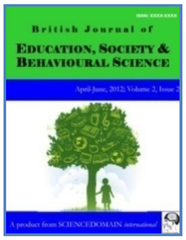

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Will the Mathematics Teaching Methods Used in Eastern Countries Benefit Western Learners?

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Authors' contributions

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ABSTRACT

This study explores the effectiveness of rote memorization on the development of pre-algebra concepts. In Eastern culture, India in particular, rote memorization is used in math instruction to teach multiplication and other pre-Algebra concepts. This research agenda involved mass recitation of multiplication tables for about 10 minutes in 5th grade math classes, every school day, for a period of one month in three American elementary schools. The rationale behind the research study is based on Chinese and Indian educators' beliefs that concept formation at the initial stage is helped by rote learning. The main objective of the study was to determine if Western learners would benefit from an Eastern method of instruction in math classes based on rote memorization. Students were divided into experimental and control groups. Before administering the treatment, a pre-test was given to all the students; a post-test was given after the completion of the program. The Gain scores from the two tests were compared between the control and the experimental groups. This teaching method, which is broadly practiced at elementary levels in India, was expected to enhance math proficiency of elementary school children in the United States, yet results did not support this hypothesis. Some suggestions for these results are presented in this paper.

Keywords: Rote memorization; rote learning; pre-algebra concepts; TIMSS; relational thinking; Indian versus American math instruction.

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1. INTRODUCTION

The National Council for Teaching Mathematics (NCTM) advocates professional development of teachers using research. In 2000, the NCTM suggested that there is no "right way" to teach, that teachers can adopt different learning styles and strategies for helping students learn mathematical concepts [1]. Teachers are encouraged to experiment with different techniques adopting methods from different cultures thereby bringing innovations in their style. The main objective of such a strategy would be to effectively facilitate learning for students by using a variety of learning styles. Efforts to pursue high quality classroom instruction have resulted in the exploration of teaching styles from cross-cultural perspectives. One mathematics achievement model published in 2011 and based on the TIMSS (Trends in International Mathematics and Science Study, 2003) [2] revealed that in a mathematics classroom in Japan, students are asked to learn facts through repeated recitation. Results were promising, yet some researchers examined teacher's views on memorization and their opinions were diverse. For example, Western educators believe that memorization can only come "after" understanding while teachers from Mainland China believe that memorization can come "before" or "after" understanding [3]. Narayan [4] argued that concept formation relies on basic language and mathematical skills, which in the initial stages are helped by rote learning. Research supports this idea and suggests that the excellent performance of Asian learners on international standardized tests may be due to the combination of understanding and memorization, not commonly found in Western students [4].

Famous developmental psychologists Jean Piaget held that children process and interpret new understanding in terms of their old understandings of ordered relations; only when this understanding is fully achieved can the child remember the new knowledge accurately. Thus, memory reflects and depends on the entire cognitive structure. Memory becomes active understanding rather than in a static or passive state [5]. This theory validates the idea that rote memorization in mathematical teaching is not the mere "cramming" of facts and numbers, but is an active, ongoing process. Miller's study involved testing a hypothesis on rote learning in an elementary school and its subsequent impact on number sense and basic algebra concepts (related to the basic concepts of multiplication). Miller hypothesized that children who recite multiplication tables every day for a certain period of time would perform better in multiplication tests than students who practiced multiplication using worksheets or other methods. Conclusions suggest that mass recitation is an appropriate method of learning multiplication.

Teaching mathematics involves creating, enriching, maintaining, and adapting instruction to move toward mathematical goals, capture and sustain interest, and engage students in building mathematical understanding [6]. Stigler and Hiebert describe teachers in the United States place a major emphasis on review and student participation [7]. In 2002, Sloan, Daane and Giesen [8], after studying 72 elementary pre-service teachers, found that teacher attitude also affects student learning. Negative attitudes in the classroom pass on negative feelings to students. Moreover, mathematics instructors who teach primarily through lecture and rote memorization of algorithms, often neglect to meet the learning styles of all students and, therefore, may unintentionally perpetuate mathematics anxiety. Stigler and Hiebert added that review and student participation were important factors related to effective instruction involving student learning.

A study conducted on teaching strategies of 14 teachers using the University of Chicago School Mathematics Project (UCSMP) textbooks was compared to 14 teachers using other technology-based textbooks [9]. Findings showed that the teachers using the UCSMP text books spent significantly more time on “group work” or “cooperative learning” and considerably more time on “reading” text books while devoting less time on lecturing. The UCSMP teachers employed more technology, including computers and calculators, in their teaching strategies. According to these teachers, the textbooks influenced their teaching strategies in their classrooms. Textbooks with different features, however, conveyed pedagogical orientations to teachers and provided them with certain curricular environments for utilizing different teaching strategies [9]. Studies have found that primary (K-2) level teachers are more likely to use hands-on materials to teach mathematics as manipulative. Instruction promoting the social interaction of students while doing mathematics, particularly in cooperative learning groups, has also been found to be more prevalent in elementary grades as compared to the upper grades [10]. The authors suggested that teachers with higher content knowledge believed in traditional method of teaching while teachers with low content knowledge believe in a more inquiry-based teaching approach. It is the teachers' beliefs and attitudes related to mathematics that ultimately shape their instructional practices. In order to change teachers' beliefs about particular instructional methods and increase teachers' use of instructional practices that promote student understanding, they must be given the opportunity to work first-hand with these methods to experience the positive value of the methods for themselves.

The Mathematical Association of America [11] recommended the preparation of mathematics teachers from a vision of an ideal mathematics teacher. The recommendations include viewing different topics and subtopics as being interrelated, communicating mathematic accurately both orally and in writing, understanding the elements of mathematical modeling, understanding and using calculators and computers appropriately in the teaching and learning of mathematics, and gaining an appreciation of the development of mathematics culturally and historically [11].

In 1983, the White House established presidential awards for Excellence in Mathematics and Science Teaching (PAEMST); these programs were designed to recognize the contributions of outstanding mathematics and science teachers in the United States. A comparative study of teaching strategies of awardees along with other teachers revealed their extraordinary involvement in their profession [12]. In this study, the authors also found that these teachers were in strong agreement with NCTM teaching standards. However, this group differs from other teachers in that the teachers receiving the excellence awards placed a greater emphasis on reasoning while other teachers placed more of an emphasis on learning computational skills. Presidential awardees were less likely to use multiple–choice tests while other teachers frequently used these traditional practices and their students read textbooks in class and drilled with worksheets [12].

1.1 International Research

A study using the Trends in International Mathematics and Science Study: TIMSS 2003 built mathematics achievement models of 8th graders in four countries: the USA, Russia, Singapore and South Africa [13]. It was observed that students' self-concept ability was related to mathematics achievement in each of the four countries. In Russia, the highest self–concept ability of the students was due to positive perception of the mathematics teacher. This was responsible for their higher mathematical achievement. Self-concept ability of the students in mathematics predicting their own achievement in the other countries was similar. It was observed that parental involvement was negatively related to student mathematics achievement in South Africa (this variable was not significant in the other three countries). The role of the mathematics teacher was observed to be the most important factor affecting learning in each of these countries [13]. One conclusion for the differences observed in this comparative TIMSS study was that differences were due to the culture of the country.

A study conducted with pre-service teachers in Ireland, emphasized the importance of one-to-one interviews of the children with their teachers for understanding children's mathematical thinking. This process of the one-to-one interview began approximately a decade ago in Australia. It engages the teachers both on an emotional level and on an intellectual level and has been shown to be highly successful in early childhood mathematics learning and teaching. The project, "Big Math for Little kids" is a similar program and prevalent in the United States [14].

The elementary school mathematics curriculum and teaching in Taiwan is influenced by the reforms standardized by the NCTM. In a study conducted in Taiwan, a teacher's pedagogical value was found to be connected to her students' mathematics learning. The research revealed that values are integrated in mathematics teaching and these values are the values related to the religion and culture of the mathematics teacher as evident in the teacher's dialogue: "My purpose is to keep absent minded students' attention …. I realize that if one can calm down and has a peaceful mind, he or she can learn things quickly. I recognize this is Buddhism on my own" [15]. They concluded that an important implication of this study was that curriculum reform is the reform should be compatible to teacher's values. The values of the teacher are recognized as a significant factor in student learning.

A study conducted on Malaysian mathematics teachers revealed that the teacher's perception about learning math is influenced by the exam-oriented culture, one specific to Asian culture [16]. However, some characteristics of the mathematics teaching in Malaysia are also shared by mathematics teachers of other cultures. These include a strong content knowledge by teachers, mastery in instructional skills of the teachers, an overall attitude of caring for the students, and a variety of classroom management strategies. There was also a common agreement among the Malaysian teachers that all effective teachers should use multiple teaching methods and teaching aids and concrete objects to make teaching effective. The Malaysian characteristics of effective mathematics teaching are similar to other cultures, making these characteristics universal in nature.

Finnish elementary teachers believe that teaching should be goal oriented. In order to make mathematics teaching an effective goal of teachers, there should be a development of the pupil's basic math understanding and calculation skills. They also focused on their student's thinking and actions. According to Kaasila and Pehkonen [17], the most important quality of a teacher is to listen to the pupil and understand his/her ideas. They also supported practicing different teaching methods in different situations. It is observed that the Finnish conception of effective teaching is closer to that of the pragmatic concepts of Germany, Australia and America rather than that of the formalist concepts of China and/or Hong-Kong.

Efforts to pursue high quality classroom instruction worldwide has led to the exploration of different teaching styles in East Asian countries like China, Japan, India and others. One country that requires special consideration is China. A typical Chinese classroom is characterized by a large class size with a lecture-oriented classroom instructional method. Findings suggested that a teacher–oriented style of teaching in China does not mean that students are not actively engaged in the classroom lesson [18]. One common practice in teacher-oriented Chinese schools is using an evaluation sheet to judge the quality of mathematical classroom instruction. Chinese schools gradually and continually revises the evaluation sheet based on the teacher's feedback.

Thorough interviews with twenty Chinese teachers, educators identified the relationship between memorization and understanding. Cai and others [2] suggest that for Chinese educators, memorization does not necessarily lead to rote learning. Instead, it can be used to deepen student understanding. Their study concluded that mathematical understanding, followed by memorization, helps to retain and assimilate new knowledge to the pre-existing knowledge. They suggest that memorization is important especially when one needs to solve mathematical problems. This Piagetian approach is a useful in effective math instruction.

1.1.1 Indian Mathematics Instruction

The traditional approach of teaching in India involves rote learning reinforced with blackboard and chalk (or paper and pencil). Children remained at their desk while teachers impart a lecture. The student-teachers of the Marymount University collaborated with undergraduate teacher education students to develop a two week, integrated approach to teaching which involved both the American and the Indian style of teaching. The result of this collaboration built the foundation of a new concept of integrated teaching in educating students. In this context, the performance of the Indian children's mental agility surprised the American student teachers of Marymount University. By incorporating a lattice system, a simplified technique in multiplication skills, every student took part and became more interested in learning math [19].

Narayan [3] analyzed the importance of rote learning and algorithmic methods of teaching as the preparation for concept formation. He also emphasized that it is difficult for people to learn anything new without some basic knowledge of the new idea. Similarly, a child has to memorize the alphabet as well as basic mathematical operations at the beginning of their schooling, yet during this time, concepts have no meaning. Thus, according to Narayan (2009), rote learning is an important aspect of the Indian teaching method for mathematics. Rote learning can be regarded as a strong framework upon which a superstructure of advanced learning can be built.

The Indian style of teaching mathematics focuses on certain unique practices such as finger counting, mental calculations and repetitive practice. Memorization is also considered an effective tool in learning mathematics. Children in India learn counting numbers in an exclusive way with the help of fingers. It starts with counting fingers on one hand and then counting shifts to fingers on the other. As each finger represents a number, each line in each finger is also taken into account while counting a larger number. Many people in the rural areas teach their children basic mathematics at an early age while these children accompany their parents to sell goods in the market. These children do not depend on external tools like a calculator. All calculations are done mentally. Teachers and parents of most Indian children emphasize the use of the finger counting method and mental calculations for stronger mathematics learning. These techniques, while culturally relevant to Indian children, can be viewed as an alternative mathematic learning strategy that should be explored for possible adaptation in any primary USA classrooms [20].

India has a rich source of diverse forms of mental mathematics. Appreciating the richness of these methods can enrich a child's perception of mathematics. A national focus group on the teaching of mathematics in schools [21] has recommended inclusion of certain processes in order to enhance mathematic learning and skills. Two such important processes are the estimation of quantities and the approximating solutions, used for making connections between mathematics and other subjects of study. An emphasis to the above-mentioned processes in the classroom would enable children to connect mathematics with real life. The national focus group also recommended that teachers should be supported (through communication means) by research mathematician and college teachers. “When teachers network among themselves and link up with teachers in Universities, their pedagogical competence will be strengthened immensely. “Such systematic sharing of experience and expertise can be of great help” [21].

Gandhi and Verma [22] advocated an instructional approach, “Strategic Content Learning”, to promote self–regulated learning skills among average mathematics performers. They suggested that task-specific strategies are not always determined in advance. Instead, students and teachers established an understanding of the task, define the task goals, and then, using the task goals as a foundation for decision-making, invent task-specific strategies. An essential component of the study was the student’s internal motivation and voluntary participation [22]. These strategies could be relevant in a middle school mathematics classroom where goals and decision making are more prevalent. The education reformists, however, must be willing to devise new and innovative methods to make teaching and learning more effective, from the younger grades on up. Other research [23] has pointed out that the use of memory, not as a skill but as a distinct modality of learning mathematics, was conceived and practiced in elementary schools of southern India.

Early childhood schools in India stress the foundation for future education and therefore training in the 3R’s (Reading, Writing and Arithmetic) are considered valuable. Other cultural factors, like obedience and compliance, also affect the teacher child interaction with the teacher and students within the classroom [24]. The education system in present India, however, is complex and multilayered. Indian philosophy and culture influences both curriculum and the methodology of teaching. One lasting result from the British colonialism seems to be manifested in rigidly structured tests and the curriculum. The discourse of the American’s progressive educational system influences all education systems in its activity-based learning and child-centered classrooms and thematic teaching modules, even though these cultural instructional strategies are restricted mostly to early childhood classrooms and in private schools [25].

According to educational psychology, student involvement in self-evaluation can be considered as a strong motivating factor in learning. When “retrieval” is practiced, improvement can be seen in the later recall of learned information. The practice of verbal information (or “recitation”) constitutes a repeated review of information learned or stored. An individual can visualize the information while repeating it again and again [26]. Gagne described individual characteristics (like cognitive strategies and attitudes) as intellectual skills (or thinking skills) and suggested they are connected to the organized form of information in the human memory. New learning, therefore, is dependent upon an organized structure of information stored in our memory. In his book, The *Conditions of Learning*, Gagne describes the effectiveness of an external condition (the advanced organizer) as helping in accomplishing retention of the information that improves learning. This advanced organizer, which in this present context is the repetitive recitation of multiplication tables, will help the learner to connect the meaningful context available in the memory for new learning. When the information enters long term memory from short-term memory, the information becomes a concept. This concept formation is critically important in learning. In order to understand whether the concept formation is concrete, entities from the long-term memory are retrieved by the learner. Therefore, the learner connects the old concepts with the learned concepts in such a way that it becomes an automated skill [26]. In summary, repetitive recitation improves learning in mathematics as can be seen by a multiplication table, meaningful context needed for all other stages of math.

2. METHODOLOGY

The purpose of this study was to assess student's understanding of some basic Algebra concepts in relation to rote memorization of multiplication facts. For this study, a program of mass recitation of multiplication tables was implemented in American elementary classrooms for a period of one month. The research method was quasi-experimental and engaged 130, 5th grade students studying in different elementary schools, allocated within a mid-western public school district. Data was collected through written responses of the students. Observations and interviews of students and teachers were also part of the data collection process.

2.1 Subjects

The subjects for this study were in the fifth grade and ranged in age from 10-12 years of age. Eight schools in one urban school district were originally selected at random to be a part of the study yet only three schools agreed to participate. In each school, one class was randomly assigned to be the control group and one to the experimental group.

2.2 Procedures

The subjects were divided into two groups – the experimental group and the control group. The groups were selected randomly in each school irrespective of socio-economic and cultural background; thereby the strength of internal validity was preserved. A worksheet (pre-test) lasting two minutes was given to all the students to identify their proficiency in multiplication before administering the program. The treatment lasted for one month for the experimental group while the control group was taught using an American style of instruction. A post-test was given to all students. The Gain score was used to compare the two groups in the study.

The treatment for the experimental group involved mass recitation of the multiplication tables every day for about ten minutes at the beginning of a regular math period for four weeks. The children recited together at least two multiplication tables in recurring rhythms each day. During the study weeks, the experimental group practiced the same exercise repeatedly along with their teacher. After one week in which there was no recitation practice in the classes, the post-tests were presented to the students. While the experimental group experienced the new program, the control group continued their multiplication practice using the worksheet method which the teachers had been using with their students. The post-test was given to all the students and lasted approximately two minutes. The pre- and post-tests were the same content, presented in two sections; one section tested the subject's skills on multiplication while the other section tested basic algebraic concepts. Each section of the test comprised ten simple questions.

Pre-Test: Section 1: Sample problems in this section include:

#1. 9 x 8 = ___
#2. 12 x 3 = ___
#3. 125 x 9 = ___.

Pre-Test: Section 2: Sample problems include:

#1. (2 x 9) + 10 = ___________
#2. 5x (5+5) = 25 + ____________
#3. ___________ x 7 = 63

2.3 Data Analysis

The data analysis in this quasi-experimental study consisted of examining and comparing the responses between the groups in the pre- and post -tests. The control group included students in the regular classroom who did not participate in the memorization drill. The experimental group included the students who practiced the memorization drill every day at the beginning of math class. The control group and the experimental groups were compared by showing their differences between the mean classroom test scores using the t-test.

3. RESULTS

The mean scores, standard deviations, and standard error of the means for pre-test and post-test as well as Gain scores are presented in Table 1. The mean pre-test score of the control group was found to be 4.55 while the mean pre-test score of the experimental group was 7.80. This compares to the mean post-test score of the control group of 7.35 and the mean post-test score of the experimental group of 8.01. Also observed in Table 1, the mean Gain score of the experimental group was 0.22 while the mean Gain score of the control group is found to be 2.80. The Gain score of the control group was 2.58 points higher than the Gain score of the experimental group, a finding that needs to be discussed.

Table 1. Mean Scores of the Pretest, Posttest and Gain in Experimental and Control groups

	Group	**No. of students**	**Mean**	**Std. Deviation**	**Std. Error Mean**	***P* value**
Pretest	Control	51	4.55	3.607	.505	.00*
	Experimental	79	7.80	3.950	.444	
Posttest	Control	51	7.35	3.783	.530	.392
	Experimental	79	8.01	4.564	.514	
Gain	Control	51	2.80	5.056	.708	.016*
	Experimental	79	.22	6.400	.720	

** P= .05*

4. DISCUSSION

A study entitled “Minute Math” [27] involved an action research project relating student self-assessment with their mathematical learning. Results of this study showed that student self–assessment was successful in turning rote memorization of learning into a deeper experience by monitoring their own learning. The study provided an extensive presentation of practical results on self-assessment. The study suggested that student involvement in their own assessment is an effective strategy that can add reflection and meta-cognition to rote memory lessons. The present study is similar to "Minute Math" and was conducted to understand the effectiveness of the program of mass recitation of multiplication tables with an objective to promote cross-national teaching and learning.

As seen in Fig. 1, the mean Gain score of the experimental group (0.22) was significantly lower than the mean Gain score of the control group (2.80). This result does not support the research hypothesis "The students who will recite the multiplication tables for one month will perform better than the students who will practice multiplication by means of methods used by their teachers."

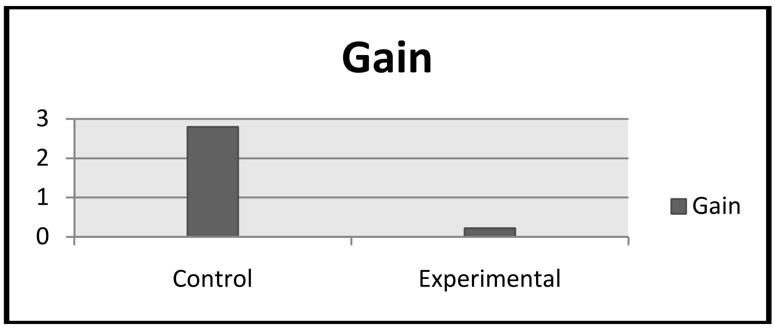

Fig. 1. Graph showing Mean Gain score of the Experimental and the Control Group

The drilling practice of multiplication tables every day for one month appeared to have a negative impact on math achievement in these U.S. elementary classrooms; negative in the sense that improvement was hindered. The other method (the worksheet method used by the teachers) of the control group was evidently much more effective in bringing improvement in the control group than in the experimental group.

How could a method of instruction, used by Eastern countries for years, appear to have a negative effect on that achievement in the United States? What could have caused the discrepancy of results from the logical hypothesis? An answer to these questions can be found by disaggregating the data. Instead of looking at the combination of student data from all three schools, individual school data is presented below. As observed in Fig. 2, the mean Gain score (2.6) of the control group in School #1 was found to be higher than the mean Gain score (0.9) of the experimental group. Subsequently, by performing a t-test it was observed that the p-value of significance is greater than 0.05 in the pre-test, post-test and Gain indicating no significant difference in the performance of the two groups.

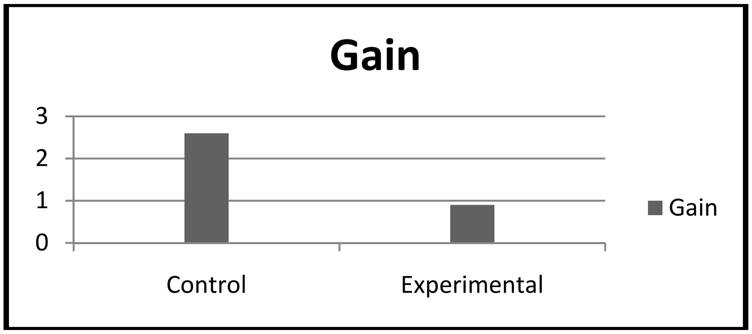

Fig. 2. Graph showing the Mean Gain Score in School #1

In Fig. 3, the mean Gain score of the control group (2.44) is found to be higher than the mean Gain score of the experimental group (1.82) in School #2. The p-value for Gain scores showed that there is no significant difference between the two groups in their Gain scores.

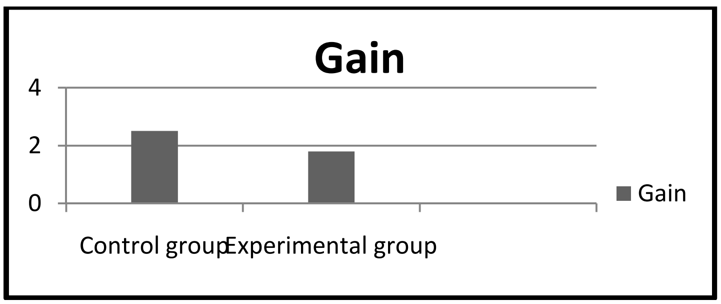

Fig. 3. Graph showing Mean Gain Scores in School # 2

The mean Gain score of the experimental group is found to have dropped substantially in School #3 showing deterioration in their performance in the post- test (Fig. 4). The p-value of the pre-test reflects the fact that the two groups may or may not be similar in their performance. However, the p-value of the post– test and Gain scores were less than 0.05 showing a significant statistical difference between the groups.

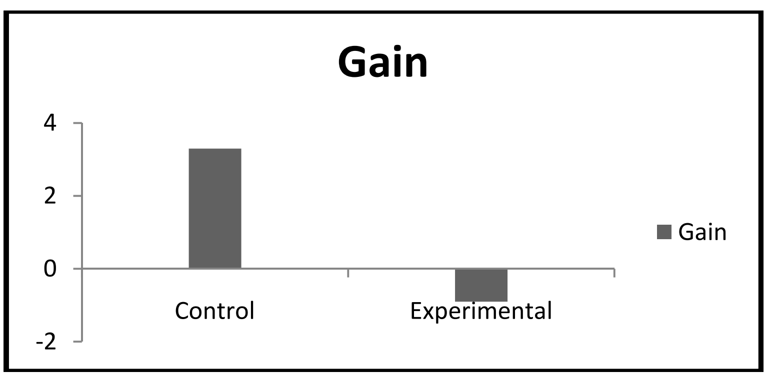

Fig. 4. Graph showing Mean Gain Scores in School # 3

Furthermore, comparison of the first section of the assessment by the t-test yielded the same results. Thus, this result showed a better performance of the experimental group, yet could not support the hypothesis that rote drilling of multiplication tables is a better technique of learning multiplication tables. The degree of improvement in performance is observed to be same in each group.

An obvious explanation of the data would be that there was an extremely poor selection of students for the study. A poor sampling methods of students could explain a statistical regression to the mean. Although many statisticians would claim this to be a weak explanation, there are valid reasons why this is exactly what happened in this study. Since this study was conducted in real schools, with real students, the limited access to a greater variety of schools could have resulted in improper sampling. Although the two groups were selected randomly, the experimental group in each of the three schools was found to be at a higher level of proficiency than the control group in the pre-test (see Fig. 5), whereas the ideal sampling required the same level of proficiency. As evident in the Fig. 5, a marked difference in the height of the column graph of the two groups is observed in the pre-test. Consequently, chances of regression to the statistical mean increased as the sample size is small and the proficiency level is low. Regression to the mean is a statistical phenomenon that is observed especially when the average scores in a sample are extremely low. This effect of statistical regression is observed in all the participating schools. Fig. 5 demonstrates that the experimental group, even though it did improve after treatment, was only able to improve a relatively small amount. The control group, with a very low score on the pre-test, was able to improve a much greater amount, and it did.

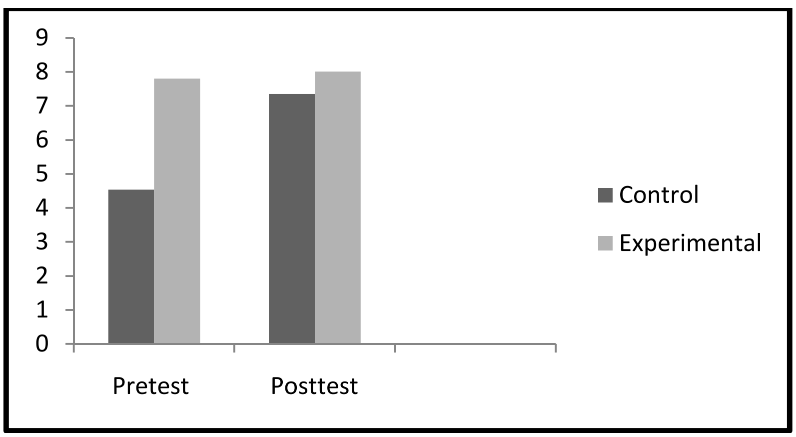

Fig. 5. Graph showing Comparative Performance of Experimental Group and the Control Group in the Pre-test and the Post-test for all schools.

The experimental group is found to be at a higher level than the control group in the pre-test. However, the post-test graph indicates that the control group performed significantly well, scoring almost the same as that of the experimental group, while little improvement is observed in the experimental group. The significance value (p value) for pre-test and Gain showed that there was a noticeable difference between the two groups.

A second plausible explanation for the non-anticipated results was the insufficient time period to bring about any change. It is natural that a certain fraction of the students would be apathetic towards a new method of learning, particularly when they were used to a certain method of teaching and learning (worksheets only in the U.S. schools). This attitude of the students was reflected in the observation report on School #1. The report was collected 15 days after the initiation of the program. The observer wrote, "…students are less enthusiastic in the middle of the program. All took interest at some point." However, the observer in School #3, who observed the recital of the experimental group a few days after the completion of the posttest, contradicted this view. She wrote that, "…students were able to recite better without the help of their teacher." It appears that the time limit of one month may be too short to measure any significant change in the progress of the students, especially when the overall sample size is small. As one of the teachers from School #2 said, "I was surprised by how engaged my students were in the program. I had several of them who became leaders in terms of keeping the rhythm of the recitations. One of my students who struggle with her basic math facts became the person who reminded me every day to do our multiplication tables. I think that, with continued practice on a daily basis, we could see a huge growth over the course of a year".

A final explanation of the data is that the students did in fact score better using the traditional American method using worksheets, than the Eastern method of mass recitation. The statistician would say this is the most likely explanation, as long as proper sampling procedures and procedural protocols were followed. The objective with this study was to find an effective way to education students in the area of mathematics. The attitude of the teachers was observed to determine if there was any bias toward the traditional way math was being taught. It was found that all the teachers of the experimental group were very enthusiastic about the program. The enthusiasm of the students and the teachers were reflected when School #2 was observed during the final weeks of the program. The students recited the multiplication tables independently and with confidence. The teachers found it to be a very effective method of learning multiplication tables. According to the teacher of School #2, "… my students enjoyed taking part. I believe we will benefit much from this structured practice. I also believe that oral recitation with rhythm will greatly aid their memorization." The teacher of School #3 said that, "The kids liked the rhythm and beat that went with the recital. They made it their own, after a while, made it a little faster than I had started. It came out quite well."

4. CONCLUSION

Memorization is an important part of learning. Recitation or oral repetition of facts, a learning method considered to enhance memory skills, is practiced in India. This view was supported in the literature review section of this study. The main objective of the study was to find out the effectiveness of a traditional Indian teaching method in American classrooms, aiming to bridge the gap between Eastern and Western learners. It was realized that in order to implement such an action-based research project in order to bring about changes in the teaching practices, the task is not an easy one. There were unforeseen interferences, due to which the results of the study were jeopardized and hypotheses were not supported by the statistical analysis of data. However, the program was highly appreciated by the participating schools. The schools speculating success in the long run are eager to implement the method in their regular curriculum. Therefore, this study can be considered a stepping stone towards integrating learning techniques with cross-cultural perspectives. This will eventually lead to a new dimension in curriculum development.

With regard to this aspect, a future study is highly recommended under stringent experimental condition to avoid confounding impact of other factors on the assessment results. According to Rosenshine and colleagues [28], the retention and application of previously learned knowledge and skills comes about through constant learning. That is, practice beyond the point where the student has to work to give the correct response. This results in an automatic response that is rapidly executed and requires little or no conscious attention. In a large number of academic situations, the students need to apply and use the knowledge that has been previously learned. Students who have thoroughly assimilated the multiplication tables were expected to show superior performance than other students. The data showed that the worksheet method was more successful for American students than the verbal recitation of multiplication facts. It has been hypothesized that students are motivated differently to achieve academic success; students with high achievement motivation tend to adopt whatever approach they feel will maximize their chances of academic success [29]. Therefore, trying to improve the product of schooling by changing just one factor is likely to be counter-productive if other components in a learning system remain unchanged. This is one of the challenges with this study - it is difficult to come to reliable conclusions is such a short time period or treatment, especially when motivation and academic achievement are involved. Future attempts to identify effective methods of instruction across cultures will need a full semester of observation, not just a short month.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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