



International Journal of Research in Education and Science (IJRES)

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www.ijres.net

To cite this article:

Altiparmak, K. (2016). The teachers views on Soroban abacus training. *International Journal of Research in Education and Science (IJRES)*, 2(1), 172-178.

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The Teachers Views on Soroban Abacus Training

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Abstract

Soroban abacus training is called as mental arithmetic training in our country. It is known for mental arithmetic to increase the ability of four mode operations. Besides this, how is the situation for the students which are having Soroban abacus training in the terms of problem solving abilities, creativity, development of concepts, attraction towards mathematics, success in other lessons and their social relations with their peers? In order to find an answer to this question, this work studies the answers provided from the teachers of 14 students those are having mental arithmetic training which are aged between 7 and 12. In order to reach these students, the snow ball method which is a kind of improbable sampling methods had been used. In this study for the students which are having Soroban abacus training are observed for the effect of Soroban abacus training for their problem solving abilities, creativity levels, understanding of the concepts, their attraction towards mathematics lesson, their success status for the lessons other than mathematics and their social relations with their peers. For the areas mentioned above, the answers and comments from mathematics and form teachers of the 14 students that are having Soroban Abacus training are collected. Descriptive analysis had been conducted for the results obtained from these interviews. As a result, relying on the reviews and comments obtained from the teachers, it can be said that the students which are having Soroban abacus training are performing better than their peers in terms of the areas mentioned above.

Key words: Soroban abacus training; Mental arithmetic; Problem solving

Introduction

On our day when we look to the Mathematics Education theories, in order to achieve a meaningful education a path from tangible to abstract education can easily be mentioned. Learning the tangible meanings for the concepts are the first step in the learning circle. Tangible can be defined as the situations where the new information can be obtained with the help of the preliminary information. On education the tangible step must be substituted by the semi abstract stage in progress. For semi tangible stage logs and number line can be mentioned. The real objects and their pictures are substituted with the logs and the number line on this stage. On Math training the ability of operations holds an important place. The ability to solve the operations of addition, extraction, multiplying and dividing by the students by mind gives them the ability for practical operations. The tangible step for teaching the mathematical operations is the real objects. While becoming meaningful by reality the concept of operation can be transferred to units. The systematically use of the units can be observed in semi-tangible stage. After tangible and semi-tangible stages, abstract step will be reached. One of the most important purposes of the Math Education is to teach students the ability of abstract thinking. It might not be easy to visualize the numbers and to do the operations between them by mind. For this reason the supportive materials are needed. People in the old ages used the logs. Later this situation has been substituted by the more and more developing abacus. At around 300 BC the marble made "Salamis Table" which can be seen in Figure 1 had been used for these operations (<http://www.ee.ryerson.ca/~elf/abacus/history.html>). Salamis Counting board been known as the first abacus in history. Later, with different designs, abacus designed as beads lined on sticks covered by a wooden frame used in Egypt, Iran (Persia) and Greece.

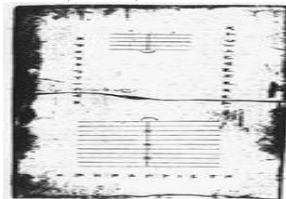


Figure 1. Salamis table

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On our day, the Soroban abacus which had been founded by Lee Kai-chen in 1958 is oftenly used for Mathematical Operations. This abacus is consisted of quintet beads sliding along sticks. Operations are made with the help of these beads (<http://www.ee.ryerson.ca/~elf/abacus/history.html>). The operation of $27+16$ by Soroban abacus can be seen in the figure below.

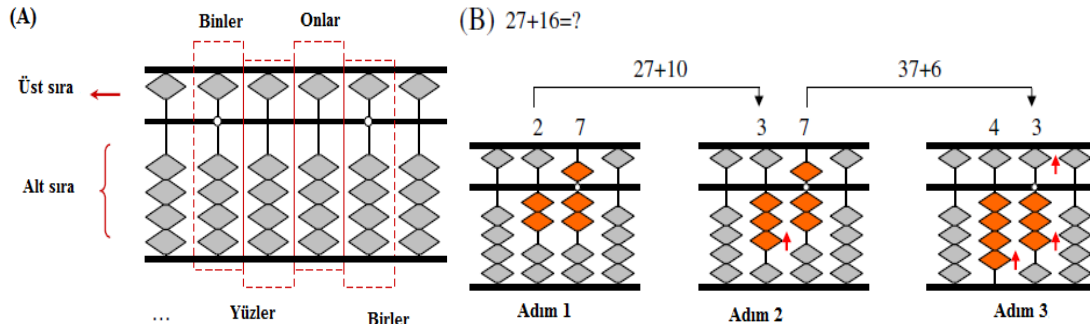


Figure 2. Soroban abacus (Chen et al 2006)

In the Soroban abacus in figure 2(a) each of the beads positioned on the top part are valued as 5, each of the beads positioned below are valued as 1. On the Figure 1, the columns for unit digits, tens digit, hundreds digit, thousands digit.....etc. are stationed from left to right. Beads positioned on the below of units digit are valued as 1, bead positioned on the top are valued as 5. Beads positioned on the below part of tens digit are valued as 10, the bead positioned on top part valued as 50. Each bead positioned on the below part of hundreds digit are valued as 100, the bead stationed on the top is valued as 500. On Figure 1 (B) the operation of $27+16$ had been done as following. First, in order for numerical view of 27; beads stationed on the below part of the tens digit column are slid to top ($10+10$) after that to have $+7(+5+2)$ one bead from the top of the units digit had been slid down ($+5$) and 2 beads ($+2$) from the below part of units digit had been slid to top. Addition of $16(+10+6)$ to 27 had been done as the following. For $+10$, one bead positioned on the below part of the tens digit column had been slid to top part and for $6+(10-5+1)$ first to get $10-5$ one bead stationed on top part of units digit had been withdrawn (-5) then one bead had been slid to top part from tens digit column ($+10$). Later on, for $+1$ one bead from the bottom part of the unit's digit had been slid to top part. In figure 1(B) the result as 43 can be seen on the step 3 (Chen et al., 2006).

Baddeley and Hitch (1974) had described a working memory system. The working memory model had been developed in order to describe how we are temporarily processing the information and storing this information while thinking logically. Working memory system has an important role in determining the logical ability performances and people's general IQ and School achievements (Gathercole, 1999). Experienced people who use abacus-a physical calculating device, do the visualization part with mental abacus and perform the arithmetical calculation in a better way (Miller & Stigler, 1991). Positive effect that abacus have for the working memory had been proved by many of the trained researches (Chen et al. (2006), Lean and LAN (2005), Lu (2002), Hanakawa et al. (2003), Şahiner and Şad (2014) had examined the views of teachers, students and parents' views on mental arithmetic education. For this purpose, researches made by taking account the results of the semi pre-structured meetings with 10 students, a teacher and parents they reach to the opinion that the mental arithmetic has a positive effect on students' academic success, increasing their operations ability, helping them to develop a positive behavior towards learning, to their motivation and active participation to lessons. According to Hayashi (2000), Kawano (2000) and Amaiwa (2000) abacus training for the children in early ages helps children to develop their problem solving abilities. Rubenstein (2001) has reached to the conclusion that, students who are learning abacus are developing their skills of problem solving while they are also generating different techniques and methods to solve the problems. Additionally, they developed a positive attitude towards the Mathematics Lesson.

Tsang and friends (2009) have observed the intersection ways of the areas related to mental arithmetic ability by a functional MR work with diffusion tensor viewing method on 28 children(14 girls & 14 boys) aged between 10-15. This intersection defined anatomically on each of the children. With this calculation, the intersections on the left side of the brain are observed as more efficient for arithmetical operations, problem solving and mental abilities (transferred by Kara 2013). Kara (2013) reached to conclusion that the mental arithmetic training on abacus training had a positive effect on the development of the mathematical problem solving abilities and the wideness effect as a result of the observation trained on 33 abacus training students. On literature, most of the exercises done with the Soroban abacus are related with the "working memory" as

described by Baddeley and Hitch (1974). As far as we can reach from the literature, there are only a few researches of abacus training students related with the problem solving, creativity, understanding the concepts, attraction to Mathematics lessons and social abilities with their friends. Considering this situation, the purpose of this work appears as to investigate the problem solving abilities, creativity, concept learning statuses, attraction towards mathematics lessons, success states for the other lessons and the social communication abilities with their friends for the abacus training students in the remarks of their teachers.

Method

Participants

Abacus trained students from the City of Izmir had been collected with Snowball Sampling Method. This method is the idea of reaching to the other participants from one of the participants (Karasar 2007). Classes or the mathematics teachers of the abacus trained students are the participants of this observation. In this work, 14 teachers had been sampled. Table 1 below shows the information of which Teacher is teaching to which class.

Table1. Teachers Responsible Classes

Teacher	Grade	Teacher	Grade
Teacher1	2nd Grade	Teacher8	3rd Grade
Teacher2	4th Grade	Teacher9	2nd Grade
Teacher3	3rd Grade	Teacher10	5th Grade
Teacher4	4th Grade	Teacher11	2nd Grade
Teacher5	4th Grade	Teacher12	4th Grade
Teacher6	1st Grade	Teacher13	3rd Grade
Teacher7	3rd Grade	Teacher14	4th Grade

Data Collection Tool

With this research, it is intended to compare the abacus training students against the non-abacus training students regarding the ability of problem solving, creativity, concept learning, and attraction status for mathematics lessons, and success status for the lessons beside Mathematics, behaviors in classroom and relations with their friends. On this occasion, 6 questions intended to be asked to teachers related with the information stated above had been chosen by the remarks of the 2 experts on this field. The final forms of the questions are as follows;

1. What would you like to state about the problem solving abilities of the children that have abacus training compared to other children that don't have abacus training?
2. What would you like to state about the creativity skills of the children that have abacus training against the other children that don't have abacus training?
3. What would you like to state about the success of understanding the concepts of the children who have abacus training against the other children that don't have abacus training?
4. What can you say about the attraction level for mathematics lesson of the children that have abacus training against the other children don't have abacus training?
5. How do you consider the level of success for the children who have abacus training compared to other children who don't have abacus training regarding the success on other lessons rather than mathematics?
6. What would you like to state for the social relations of the students that have Soroban abacus training compared to the other children that do not have Soroban abacus training?

Written answers for these questions had been requested from the participant teachers.

Data Analysis

Results obtained by descriptive analysis conducted on the written answers to the above mentioned questions. Descriptive analysis is a quantitative analysis of the data that collected with various data collection techniques summarized and interpreted with the predefined themes. In order to reflect the ideas of the participants in a strict way, researcher might use direct references often. The main purpose of this analysis method is to present the outcomes of the research to readers as summarized and interpreted (Yıldırım and Şimşek 2003).

Findings

Answers given by the Soroban abacus Training students' teachers to the 6 questions asked to them are as follows;

1. *What would you like to state about the problem solving abilities of the children that have abacus training against the other children that don't have abacus training?*

Out of 14 teachers, Teacher 1 and Teacher2 answered t this question as the problem solving ability of the abacus trained children are lower than the other children who don't have abacus training. Teacher3 and Teacher4 stated that there's no difference between the students that have abacus training and other students. Remaining 10 teachers, ordered as 5,6,7,8,9,10,11,12,13 and 14 stated that the students who have abacus training are better than the other students regarding the problem solving abilities. Form teacher of the 1st Grade mental arithmetic student had replied to this question as follows:

"In time, it appeared that the children who can have alternative answers to problems are better on mental arithmetic."

Teacher of a 5th grader mental arithmetic student replied to this question as follows;

"He/She has the ability to generate solutions faster."

2. *What would you like to state about the creativity skills of the children that have abacus training against the other children that don't have abacus training?*

2 out of 14 teachers which are teacher1 (2nd grade) and teacher9 (3rd grade) stated that the creativity skill of the children who have Soroban abacus training are not better than the other children that don't have the Soroban abacus training. Teacher3 (3rd grade) and Teacher13 stated that the children who have the Soroban abacus training are not significantly different than the other children. Teachers 2,4,5,6,7,8,10,11,12 and 14 stated that these students' skill are better than the other students. Some of the statements of these teachers are as follows:

"These children are more productive than the others in ZEP (Enriched Education Program) lessons."(4th grade, teacher12)

"They can generate different ideas by creating quick solutions and having different points of view."(5th grade Mathematics Teacher)

3. *What would you like to state about the success of understanding the concepts of the children who have abacus training against the other children that don't have abacus training?*

One out of 14 teachers had found these children unsuccessful compared to other students. Teachers 3,4,5,9 and 12 stated that as per by having abacus training in the way of understanding the concepts, these children are not significantly different than the other children. From teachers 1, 2,6,7,8 and 10 stated that these children are better than the others on this skill. Teacher 9 has given the statement below regarding this subject:

"They learn the topics on the same level as the other children but on the precision questions they are misunderstanding the questions as a result of being too fast."

4. *What can you say about the attraction level for mathematics lesson of the children that have abacus training against the other children that don't have abacus training?*

On this subject Teacher 4 stated that the children that have abacus training are less attracted to mathematics lessons compared to other children but also stated that these children are more attracted to the verbal lessons.

5. *How do you consider the level of success for the children who have abacus training compared to other children who don't have abacus training regarding the success on other lessons rather than math?*

Teacher 11 answered to this question by stating that the children have the abacus training are less successful on other lessons compared to the children that they don't. Teachers 1, 10 and 9 stated that there is no difference. Teachers 2,3,4,5,6,7,8 and 12 stated that the children who have abacus training are more successful than the other children regarding the other lessons. Besides this, from 4th grade teachers Teacher12 and Teacher5 stated that they are on the first place in their classes as per their academic successes.

6. *What would you like to state for the social relations of the students that have Soroban abacus training compared to the other children that do not have Soroban abacus training?*

Teachers answered this question differently. Some teachers as teachers8, 11 and 12 stated that there is no relation between abacus training and social communication. We did not considered these answers. Because we've asked about the social status of these children with their friends. Besides this teachers 2,3,4,5 and 7 stated that these children have a better social relation compared to other children. Teacher 8 stated that student being too fast and having hard time to control him/herself. Teacher 10 did not answer to this question. Teacher6

approached to social relations of the student in a negative manner and related this situation to the competitive environment around the children. Teachers 1,9,13 and 14 stated that these relations are not different from the other children. Information gathered above had been tried to be summarized partially in Table 2.

Table2. Status of the abacus training children compared to other children according to Teacher views

Questions	Underachieving	Same	More Successful
1. What would you like to state about the problem solving abilities of the children that have abacus training against the other children that don't have abacus training?	Teach1, Teach2	Teach3, Teach4	Teach5, Teach6, Teach7, Teach8, Teach9, Teach10, Teach11, Teach12, Teach13, Teach14
2. What would you like to state about the creativity skills of the children that have abacus training against the other children that don't have abacus training?	Teach1, Teach9	Teach3, Teach13	Teach2, Teach4, Teach5, Teach6, Teach7, Teach8, Teach10, Teach11, Teach12, , Teach14
3. What would you like to state about the success of understanding the concepts of the children who have abacus training against the other children that don't have abacus training?	Teach11	Teach3, Teach4, Teach5, Teach9, Teach12	Teach1, Teach2, Teach6, Teach7, Teach8, Teach10, Teach13, Teach14
4. What can you say about the attraction level for math lesson of the children that have abacus training against the other children don't have abacus training?	Teach4		Teach1, Teach2, Teach3, Teach5, Teach6, Teach7, Teach8, Teach9, Teach10, Teach11, Teach12, Teach13, Teach14
5. How do you consider the level of success for the children who have abacus training compared to other children who don't have abacus training regarding the success on other lessons rather than Math?	Teach11	Teach1, Teach9, Teach10	Teach2, Teach3, Teach4, Teach5, Teach6, Teach7, Teach8, Teach12, Teach13, Teach14
6. What would you like to state for the social relations of the students that have Soroban abacus training compared to the other children that do not have Soroban abacus training?	Teach6	Teach1, Teach9, Teach13, Teach14	Teach2, Teach3, Teach4, Teach5, Teach7

Conclusion

Soroban abacus training is helping to the number concept and helping the operations on numbers at the beginning and helping to do these operations on mind afterwards. This situation is displaying the path of reaching to abstract by starting from tangible. Mathematics is an abstract science (Katrancı & Altun, 2013). Yurdakul and Gülay (2011) mentioned that by presenting the abstract multiple numerical relations in a tangible bead based system mental arithmetic and abacus students are easily building the relation between the numerical values and understanding the mathematical concepts. Mathematical calculation is a cognitive skill. It relies on the working memory usage, problem solving skill and ability of mind based calculation (Sokol et al., 1991). On the works of Lu (2002) the conclusion was that the people who have trained with mental abacus have developed their visual-spatial skills greatly and observed huge differences between the two groups' short term visual-spatial sketchpad storages.

Lean and LAN (2007) observed the problem solving skill of the abacus mental training children are more developed compared to the other children which are not having mental abacus are training. On this work the

better problem solving skills observed by the teachers for abacus training children compared to other children. On his work Kara (2013) stated that the abacus mental arithmetic training creative thinking program has a positive effect on the development of mathematical problem solving skills and stated that this effect has a huge influence. On this work 11 out of 14 teachers of these children stated that these children have better creative skills compared to other children. Amaiwa (2000) stated that the people who have mental abacus training are developing their mathematical problem solving skills and positive effects can be observed on negative numbers and fractions .Hayashi and Kawano (2000) stated that “It is efficient for the children to start training with the abacus in the early stages to solve the mathematical problems and for understanding of the numerical concepts” (quoted by Kara (2013). On this work 8 out of 14 teachers observed that the children training with abacus understand the concepts better than the other children. One of the reasons for this might be the positive effects of abacus training on the development of working memory. Increase in the participation of the neurons for the calculations of visual spatial in two dimensional spaces is possibly linked with the Mental Abacus (Hanakawa et al., 2003). Lee et al. (2007) after abacus training, participants have developed their storage and reach-back skills for visual-spatial information with great efficiency. On this work 11 teachers stated that the children having Soroban abacus training are more attracted to Mathematics Lessons. Fidan (2008) on his work also reached a conclusion alike. Numbers and the numerical operations are holding a great place in 1st and 5th grade syllabus. As a result of doing these operations in a high level students might be more attracted to Mathematics Lessons. Also by succeeding in this cognitive skill required lesson and having a more developed working memory might have helped them to develop a positive behavior. 10 teachers out of the teachers of children training with abacus stated that these children are also more successful on the other lessons compared to other children. On this work 7 teachers stated that these children are more successful in social relations with their friends. This result is the less agreed situation by the participants’ teachers on this work compared to other questions. This work consisted by the written statements of only the teachers of 14 children who are training with abacus. In order to make generalizations we think that this field requires more research. Education based on tangible to abstract might be considered for increasing their success because tangible situations involves the preliminary information for learning process in a circle of simple to hard. One of the descriptions for learning is reaching to new information with the help of preliminary information. Enrichment of the learning environments might make learning more meaningful. On this occasion students must be provided with rich leaning environments.

Acknowledgements

This study was presented as an oral presentation at the 2015 ICEMST conference.

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