DOI: http://dx.doi.org/10.4314/gjedr.v11i1.4

GLOBAL JOURNAL OF EDUCATIONAL RESEARCH VOL 11, NO. 1, 2012: 21-29
 ISSN 1596-6224
www.globaljournalseries.com; Info@globaljournalseries.com

TEACHING MULTIPLICATION OF LARGE POSITIVE WHOLE NUMBERS USING GRATING METHOD IN JUNIOR SECONDARY SCHOOLS IN OBIO AKPOR LOCAL GOVERNMENT AREA OF RIVERS STATE

N. R. OKPOBIRI

(Received 30, January 2012; Revision Accepted 22, February 2012)

ABSTRACT

This study investigated the teaching of multiplication of large positive whole numbers using the grating method and the effect of this method on studentsôperformance in junior secondary schools. The study was conducted in Obio Akpor Local Government Area of Rivers state. It was quasi- experimental. Two research questions and one hypothesis guided the study. The sample consisted of eighty (80) Junior Secondary two (JS2) students from two (2) schools. Forty JS2 students (experimental group) were taught multiplication of large positive whole numbers using the grating method and another forty (control group) were taught the same concept using the conventional long multiplication method. The instrument used for data collection was a researcher made ó2-item-show-workingô achievement test tagged multiplication of Large Positive Whole Numbers (MLPWN). This MLPWN was used to pre-test and post test the two groups. The MLPWN was validated and a test retest was carried out using the pearson product moment correlation to obtain a reliability coefficient of 0.75.The descriptive statistics was used to analyse the research questions while the t-statistic was used to test the hypothesis at 0.05 significant level. The result showed that the students taught multiplication of large positive whole numbers with the grating method performed better than those taught with the conventional long multiplication method. The paper recommended that secondary school mathematics teachers should integrate history of mathematics during mathematics instruction and also the curriculum designers should give history of mathematics its rightful place in Nigerian mathematics curriculum.

KEY WORDS: Grating Method, History of Mathematics, Long Multiplication.

INTRODUCTION

Every subject of study requires justification. One way of explaining the worth of mathematics is through its history. The history of anything is very useful and indispensable because it provides a link between the present and the past. History is the study of the past. It offers a storehouse of information about how people and societies developed. Teachers should know that history of mathematics is an inescapable aspect 0f mathematics that needs to be integrated into the teaching of mathematics since it is the past that causes the present and also the future.

Stearn (1993) opined that the history of everything should be studied because it is essential to individual, society and that it also habors beauty.

The area of study known as the history of mathematics is primarily an investigation into the origin of discoveries in mathematics and, to a lesser extent, an investigation into the mathematical methods and notations of the past. It is only through the history of mathematics that we can grasp how mathematics concepts were developed by great humans (Pythagoras, Aryabhata, Euclid, Bhaskara, Bernoulli, Lemma, Gauss etc) and civilizations (Babylonians, Egypt, Chinese, Arab, Hindus etc).

N. R. Okpobiri, Department of Mathematics/ Statistics, Rivers State University of Education, Rumuolumeni, Port Harcourt, Nigeria

Unfortunately according to Odili (2006), the aspect of mathematics which has not been given its rightful position in the mathematics curriculum is the history of mathematics. Studies have it that primary and post-primary school mathematics teachers do not relate the teaching of mathematics to its history at all. This leaves in the students a feeling that the modern mathematics which they are studying today suddenly found its way in textbook form without the efforts of human**.** There are certain mathematical concepts that could be best presented to the learners historically in order to give mathematics a facelift. Teaching mathematics with an iota of its history create a source of fascination to the learner.

Fauvel (n.d.) opined that there is a recent movement for teachers to make more use of history of mathematics in the teaching of mathematics concepts. The history of mathematics should not be compartmentalised but rather be integrated or permeated into the teaching of mathematics concepts in Nigerian primary and post-primary schools. This means that the historical approach can be at the introductory stage, developmental stage or the concluding stage of the teaching procedure. This may suggest why Siu and Tzanakis (2004) emphasized that the history of mathematics can enhance the teaching and learning of mathematics by likening it to appetizer, main course and dessert which caters respectively for motivation, content and enrichment.

There are so many mathematics concepts that could best be presented by integrating a historical approach. One of such concepts as put by Aser (1996) is the multiplication of large positive whole numbers. The Wolfram mathworld (n.d.) opined that the long multiplication method is the conventional method of teaching students multiplication of large positive whole numbers in many post primary schools today. Walsh (2000) pointed out that the grating multiplication is the method for multiplying that was popular in India centuries ago when the number notation was first used. The grating method is synonymous to gelosia method or the lattice method of multiplication. This method later spread to other parts of civilisations.

Concepts such as Roman numerals; Tally system; Multiplication of large positive whole numbers; Sieve of Erasthosthenes; Pythagorasô Theorem etc could well be taught from their historical point of view by permeating them during the teaching process. This is because it will make clearer the meaning of historical dimension and deepen the understanding of its various aspects. It is therefore imperative to encourage teachers of mathematics to integrate the history of mathematics as an appetizer, main course or dessert when teaching some mathematics concepts as opined by Siu and Tzanakis (2004).

Statement of the Problem

There are varieties of ways a mathematics teacher can add spice to the teaching of mathematics concepts in order to make it fun and interesting for students to learn. Multiplication of large positive whole numbers is a concept that most teachers teach in junior secondary schools by relying on only one conventional method known as the long multiplication. They do not expose students to alternative methods of multiplying large positive whole numbers. This one method becomes monotonous and does not cater for the needs and interest of individual learners. Doyerl, (2004) opined that this routine sometimes become boring to students and may affect their performance negatively. Alternative method of multiplication of large positive whole numbers can be sought historically in mathematics. Therefore, this study seek to find out the alternative method of multiplying large positive whole numbers and the possible effect that this new method might have on students performance.

Purpose of the Study

The purpose of this study is to:

1. Explore the conventional method (long multiplication) of multiplying large positive whole numbers by teachers during mathematics instruction.
2. Investigate the grating method of multiplying large positive whole numbers.
3. Find out the extent to which students appreciate the use of either of the two methods used for multiplication of large positive whole numbers.
4. Ascertain if any significant difference exists between the performance of students taught multiplication of large positive whole numbers with the grating method and those taught with the conventional long multiplication method.

Significance of the Study

Teachers of mathematics will be equipped with a better understanding of the grating method to teach multiplication of large positive whole numbers and students will have at their disposal alternative methods of multiplying large positive whole numbers.

Research Questions

1. To what extent do students use the long multiplication method to solve the problems in the pre- test and post-test?
2. Does any significant difference exists between the performance of students taught multiplication of large positive whole numbers with the grating method and those taught with the conventional long multiplication method?

Hypothesis

H_O **:** There is no significant difference between the performance of students taught multiplication of large positive whole numbers with the grating method and those taught with the conventional long multiplication method ($P<0.05$).

Design of the Study

A pretest -post test quasi-experimental design was used for the study.

Material and Method

The population of the study comprised of all the JS2 students in the sixteen (16) public junior secondary schools in Obio Akpor Local Government Area of Rivers State. A simple random sampling was used to select the two schools that were used for the study. A further simple random sampling was carried out to select an intact class of 40 students from each of the sampled schools. This gives a sample of 80 students for the study. The instrument used for data collection was a researcher made achievement test tagged multiplication of Large Positive Whole Numbers (MLPWN)**.** The instrument consisted of two problems (show working) on multiplication of large positive whole numbers. It was clearly spelt out in the MLPWN that the use of any form of calculator or four figure table to perform the multiplication operation was prohibited. Students were instructed to solve the two problems using any method at their disposal except the use of calculator or four figure table. Each of the two problems was scored over fifty and this gave a total score of one hundred. A table of specification was prepared to guide the scoring and allocation of scores. The validity of the instrument was determined by two mathematics educators/experts from University of Port Harcourt, Choba. To determine the reliability of the instrument (MLPWN), a test- retest was carried out. The Pearson Product Moment Correlation was used to obtain a reliability coefficient of 0.75

Experimental Procedure

The teaching was done by the regular mathematics teachers using the lesson plans prepared by the researcher. The teachers were trained for two days. All the teaching session lasted for 2 weeks of three periods/ week. The study presented two groups (experimental and control) from two different schools. Both groups were given pre-test of MLPWN before the commencement of treatment. Then both groups were subjected to different treatments. The experimental group was taught multiplication of large positive whole numbers using the grating method while the control group was taught the same concept using the conventional long multiplication method. A total of ten problems were solved for each of the two groups with respect to their multiplication method during the treatment. After the treatment a post-test of the same questions was given to the two groups. The scripts for the pre-test and post-test were marked and scored in percentage. The age, class and previous knowledge of both groups of students were put into consideration during the study.

Method of Data Analysis

The descriptive statistics was used to answer the research questions while the t-statistic was used to test the hypothesis at a significant level of 0.05.

LONG MULTIPLICATION ALGORITHM

The long multiplication is a special way of multiplying large numbers. It involves partial short multiplications of two digits and the summing of the partial results to arrive at the final answer. The numbers to be multiplied are placed vertically over one another with their least significant digits aligned. The top number is named the multiplicand and the lower number is the multiplier. The result of the multiplication is the product.

Sample Problem: Use the long multiplication method to multiply 9876 by 6789

CALCULATION PROCEDURE

```
   9 8 7 6
X  6 7 8 9
-----------
   8 8 8 8 4
   7 9 0 0 8
   6 9 1 3 2
   5 9 2 5 6
-----------
 6 7 0 4 8 1 6 4
-----------
```

9876 X 6789 = 67, 048, 164 (ANSWER)

The long multiplication algorithm starts with multiplying the multiplicand by the least significant digit of the multiplier to produce a partial product, then continuing this process for all higher order digits in the multiplier. Each partial product is right-aligned with the corresponding digit in the multiplier. The partial products are then summed to arrive at the answer.

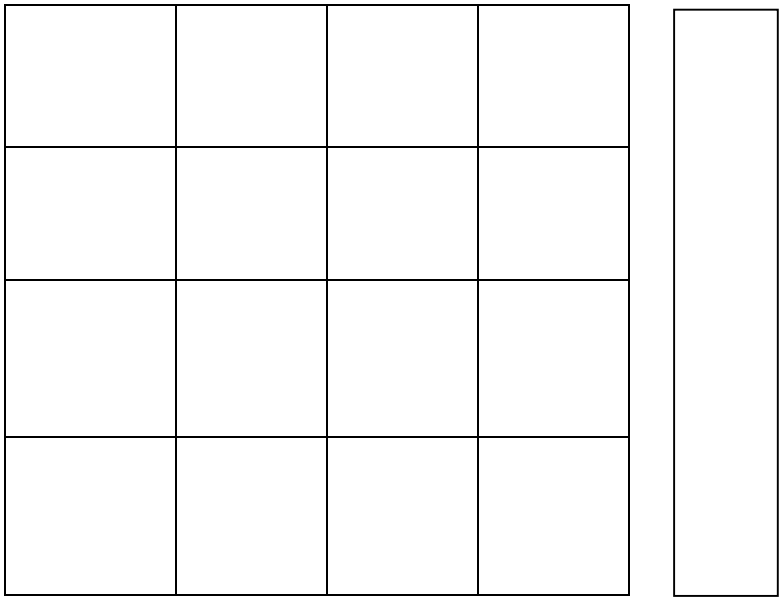
THE GRATING ALGORITHM

Sample Problem: Use the grating method to multiply 9876 by 6789

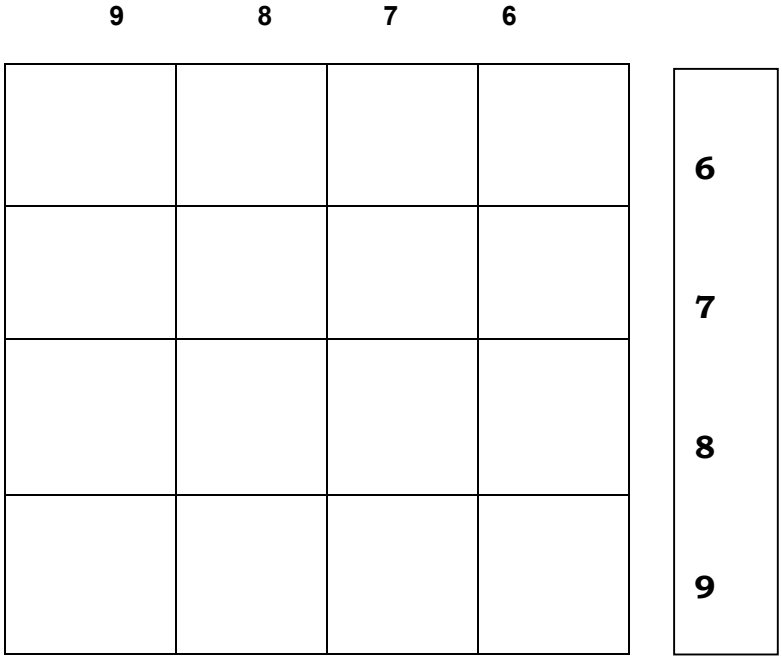
CALCULATION PROCEDURE

NOTE: In multiplying positive whole numbers using the grating method, no carrying of numbers are made until the final addition that leads to the answer.

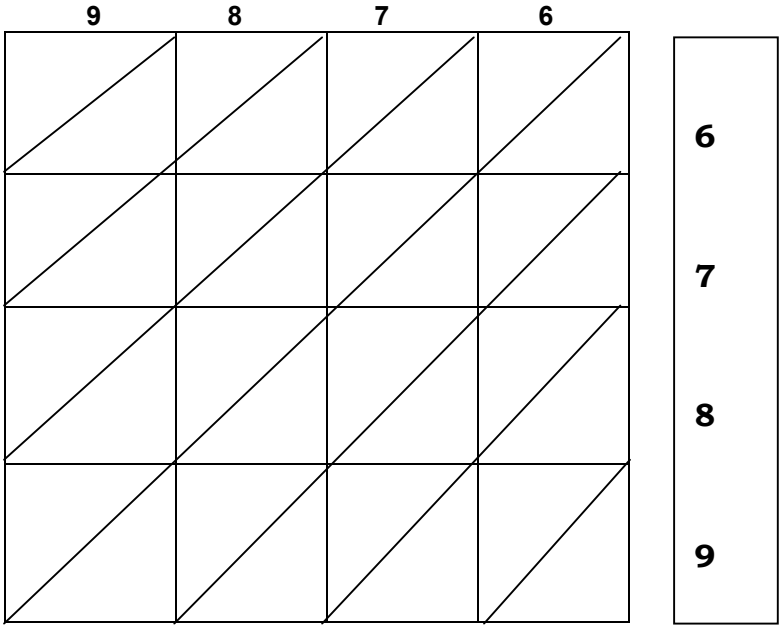
STEP 1: Draw a square and make a grating/partition into 4X4



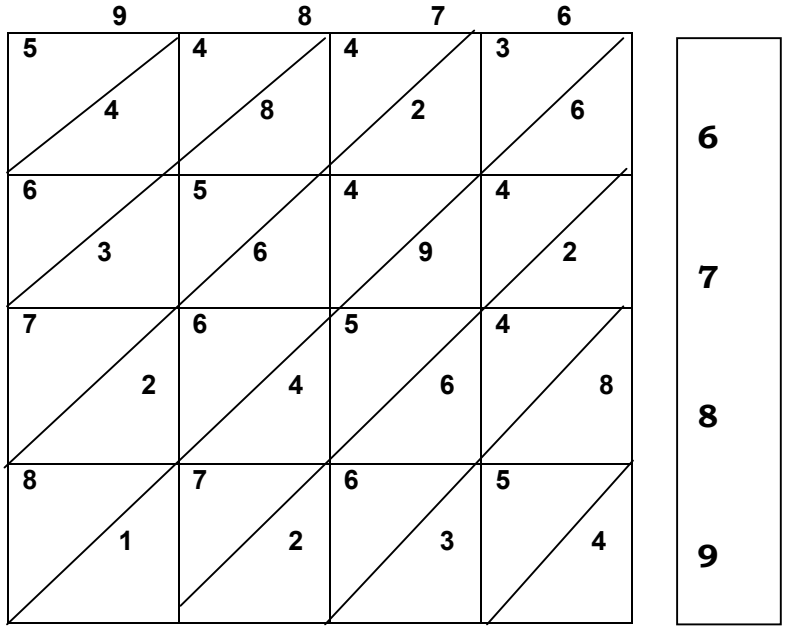
STEP 2: Enter 9876 along the top and 6789 along the right side.



Step 3: Draw diagonals on each small square from top right to down left.



Step 4: Multiply 6 by 6 =36 and enter as shown below i.e. the first digit written on the upper part of the diagonal and the second digit written on the lower part of the diagonal.



CONTINUE WITH: 6 X 7 = 42

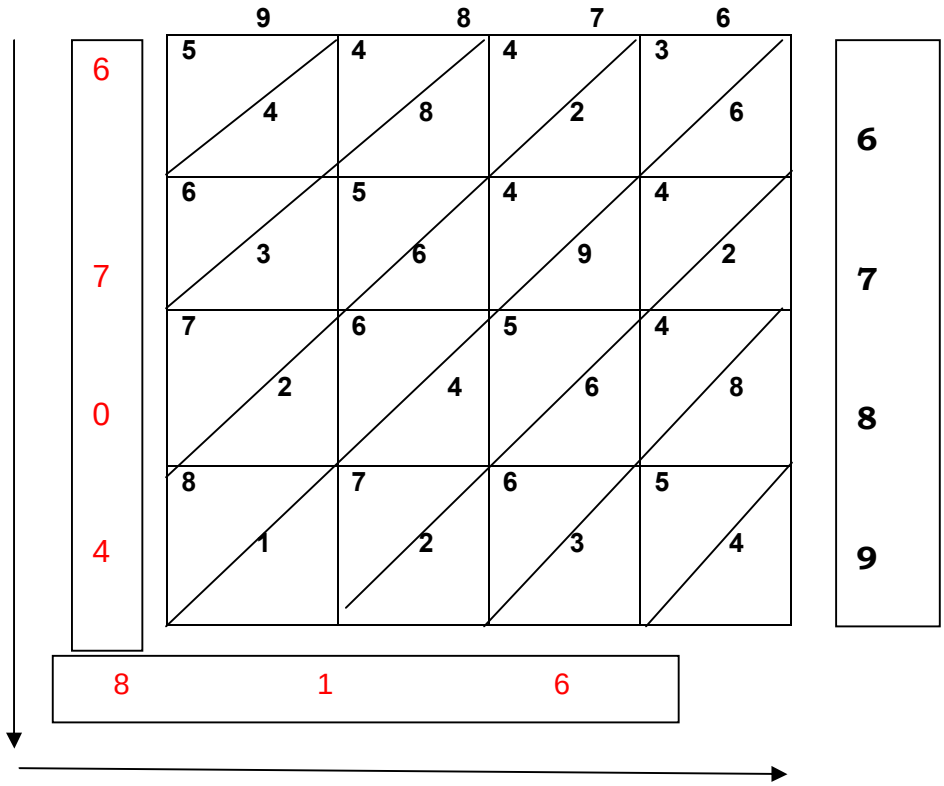
6 X 8 =48
6 X 9 = 54

then 7x6=42
7x7=49
7x8=56
7X 9 =63

then, 8X 6 =48
8 X 7 =56
8 X 8 =64
8 X 9 =72

Finally, 9 X 6 =54
9 X 7 =63
9 X 8 = 72
9X 9 = 81

Step 5: The table now looks like this. To get the answer, the diagonals are added, starting at the lower right and carrying is done when needed at this point.



1st diagonal is 4. Write it down.

2nd diagonal is 3+5+8 =16, write down 6 and carry 1 to 3rd diagonal.
3rd diagonal is 2 +6+6+4+2+ carried 1of 2nd diagonal = 21, write down 1 and carry 2 to 4th diagonal.
4th diagonal is 1+7+4+5+9+4+6+carried 2 of 3rd diagonal =38, write down 8 and carry3 to 5th diagonal.
5th diagonal is 8+2+6+6+4+2+3+carried 3 of 4th diagonal =34, write down 4 and carry 3 to 6th diagonal.
6th diagonal is 7+3+5+8+4+ carried 3 of 5th diagonal =30, write down 0 and carry 3 to 7th diagonal.
7th diagonal is 6+4+4+ carried 3 of 6th diagonal = 17, write down 7 and carry 1 to 8th diagonal.
8th diagonal is 5+ carried 1 of 7th diagonal = 6, write down the 6.

The answer is read using the arrows. Start ↓ → end for the red digits only.

9876 X 6789 = 67, 048, 164 (ANSWER)

Research Question 1: To what extent do students use the long multiplication method to solve the problems in the pre-test and post-test?

Table 1: No. of students that used the long multiplication in the pretest and postest

Group	N	Pre-test				Post-test			
		Problem 1		Problem 2		Problem 1		Problem 2	
		LMM	GM	LMM	GM	LMM	GM	LMM	GM
Experimental	40	40	-	40	-	11	29	7	33
Control	40	40	-	40	-	40	-	40	-

NOTE: LMM stands for Long Multiplication Method while GM stands for Grating Method.
From table 1, all the students in both experimental and control groups used only the LMM to solve problems 1 and 2 in the pre-test. In the post-test 11 students in the experimental group solved problem 1 with the LMM while 29 solved with the GM. To solve problem 2 of the post test in the experimental group, 7 students used the LMM while 33 used the GM. Also, from table 1, all the students in the control group used no other method but the LMM to solve problems 1 and 2 of both pre-test and post-test.

Research Question 2: Does any significant difference exists between the performance of students taught multiplication of large positive whole numbers with the grating method and those taught with the conventional long multiplication method?

Table 2: Mean gain scores of experimental and control groups.

Group	N	Mean Score		Gain Score
		Pre-test	Post-test	
Experimental	40	36.80	71.60	34.80
Control	40	37.45	42.48	5.03

From table 2, the mean gain score of students taught multiplication of large positive whole numbers with the Grating Method (experimental) was 34.80 and the mean gain score of students taught the same concept with Long Multiplication Method (control) was 5.03. This showed that the experimental group performed better than the control group.

Hypothesis Testing
H_O **:** There is no significant difference between the performance of students taught multiplication of large positive whole numbers with the grating method and those taught with the conventional long multiplication method ($P<0.05$).

Table 3: t-test analysis of difference between the experimental and control groups.

Group	N	Mean	SD	df	t-cal	t-crit	Decision
Experimental	40	71.60	10.69	78	6.39	1.96	Reject
Control	40	42.48	7.91				

Table 3 showed that the t-calculated (6.39) was greater than the critical value of
t(1.96) at 78 degrees of freedom and 0.05 level of significance. The hypothesis is therefore rejected and this implies that there is a significant difference between the performance of students taught multiplication of large positive whole numbers with the grating method and those taught with the conventional long multiplication method.

DISCUSSION OF RESULTS

This study has revealed that teaching students multiplication of large positive whole numbers using the grating method which is mathematically historical has significant effect on studentsô performance. A close look at the methods employed by students to solve the two problems in the pre-test showed that all the students in both experimental and control groups used only the conventional long multiplication method. This seems to be the only method at their disposal. After the treatment, 29 out of 40 students in the experimental group used the grating method to solve problem 1 and the number that used the grating method increased to 33 in problem 2. No student in the control group used the grating method but rather all the students continued with the conventional method. The study also revealed that all the students taught multiplication of large positive whole numbers with only the conventional long multiplication method stuck to only this method when solving the problems in the pre-test and post-test. This implies that the individual students in the control group that this method catered for their needs and interest or not are compelled by virtue of the method at their disposal to stick to the only conventional method with which they have been exposed to. It is clear from the result that the students in the experimental group that left the conventional method for the grating method in the post-test did so because the latter catered for their needs and interest. The experimental group (mean gain=34.80) performed better than the control group (mean gain=5.03).

CONCLUSION

This study concludes that teaching of multiplication of large positive whole numbers using the grating method which is mathematically historical has a significant effect on the performance of students and that students appreciated the use of the new historical method.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made.

1. Mathematics teachers should adopt the grating method for teaching multiplication of large positive whole numbers in the junior secondary schools.
2. In-training mathematics teachers should be exposed to various interesting methods of solving some mathematics concepts from history of mathematics.
3. Curriculum designers should accord history of mathematics its rightful place in the Nigerian mathematics curriculum.
4. Mathematics teachers should integrate history of mathematics when teaching mathematics concepts.

REFERENCES

Aser, D. K., 1996. Teaching mathematics concepts with historical approach. London: Routledge Falmer.

Doyerl, F. B., 2004. Monotony in mathematics problem solving. Orlu: Munas Publishers.

Fauvel, J. G., (n.d.). What mathematics teachers do with history? Retrieved October 15, 2011 from http:// www.fed.edu.hk

Long multiplication (nd). Retrieved May 24, 2010 from http://mathworld.wolfram.com

Odili, G. A., 2006. Teaching mathematics in Nigerian secondary schools. Port Harcourt: Anachuna Publishers.

Siu, M. K., 2004. History of mathematics in classroom teaching- Appetizer? Main course? Or Dessert? Mediterranean Journal for Research in Mathematics Education. 3(1&2), 5-10.

Stearns, P. N., 1993. Meaning over memory: Recasting the teaching of history and culture. Chapel Hill: University of North Carolina Press.

Walsh, S., 2000. Gelosia multiplication. Retrieved December 13, from http://homepage.mac.com