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On Grid Numbering and Translational Number as Two New Techniques in Multiplication

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ABSTRACT

The multiplication operation in maths is still considered to be difficult by school students. Despite, multiplication is one of the most important topics in mathematics learning, since this operation is taught from elementary to secondary school levels, and we often encounter its application in everyday life. In the learning process, the multiplication operations will not only develop mathematical numeracy skills, understanding multiplication will also have an impact on the growth of students' critical thinking skills. Therefore, the basic concepts related to multiplication operations in mathematics must be taught fundamentally by the students, thus they can take advantage of it later on in their daily life.

INTRODUCTION

The multiplication operation in maths is still considered to be difficult by school students. Despite this, multiplication is one of the most important topics in mathematics learning, since this operation is taught from elementary to secondary school levels, and we often encounter its application in everyday life. In the learning process, the multiplication operations will not only develop mathematical numeracy skills, understanding multiplication will also have an impact on the growth of students' critical thinking skills. Therefore, the basic concepts related to multiplication operations in mathematics must be taught fundamentally by the students, thus they can take advantage of it later on in their daily life.

Raharjo et. al (2009) explains that the multiplication concept can be divided into two parts, namely basic multiplication and advanced multiplication. Basic multiplication relates to the multiplication of two numbers which each number contains one digit only, while advanced multiplication is multiplication which involves any two numbers whose numbers contain one, two, three more digits. In basic multiplication it is very easy to do, but for the advanced multiplication requires special techniques apart from the use of direct definitions, such as stacking techniques, both long and short one, some techniques which are using geometrical shapes such as lines, circles or squares. But in reality, students are still experiencing many difficulties especially when they are using stacking techniques. Stacking techniques give students of specific complexity, since apart from understanding the concept of multiplication they must also understand the addition and storage operations. Students who are just at the level of knowing the basic concept of multiplication, will experience some difficulties. Besides, they are also required to understand the position values of digits in the multiplication results, by knowing the position value, they will proceed by doing an additional process in its last process (Luh Putu Ida Harini, 2014). According to Heruman in Nur Arima (2018), Principally, multiplication is equal to repetitive addition, thus students are faced with two operations at once, this is the cause of the in-efficient process of the stacking techniques.

Furthermore, along with the development of this era, many researchers have developed a lot of research results related to multiplication techniques. This will make it easier for us to do multiplication efficiently. Monalisa et al, (2019)stated that it is very important to have fast multiplication techniques, especially when solving paving block design problems. Therefore, in this paper we will provide the latest research results related to multiplication techniques. The name of the new techniques are a grid numbering technique and a number translation technique. This grid numbering technique is a very easy and interesting technique, and it is also considered to be easy in the implementation. We do not have to memorize the multiplication process, but rather we need to understand only an additional operation. It is said to be interesting, since we can maximize our right brain and left brain as in this technique we also have two main activities, namely drawing and counting. Indirectly this grid numbering technique also teaches students about the concept of division, since students must divide the drawn squares into grids according to the number of digits in the multiplier. Then, the student should place the digit of the second number in each grid. Finally, it concludes the result. The second technique obtained in this research is the number translation technique. This technique is considered the most practical and easy to understand and apply, since it combines the multiplication and translational numbers. Furthermore, the multiplication process is not done crossingly, instead we do multiplication straightly and the results are stored in notation [...], which makes this technique more effective and efficient . Both of these techniques apply for multiplication of any two numbers.

RESEARCH METHOD

This study uses mathematical inductive-deductive processes under grounded theory phases. Visualisation through the specific illustration given by the researchers is the simplest step to go forward to reach generalisation. We integrate with simplest software such as Matlab and Excel to test the rightness of the results. Once we have finished generalizing, we bring this technique into a classroom to do dissemination and development whether the results have been right or not. The following steps are the resume of the steps which are carried out in this research. 1. Open problem from the research group. 2. Open problem posing activities in the classroom. 3. The students obtain some initial solutions. 4. Research group analyse and develop deeply the cases. 5. Disseminating the results to test the accuracy. 6. Analysing to generalize the cases. 7. Conclude the results

RESULTS

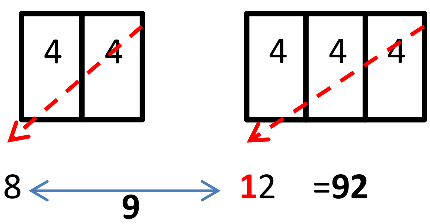
The results in this study show two new multiplication techniques that are very useful in the development of this multiplication operation. We call these two techniques as a Number Grid Multiplication and Translational Number Technique. The following is an explanation of the two techniques:

Grid Numbering Multiplication Techniques

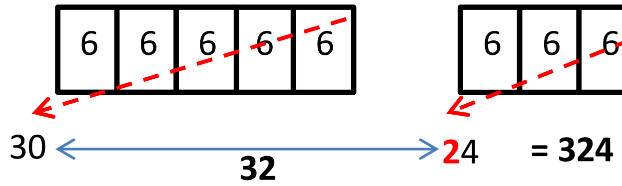
This multiplication technique is a new technique developed by the author and the research team. The concept is to combine squares with writing numbers on the squares. This technique can be generally accepted for all multiplication operations of two any numbers. Starting with multiplication of two numbers containing one digit, two digit, three digit and so on, see examples for a complete description. The beginning steps taken are to consider the multiplier and the multipliee when starting the multiplication operation. Suppose we have a multiplication operation of two numbers *axb*, then the multiplier number is *a* and the multipliee is *b*. The first step is to draw a rectangular grid that refers to multipliers. For example the number is 24 x 32, then the multiplier number is 24. Draw a grid of 2 lanes and 4 lanes. Since the multiplied numbers are two digit, the lane will be divided into two parts to form a grid. Fill in the number 3 in the first longitude and number 2 in the second longitude. Thus do the accumulation sum diagonally on the numbers listed in the grids. Consider the position of the place value in determining the final product.

In order to have a better understanding of the grid numbering technique, we present several examples of various numbers in the following.

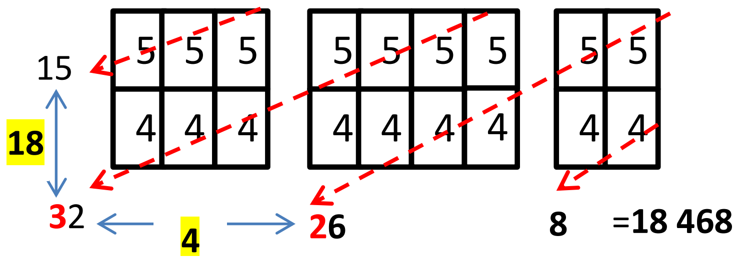
1. 23 x 4 = 92



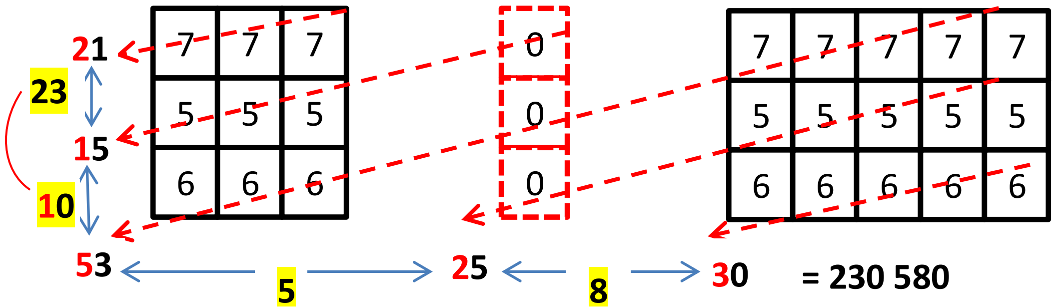
2. 54 x 6 = 324



3. 342 x 54 = 18 468

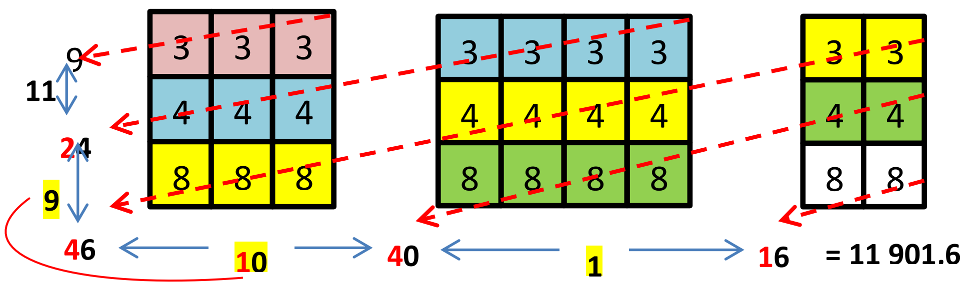


4. 305 x 756 = 230 580



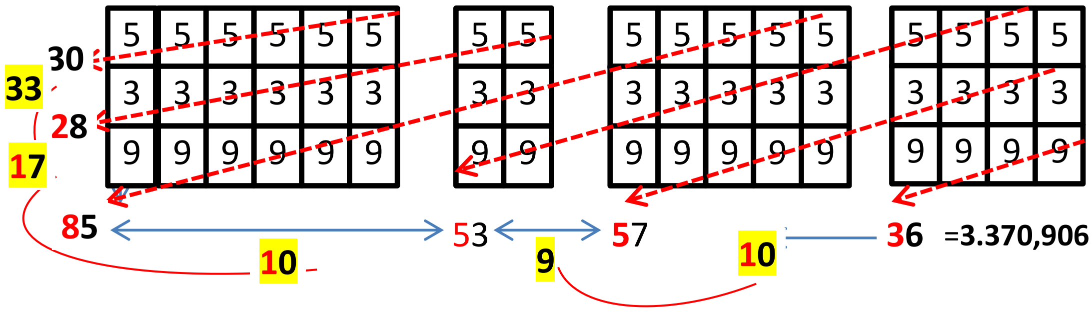
Notes :
For number 0, draw a dash square and splitted into grid horizontally with the number as many as the number of digit in multipliee number and fill the grid by 0.

5. 342 x 34,8 = 11 901,6



> Notes:
> Since the decimal number only contains one digit after comma, the results also contain one digit after comma.

6. 62,54 x 53,9 = 3.370,906



In general, the syntax of grid numbering multiplication techniques can be described in the following algorithm.

Algorithm 1.

Given that any two numbers or respectively *n* and *m* digits $x_1x_2\ldots x_n$ and $y_1y_2\ldots y_m$

For *i=1 … n*, do the following
- **Draw a square with the number of column as the number of first digit of the mulplier number.**
- **Redraw a square with the number of column as the number of second digit of the multiplier number**
- **Repeat as many as *n***

end

For *j=1 …m*, do the following
- **Split the square to form grids as many as the number of digit of the multipliee number**
- **Fill the grids with each digit of the multipliee number. For grids in rows, fill with the repetition of the digit.**
- **Repeat as many as *m***

end

Sum of the filling grids diagonally, and consider the position place value of the number, it will give the results.

End

The Translational Number Technique

This multiplication technique is a very interesting technique for the multiplication of any two numbers with any number of digits. We call this technique a a translational multiplication technique. This technique can make it easier for us to multiply two numbers quickly and accurately. First, arrange the two numbers that are multiplied, the same as the usual stacking tecnique of multiplication. Place the first number above, and place the second number underneath it. Then with the term translational, we do the process of shifting or translating thus the values of the two numbers are straight, that is, the unit is aligned with units, tens with tens, hundreds with hundreds, and so on. Secondly, move the number tens behind the unit number, the number hundreds behind the tens, and so on. Third, multiply the two numbers that correspond to the pair below and write the multiplication result below. Fourth, rearrange the two numbers to be multiplied by shifting the second number one step to the place value in front of it, which is the unit initially shifted to the place value of tens followed by the number behind it. Fifth, multiply the two numbers corresponding to the pairs below and write the multiplication results below them separately, then add up the results of each multiplication, the results are written next to it, and so on until there are no paired numbers. Sixth, write each of the multiplication results with this translational technique by sorting the last result in a row and adding the numbers that have more than one number. Add them together, starting with the last number (the leading number in the first number is added to the last number in the second number, the leading number in the second number is added to the last number in the third number, and so on). Note, the square brackets notation [..] on the product is a notation to store the product, but it is not a sign of the product operation. For more details, the stages will be presented in the following algorithm.

For illustration of this technique, we will show the multiplication of any two number as follows:

1. 23 x 4 = ….

3 x 4 = 12　　　2 x 4 = 8

23	23
← 4	4
12	8

23 x 4 = [8][12]
= 92

2. 54 x 6 = ….

54	54
← 6	6
24	30

54 x 6 = [30][24]
= 324

3. 342 x 54 = ….

2 x 4 = 8   4 x 4 = 16   2 x 5 = 10   3 x 4 = 12   4 x 5 = 20   3 x 5 = 15

342 54	342 45 8	342 45 (16)+(10) = 26	342 45 (12)+(20) = 32	342 45 15

342 x 54 = [15][32][26][8]

= 18468

4. 305 x 756 = ….

305 756	305 657 30	305 657 (0)+(25) = 25	305 657 (18)(0)+(35) = 53

305 657 (15)+(0) = 15	305 657 21

342 x 54 = [21][15][53][25][30]

= 230580

5. 342 x 34,8 = ….

342 34,8	342 843 16	342 843 (32)+(8) = 40	342 843 (24)(16)+(6) = 46

342 843 (12)+(12) = 24	342 843 9

342 x 34,8 = [9][24][46][40][16]

= 11901,6

7. 62,54 x 53,9 = ….

62,54 53,9	6254 935 36	6254 935 (45)+(12) = 57	6254 935 (18)(15)+(20) = 53

6254 935 (54)(6)+(25) = 85	6254 935 (18)+(10) = 28	6254 935 30

62,54 x 53,9 = [30][28][85][53][57][36]

= 3370,906

Notes :

= add

= move/jump

= shift

Algorithm 1.

Given that any two numbers or respectively *n* and *m* digits $x_1x_2 \ldots x_n$ and $y_1y_2 \ldots y_m$

For *j=1 … m*, do the following

- Arrange the two numbers that are multiplied
- Place the first number above, and place the second number underneath it.
- Do the process of shifting or translating thus the values of the two numbers are straight, that is, the unit is aligned with units, tens with tens, hundreds with hundreds, and so on.
- Move the number tens behind the unit number, the number hundreds behind the tens, and so on.
- Multiply the two numbers that correspond to the pair below and write the multiplication result below.
- Rearrange the two numbers to be multiplied by shifting the second number one step to the place value in front of it, which is the unit initially shifted to the place value of tens followed by the number behind it.
- Multiply the two numbers corresponding to the pairs below and write the multiplication results below them separately, then add up the results of each multiplication, the results are written next to it, and so on until there are no paired numbers.

- Write each of the multiplication results with this translational technique by sorting the last result in a row and adding the numbers that have more than one number.
- Add them together, starting with the last number (the leading number in the first number is added to the last number in the second number, the leading number in the second number is added to the last number in the third number, and so on).

End

DISCUSSION

Based on these results, the two new techniques have their advantages and disadvantages. The use of grid numbering technique makes it easy for us to calculate multiplication, this technique only utilizes the use of repeated sums, which can indirectly help us to memorize the multiplication. The use of grid numbering helps us to understand the concept of division, thus the students unintentionally begin to recognize the concept of division. It is believed very usefull for students to improve their mathematical generalization thinking skills, see Monalisa, et. al. (2019). In addition to providing convenience in doing multiplication, this grid numbering technique helps us to improve three types of mathematics operations at once, namely addition, multiplication and division. The weakness of the grid numbering technique is that if there are multiplications with numbers that have large numbers and many digits, then we will need more boxes and grids thus it will be a bit difficult in the process of adding up the numbers in the boxes. Furthermore, the advantage of number translational techniques is that apart from it is the most practical technique and easiest technique to implement, it can also be used for larger numbers with large digits, the process of multiplication is simply done by shifting the multiplier and adding the results, this implies that calculating the multiplication with a number translation will faster than grid numbering and even compared with other techniques. But in this translational technique we must be able to memorize the multiplication of basic numbers and need to be careful in making shifts.

CONCLUSION

This research is the result of developing new multiplication techniques that have never been used before. These two new techniques have their own strengths and weaknesses that can make it easier for us to do multiplication quickly and precisely. However, several new techniques need to be continuously developed thus students have many choices in solving multiplication problems. Thus the following open problems are still needed.

Open problem 1.

Obtain a different new technique for solving the multiplication of any two numbers of any number of digits.

Open Problem 2.

Obtain a different new technique for solving the multiplication of any two specific numbers of any number of digits.

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REFERENCES

Arima, N., Indrawati, D., 2018, pengembangan media pembelajaran multiplication stick box pada materi operasi hitung perkalian kelas III sekolah dasar, *Jurnal Penelitian pendidikan Guru Sekolah dasar.* Vol. 6 No.7, p.1242-1251

Dafik, Sucinto B, Irvan M, Rohim M A, 2019, The Analysis of Student Metacognition Skill in Solving Rainbow Connection Problem under the Implementationof Reseach-Based Learning, *International Journal of instruction* **12** 593-610.

Ding M., Li X., Caprar M. M., 2013, Preservice elementary teachers' knowledge for teaching the associative property of multiplication: A preliminary analysis, Journal of mathematical behavior, 32, p.36-52,

Harini L.P.I, Nilakusmawati D.P.E, 2014, Kajian Efektivitas Penerapan Metode Ringkas dalam Perkalian Susun, Jurnal Matematika, Vol. 4 No. 2, p. 111-129

Raharjo M., Waluyati A., Sutanti T. (2019). *Pembelajaran Operasi Hitung Perkalian dan Pembagian Bilangan Cacah SD*. Departemen Pendidikan Nasional. Yogyakarta

Monalisa L A, Dafik, Hastuti Y, Hussen S, and Oktavianingtyas E, 2019, The Implementation of Research-Based Learning in Developing the Students Mathematical Generalization Thinking Skills in Solving a Paving Blocks Design Problem, *IOP IConference Series : Earth and Environmental Science* **243** 012168.

Nazula N H, Dafik and Slamin, 2018, The profile of students' creative thinking skills in solving local antimagic vertex coloring problem in research-based learning *Journal of Physics: Conference Series* **1211** 012109.

Sumartiningsih, Dafik, Suparti, 2020, The Analysis of the Implementation of Discovery-Based Learning to Improve Students' Creative Thinking Skills in Solving the Number Multiplication Problems, *Journal of Physics: Conference Series*, In Press