clears the fear of mathematics but also helps to create a strong generations in the environment.

**REFERENCES**

- [1] Tiwari, Yogesh & Patil, Pavitra (Dr.). (2017). Impact Analysis on Skill Development with Abacus Users. *International Journal of Trend in Scientific Research and Development*, Vol. 1, Issue 5, PP. 955-959
- [2] Mythili, B., Anu, S., Sangeetha, M. & Vasanthi, R.(2006). Evaluation of memory in Abacus Learners. *Indian Journal of Physiology and Pharmacology*, 50 (3), PP. 225-233.
- [3] Stigler J.W. (1980) "Mental Abacus" the effect of abacus training on Chinese children's mental calculation. *Cognitive Psychology*, 16 (2), PP. 145-176.
- [4] Tiwari Yogesh and Tiwari M. (2016). Evaluation of VAK skills (Visual, Auditory & Kinesthetic Skill) in abacus Learners. *International Advance Research Journal in Science, Engineering & technology*, 3 (8), PP. 197-202.
- [5] Hope, J.A. & Sherrill, J.M. (1987). Characteristics of unskilled and skilled mental calculators. *Journal for Research in Mathematics Education*, 18 (2), PP. 98-111.
- [6] Hatta T, Ikeda K. (1988). Hemisphere specialization of abacus experts in mental calculation evidence from the results of time sharing tasks. *Neuropsychologia*, 26 (6), PP. 877-893.
- [7] Hatta T. (1985). Hemisphere functioning in Sorobon experts, *shuzan-shunja*, 59, PP. 2-26
- [8] Hattano G, Osawa K. (1983). Digit memory of grand experts in abacus derived mental calculation, *Cognition*, 15 (1-3), PP. 95-110.
- [9] Hope, J.A. & Sherrill, J.M. (1987). Characteristics of unskilled and skilled mental calculators. *Journal for Research in Mathematics Education*, 18 (2), PP. 98-111.
- [10] Thompson, V. A., & Paivio, A. (1994). Memory for pictures and sounds: independence of auditory and visual codes. *Canadian Journal of Experimental Psychology*, 48(3), PP. 380-398.