

Enhancing Grade 6 Students' Multiplication Automaticity through Interactive Taped Problems

Charmen Nalusay, Danissa Demoral, Jeric Suguis

Teacher Education Department, Davao de Oro State College

DOI: <https://dx.doi.org/10.47772/IJRISS.2024.803360S>

Received: 06 October 2024; Accepted: 11 October 2024; Published: 14 November 2024

ABSTRACT

Previous studies show that Filipino learners are still having difficulties in Math, especially on the multiplication automaticity skill among elementary learners. This study is conducted to measure the impact of Interactive Taped Math Problems on students' multiplication automaticity skill. This study employed a quasi-experimental research design for 42 Grade 6 students. It used pre-test and post-test questionnaires to determine the level of students' multiplication automaticity before and after intervention and to determine if there is a significance difference in students' multiplication automaticity before and after the intervention. The data is analyzed using mean and Wilcoxon Signed Rank Test. This study indicated that the level of students' multiplication automaticity among Grade 6 students before the intervention is low ($Mean= 6.14$ and $SD=2.07$) and after the intervention is very high ($Mean= 19.48$ and $SD=1.09$). It means that there is a significant difference in Grade 6 students' multiplication automaticity before and after intervention, mean difference of -13.34 and Wilcoxon Value of 903.000 . They found that Interactive Taped Math Problem significantly improved students' multiplication automaticity.

Keywords: interactive taped problems, multiplication automaticity, action research, intervention

INTRODUCTION

Arithmetic operations are fundamental mathematical processes used to manipulate and calculate numbers. The four basic arithmetic operations are the Addition, Subtraction, Multiplication and Division. In the study of Umar and Widodo (2021), student's numeracy skills during the pandemic are low. It means that there are numbers of students who are not able to read four-digit numbers, have not been able to determine place values and not been able to do basic arithmetic operations. The study shows that most of the students still have difficulty in counting multiplication operations with a total of 48%. In the other hand, Sooknanan and Seemungal (2023) revealed that the Covid-19 pandemic has made the state of education worse and widened the learning gap in mathematics among young learners.

Additionally, as stated in the study of Yuhasriati et al. (2022), they concluded that the students' learning loss in the prerequisites due to online learning during the Covid-19 outbreak was one cause of the students' low performance of Mathematical representation ability.

As stated in the study of Olson (2021), the subject of math has the power to be either inspiring or discouraging. A root cause for these feelings towards math in elementary school comes from the math fact automaticity process especially in multiplication of multi-digit numbers. Math fact automaticity is an area that has been neglected in many schools as timed testing has gone away. It is resulting in frustrated students who have many barriers moving forward in other math topics. Research shows several reasons why students do not have automaticity of multiplication facts.

In other hand, McKee (2021) revealed that students in fifth grade at Mispillion Elementary in Milford Delaware, United States do not display automaticity of multiplication facts. Furthermore, Pixner et al. (2023)

revealed that many children have poor numeracy skills/math difficulties that are considered as showing lower performance in later arithmetic. Many children with mathematical learning problems have not achieved automaticity in basic arithmetic operations specifically in multiplication. Additionally, Amir et al. (2021) revealed that Grade IV SD Negeri 1 Airbuaya students have difficulty in calculating multiplication are evident.

Based on the Programme for International Student Assessment (PISA) 2022 result, it shows that Filipino learners are still lagging behind in Math, reading and Science. The study showed that in Mathematics, 16 percent of students in the Philippines attained at least Level 2 proficiency which means that it is significantly less than on average OECD countries and come up in conclusion that no students in the Philippines were top performers in mathematics.

Dela Paz Main Elementary School in the City of Biñan, 30 or 75% of the Grade IV pupils out of 40 pupils has low skills in multiplication (San Juan, 2021). In Addition, the learners had a low mastery level in recognizing Multiplication Table, can't multiply 1 digit number or solving one step word problem.

Meanwhile, Cagape et al. (2023) pointed out challenges and obstacles, especially in the area of multiplication, faced by students in the Division of Davao City. These include deficiencies in multiplication skills, such as the inability to calculate numbers beyond those listed in the multiplication table, and difficulties with multiplication operations. Multiplication is important skill driven to enable the pupils to learn math. Good mathematical dominance requires pupils to dominate the multiplication well thus; pupil's failure to dominate the multiplication will affect the achievement of mathematical subjects (Khalid & Maat, 2020). Many students understand how to follow the multiple steps in a complicated problem, yet they are unable to be successful because of basic math errors. The automaticity of multiplication facts can be utilized in a variety of mathematical situations (Olson, 2021).

As Baker and Cuevas (2018) stated that Automaticity in basic math facts is important for mathematics students. It is not just important at the elementary age, but it is of most importance at that age. When automaticity is achieved at the desired developmental stage in a child's life, they are more likely to have continued success in mathematics. Automaticity is an achievable goal for students. These researchers stated that automaticity is necessary, and further stressed its importance in multiplication. Baker and Cuevas (2018) stated that multiplication facts are one of the most important building blocks when it comes to mathematics development. There are also many students who struggle with the task of memorizing or learning facts. Mathematics is a content area that builds on previous concepts, multiplication being one of those building blocks. Not being able to recall this information not only affects the student in the classroom but can also have a negative impact on the students' view of mathematics in general (Baker & Cuevas, 2018).

The Taped Problems (TP) intervention, as described by Aspiranti et al. (2018), aims to enhance math fact fluency by promoting active and accurate academic responses. It involves listening to recorded math problems, pausing to allow students to write their answers, and then providing correct answers. This method, as evidenced by Chelecki (2022), has been found effective in increasing the number of correct responses per minute. In the traditional delivery of this intervention, participants listen to audio recordings of math problems, pause to write their answers, and then receive the correct answers from the recording. Previous research studies had already been conducted on using the Taped-problems as an intervention is increasing mathematical facts fluency of the students. However, there is no study being conducted about its effectivity to eradicate the problems in multiplication automaticity. Additionally, the researchers observed that the intervention was applied in lower grades level to improve students' mathematical facts fluency.

In this study, the researchers want to apply this intervention to enhance the automaticity in Multiplication among Grade 6 students. The previous studies revealed the prevalence of the problem related to the multiplication automaticity in global and national context. Thus, the urgency to conduct this study. This study are beneficial to students, teachers, administrators and other researchers involving the pedagogical approaches to teaching and learning that result in enhancing students' automaticity in multiplication. This

study evaluates the effectiveness of employing Interactive Taped Problems, which is important to analyze its association with the students' automaticity in multiplication.

A. Conceptual Framework

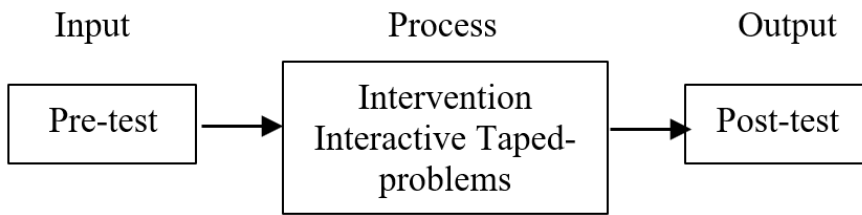


Figure 1. Conceptual Framework of the Study

The figure shows the conceptual framework, wherein it displays the Development Phase, Intervention and Output Phase.

The development phase of this research, first the researchers get the quiz result from the teacher about the students' performance in mathematics, specifically in multiplication. The researchers crafted a test questionnaire that undergoes validation from the panel of experts. Based on the validated questionnaire, the researchers administer the pre-test to the students. After the conduct of pre-test, the respondents have undergone an intervention for 15 days. In output phase, the researchers administer the post-test in which the students answer the questions. Afterwards, gather the following information and data by using the intervention; Interactive Taped Problems in enhancing students' multiplication automaticity.

B. Research Questions

This study aimed to assess the effectiveness of Interactive Taped Problems in enhancing students' automaticity in multiplication with a focus on Grade 6 Earth students from Compostela Central Elementary School SPED Center. Specifically, it seeks to answer the following questions:

1. What is the level of the student's multiplication automaticity before the intervention?
2. What is the level of the student's multiplication automaticity after the intervention?
3. Is there a significance difference in students' multiplication automaticity before and after the intervention?

C. Hypothesis

This study employs null hypotheses in answering the research objectives of the study. This study tests the hypotheses with relationship of significance:

Ho₁: There is no significant difference in students' multiplication automaticity before and after the intervention

METHODOLOGY

This section presents the following components: research design, data collection procedure, data gathering procedure, specificity of participants and how they are selected, and the ethical considerations that are plan upon the approval of this study

A. Research Design

This study is a quantitative research using quasi-experimental design. A quasi- experiment is an empirical interventional study used to estimate the causal impact of an intervention on target population without

random assignment. As stated by Thomas (2020), quasi-experimental design aims to establish a cause-and-effect relationship between an independent and dependent variable. Quasi-experiments are most likely to be conducted in field settings in which random assignment is difficult or impossible. They are often conducted to evaluate the effectiveness of a treatment—perhaps a type of psychotherapy or an educational intervention (Chiang et al. 2020).

As cited by Chiang et al. (2020), one kind of quasi-experimental research is the pretest-posttest design. In a pretest-posttest design, the dependent variable is measured once before the treatment is implemented and once after it is implemented. The pretest-posttest design is much like a within-subjects experiment in which each participant is tested first under the control condition and then under the treatment condition. If the average posttest score is better than the average pretest score, then it makes sense to conclude that the treatment might be responsible for the improvement. Additionally, this research is classified as quantitative due to the use of a pre-test and post-test to gather data. The findings obtained will be employing to devise strategies and interventions aim to improving students' mathematical skills specifically the multiplication automaticity.

Furthermore, a purposive sampling will be utilized to get the number of respondents of the study. In purposive sampling, the researcher selects participants based on specific criteria that are intended to provide the most relevant and useful information to meet the study's objectives. This method allows for the selection of individuals who are most likely to have valuable insights or experiences related to the research topic (Nikolopoulou, 2022).

B. Research Participants

In this study, the participants meet the following criteria: (a) A sixth-grade Students from Compostela Central Elementary School SPED Center, specifically from section Earth; (b) currently enrolled in section Earth. The participants are selected based on the Multiplication quiz result of the students to identify who got a low score are included in this study.

Students who did not meet these qualifications, such as those who are not sixth-grade students at Compostela Central Elementary School SPED Center or are not enrolled in section Earth, are excluded. Additionally, students from Grade 6, section Earth that composed of 42 students who did not consent or had objections from their guardians to participate in the intervention are excluded.

C. Research Instrument

The researcher crafted a questionnaire about multiplication undergo validation from the panel of experts. The questionnaire has 20 items that contains series of multiplication problems.

D. Data Gathering

The researchers get the students multiplication quiz result from the teacher. Then, the researchers crafted a test questionnaire that undergoes validation from the panel of experts. After the validation of the questionnaire, the researcher requested permission from the school to conduct the research in Compostela Central Elementary School Principal via formal letter sent to the respondents along with a request letter to allow the researcher to conduct the study. In this experiment, the researchers implement the Interactive Taped Problems for 15 days before the post-test. This study uses a quasi-experiment to establish a cause-and-effect relationship between an independent and dependent variable.

The researchers assess the new approach to teaching grade 6 Earth using an Interactive Taped Problems in enhancing students' multiplication automaticity. All students pass through a pretest and after gathering the preliminary data then the researchers implement an intervention and will assist all students after; the researcher conduct a post-test. The gather data from the post-test result undergo tabulation by the statistician.

The research is conducted at Compostela Central Elementary School face-to-face interaction with the population of 42 students in Grade 6 Earth.

E. Data Analysis

Before Intervention. The researchers craft test questionnaire and undergo validation by the panel of experts. The test questionnaire is 20 items test that contains multiplication problems. The researchers conduct a pre-test to Grade 6 Earth with a total of 42 students and undergo the primary data gathering. The questionnaire tests their prior knowledge about multiplication. Some variants of Interactive Taped Problems have the students work on the same worksheet several times, so multiple copies may be necessary. The teacher creates an Interactive Taped Problems recording where the teachers plays the problem through audio and then pause before sharing the answer through activity sheet provided by the researchers. The delay between the reading of a math fact and the answer may be varied anywhere from 0 to 5 seconds. The students listen to a recording of a fact (e.g., “9 times 4 equals...”).

The student tries to “beat the tape” by writing the correct answer before hearing the answer (e.g., “36”). If the students’ answer is incorrect, the students write the correct answer.

If the Interactive Taped Problems strategy was conducted individually with the teacher, the teacher responds to correct answers by confirming the answer (e.g., “Good. 9 times 4 equals 36”). If the students’ answer is incorrect, the teacher should correct the answer (e.g., “No. 9 times 4 equals 36”). The student continues working until the recording ends. In some versions of Interactive Taped Problems, students listen to the same recording multiple times during the same session to establish fluency.

During Intervention. In this process, the researchers introduce the intervention and explain how it went. The researchers conduct the intervention during class hour. The students continue working until the recording ends. In some versions of Interactive Taped Problems, students listen to the same recording multiple times during the same session to each student must be familiar with the Interactive Taped Problems method. Teachers will also produce recordings. Researcher introduces the Interactive Taped Problems method and monitors the student as he/she works. Students can use Taped Problems on their own once they are familiar with the method, the researcher can use Interactive Taped Problems as a type of informal progress monitoring. The researchers do their job to observe and to assist the respondents, and to ensure that the classroom ambience makes them comfortable and free from disturbance, so they could answer and comprehend effectively.

After Intervention. The last step of the data gathering is to acknowledge the outcome as well as the effectiveness of Interactive Taped Problems in Enhancing Grade 6 Earth Students’ Multiplication Automaticity. The researchers now conduct a Post-Test and the process was the same as done with the pre-Test. In conclusion, the researchers tally and tabulate the gathered data from the respondents from the pre-test and post- test with the use of statistical analysis. The researchers are able to state their conclusion if there is a significant difference before and after the intervention.

F. Data Gathering

This research employs statistical tools in processing the answers to the questions at 0.05 level of significance. The responses are obtained from all the items in the questionnaires are tallied, tabulated, and interpreted. The statistical tools that are used in the study for data analysis and interpretations are as follows:

Mean. It refers to the average value of a group of numbers and is calculated by dividing the sum of given numbers by the total number of numbers. $Mean = (\text{Sum of all the observations} / \text{Total number of observations})$. The means would be utilizing to determine the level of students’ learning retention.

Wilcoxon Signed Rank Test. Is an inferential statistical analysis that can be used to compare the mean of the differences between two sets of dependent mean; in the context of training evaluation, the population

mean is typically set to zero. It is used to test if the means of two paired measurements, such as pretest/posttest scores, are significantly different.

RESULTS AND DISCUSSIONS

In this section, the result, analysis, and intervention derived from the conduct of this study. The information is presented in both tabular and textual formats. At a level of significance of 0.05, all inferential results were evaluated and interpreted. Data gathered from the pre-test and post-test were formulated and interpreted by the statistician.

The data was gathered from Grade 6 pupils of Compostela Central Elementary School SPED Center through administering pre-test and post-test to experimental group to determine the effectiveness of utilizing Interactive Taped Problems in enhancing students' multiplication automaticity. Further, from the results generated in this study, the researcher developed actions and intervention using ITP as an educational tool (instructional material) in students' automaticity in multiplication.

Level of Student's Multiplication of Grade 6-Earth pupils in Compostela Central Elementary School SPED Center during the pre-test

As presented in table 1, the calculated mean of students' multiplication automaticity of Grade 6 Earth is 6.14, standard deviation of 2.07, coefficient of variation of 33.71% that have a description of low. This means that the level of student's automaticity in multiplication is low.

The result is supported by the study of McKee (2021) revealed that the student do not display automaticity of multiplication fact. Due to the lack of automaticity, some students struggle to master future standards which require multiplying. It stated that once students can perform a skill without hesitation that skill is integrated into other, more complex mathematical procedures. In addition, Castañeda and Andres (2019), they revealed that most students have a very weak foundation in mathematics specifically elementary pupils. They do not have mastery in basic operations specifically in multiplication which will also result in difficulty in dealing with the division. Students didn't even memorize the multiplication table that resulted to a low automaticity in multiplication. Students lacking automaticity of multiplication facts put them at a disadvantage when learning mathematics standards.

Furthermore, Rohaniah et al, (2022) demonstrated that students' basic multiplication abilities were initially lacking. Similarly, Paut et al, (2023) found that students made errors in solving multiplication operations due to low understanding of mathematical concepts, leading to struggles in multiplication tasks.

Pratt (2023) stated that the development of automaticity of number facts and computation skills is an important goal for all students in their primary school years; automaticity allows conscious attention to be devoted to the purpose of task rather than the minor elements, such as recall of basic arithmetic facts.

In addition, Baker and Cuevas (2018) found that students are continuing to struggle with single-digit multiplication problems indicating a lack of automaticity in multiplication facts. As stated in their study, mathematics is a content area that builds on previous concepts, multiplication being one of those building blocks. Not being able to recall the information not only affects the student in the classroom but can also have a negative impact on the students' view of mathematics in general.

Level of Student's Multiplication of Grade 6-Earth pupils in Compostela Central Elementary School SPED Center during the post-test

As presented in table 2, the calculated mean of students' multiplication automaticity of Grade 6 Earth is 19.48, standard deviation of 1.09, coefficient of variation of 5.60% that have a description of very high. This means that the level of student's automaticity in multiplication is excellent.

Additionally, this are supported by the study of Alptekin (2019), Interactive Taped Problems is one of the most effective techniques used to provide fluency to basic mathematical skills. Researchers state that Interactive Taped Problems has a lot of benefits to students in providing fluency to basic math facts. ITP is an intervention that allows providing immediate feedback for correct answers and correcting wrong ones. Besides, it helps students to give up strategies that they often use like finger counting and so on very quickly. Interactive Taped Problems provides students with the opportunity to practice in short intervals. That the students hear the correct answer immediately prevents mistakes. Not only does students' number of correct answers increase but also their speed increases.

Furthermore, in the study of McCallum and Schmitt (2019), an interactive taped problem has proven to be effective across populations of students (general education) and contexts (individual and class-wide). Incorporated within ITP are (a) numerous opportunities for accurate responding, (b) reinforcement for correct responding, and (c) immediate feedback on responses (whether correct or incorrect). The combination of these three factors is thought to contribute to the effectiveness of the ITP intervention.

In the study of Septra (2019) stated that daily practice with basic multiplication facts through various engaging activities as well as independent practice helps a lot in improving their basic automaticity recall.

Test for Significant Difference

Experimental Group. The test statistics table provides data on the comparison of the student's pre-test and post-test scores. It can be noted that the mean difference of Pretest and Post-test is -13.34 have a Wilcoxon value of 903.00. Its value suggests that the post-tests scores are higher than the pre-tests scores.

The study used Wilcoxon Signed Rank Test since the data is not normally distributed or non-parametric. Wilcoxon Signed Rank Test is a powerful nonparametric statistical test used for comparing paired samples (Windi et al, 2022). It is analogous to the paired sample t-test but does not require the assumption of normality in the data. The Wilcoxon Signed Rank Test is widely used on various fields to assess the significance of differences before and after an intervention (Garren & Davenport, 2022).

The table 3 shows that the calculated p-value is 0.000 and it is less than the significance level of 0.05 which leads to the decision that the null hypothesis (H_0) is rejected. Hence, there is enough evidence to conclude that there is a highly significant difference between the pre-test and post-test scores of the student's multiplication automaticity at 5% level of significance.

This supports that interactive taped problems (ITP) intervention is a math fact fluency intervention designed to produce high rates of active and accurate academic responding (Aspiranti et al., 2018). Interactive Taped Problems is a fluency-building intervention typically used to increase knowledge of math facts (addition, subtraction, multiplication, or division) or numerals.

Similar result was obtained from the study of Alptekin (2019), which found that Interactive Taped Problems are among the best methods for improving the fluency of fundamental mathematical concepts. With Interactive Taped Problems, students may practice for brief periods of time. It helps students avoid errors when they hear the right response right away. Students' speed grows together with the quantity of right responses they provide. Furthermore, it was found in the Chelecki (2022) research that the Interactive Taped Problems Intervention (ITPI) is an evidence-based intervention that works well to increase the number of right numbers that students get in a minute.

Furthermore, the results of this study of Stadler (2016), it indicated that an ITP intervention was an effective class-wide tool for increasing multiplication fluency. The majority of student demonstrated gains in fact fluency, and continuing the intervention for a longer period of time may lead to more students reaching mastery. In addition, they concluded that ITP intervention was effective at increasing math fact fluency when administered to both individual students as well as class-wide. The immediate effectiveness of an ITP

intervention also indicated that mastery level could be reached in fewer sessions than with alternative instructional methods allowing students to expeditiously move on to subsequent problem set.

Table 1. Level of Students' Multiplication Automaticity during pre-test

| Section | Mean | Standard Deviation | Coefficient of Variation | Description | Interpretation |
|---------|------|--------------------|--------------------------|-------------|--|
| Earth | 6.14 | 2.07 | 33.71% | Low | This means that the level of student's multiplication automaticity is low. |

Table 2. Level of Students' Multiplication Automaticity during the post-test

| Section | Mean | Standard Deviation | Coefficient of Variation | Description | Interpretation |
|---------|-------|--------------------|--------------------------|-------------|--|
| Earth | 19.48 | 1.09 | 5.60% | Very High | This means that the level of student's multiplication automaticity is very high. |

Table 3. There is no significant difference between the results of the pre-test and post-test scores

| | Mean Difference | Wilcoxon Value | p-value | Decision | Conclusion |
|-------------------|-----------------|----------------|---------|--------------|--------------------|
| Pretest Post-test | -13.34 | 903.000 | .000 | Reject H_0 | Highly Significant |

RECOMMENDATIONS

After a careful review of the findings and conclusions of the study, the following recommendations are given. Despite having significant results, students still need to enhance their mathematical skills in basic operations specifically in multiplication facts and its automaticity.

The specific recommendations are specified below:

To students: To be engaged in the conduct of Interactive Taped Problems. Through this, the students will be able to practice and enhance their multiplication automaticity skill and other basic operations fact fluency.

To Teachers: To strengthen the conduct of Interactive Taped Problems. With this, they will be able to leverage the multiplication automaticity skill of those who are struggling to learn and be able to engage themselves more on the lesson and develop mathematical facts fluency.

Demonstrate democratic interactional strategies, offer positive reinforcement, establish high yet attainable expectations for students' learning in light of individual diversity, and give constructive criticism.

To School Administrators: Provide funding to conduct workshops on the effective application of Interactive Taped Problems through webinars or face-to-face seminar -workshop related to the enhancement of students' automaticity in basic math operation and the effectivity of utilizing interactive taped problems in the classroom setting as well as how to create an Interactive Taped Problem using technology and applications.

To School Administrators: Provide funding to conduct workshops, webinars or seminars related to the enhancement of students' automaticity in basic math operation and the effectivity of utilizing interactive taped problems in the classroom setting as well as how to create an Interactive Taped Problem using technology and applications.

To Future Researchers: To use the result of this study as their key components of their future studies. To use the Interactive Taped Problems as intervention in enhancing other students' skills and abilities (e.g. spelling).

ACKNOWLEDGMENT

We would like to express our heartfelt gratitude to the people behind this achievement and success.

To our research instructors, evaluators, data analysts, and grammarian of this study for sharing their expertise by giving us good comments and suggestions to make this research paper to be successful and for giving us valuable advice and support that guide us toward a better result.

Also, to our respondents and validators for cooperation and time in terms of providing us with the information needed for this study. As well as to our family and friends who give us moral support and inspiration to finish this research study. Lastly, to our Almighty Father God, after all, this study would not be possible without him who gives us lives. Thank you for the wisdom, good health, strength, and courage You bestowed upon us to fully finished this research study

REFERENCES

1. Alptekin, S. (2019). Enhancing math facts fluency: taped problems interventions. *Ankara University Faculty of Educational Sciences Journal of Special Education*, 20 (3), 629-649. DOI: 10.21565/ozelegitimdergisi.504333
2. Aspiranti, K. B., McCallum, E., & Schmitt, A. J. (2019). Taped problems intervention components: A meta-analysis. *Contemporary School Psychology*, 23(4), 412–422. <https://doi.org/10.1007/s40688-018-0200-3>
3. Baker, A., & Cuevas, J. (2018). The importance of automaticity development in mathematics. *Georgia Educational Researcher*. doi:10.20429/ger.2018.140202
4. Castañeda, J. & Andres, P. (2019). Utilization of math apps in developing the automaticity in multiplication table among grade three pupils in Tagpos elementary school Binangonan Rizal. *Ascendens Asia Journal of Multidisciplinary Research Abstracts*. <https://ojs.aaresearchindex.com/index.php/AAJMRA/article/view/11484>
5. Chiang, C., Jhangiani, R., & Price, P. (2020). Research methods in psychology-2nd Canadian edition. *BCcampus Open Publishing*. <https://bit.ly/3GxJUYY>
6. Chelecki, C. (2021). Comparing the effectiveness of traditional taped-problems intervention with a remote delivery Version for increasing Math fact fluency *Doctoral dissertation, Duquesne University*. <https://dsc.duq.edu/etd/2063>
7. Khalid, N., & Maat, S. (2020). Increasing the mastery of multiplication for primary students increase the mastery of multiplication by pupils. *International Jurnal of Novel Research in Education and Learning*. <https://bit.ly/4a6raxy>
8. McCallum, E. & Schmitt, A. (2019). The taped problems intervention: increasing the math fact fluency of a student with an intellectual disability. *International Journal of Special Education Vol 26, no: 3, 2019*.
9. McKee, D. (2021). Automaticity of multiplication facts in fifth grade students. *ProQuest Dissertations Publishing*. <https://bit.ly/4a3hrrP>
10. Nikolopoulou, K., (2022). What is Purposive Sampling? Definition & Example. *Scribbr*. <https://www.scribbr.com/methodology/purposive-sampling/>
11. OECD (2023). Programme for International Students Assessment. <https://www.oecd.org/pisa/>
12. Olson, J. (2021). The importance of math fact automaticity. *Hamline University*. <https://bit.ly/4a2BQ02>
13. Pratt, D. J. (2023). The impact of automaticity training in multiplication facts on problem solving ability. *University of Otago*. <https://hdl.handle.net/10523/16159>
14. Pixner, S., Moeller, K., & Kraut, C. (2023). TIGRO-M: A program, for automatization of multiplication facts. *Psychology*, 14, 857-879. <https://doi.org/10.4236/psych.2023.145046>

15. Paut, L., Kartono, Zaenuri & Marwoto. (2023). Analysis of student's error in solving multiplication operations in terms of mathematical concept understanding. *International Journal of Research and Review*. <https://doi.org/10.52403/ijrr.20230347>
16. Rohaniah, S., Wibowo, E., & Rachmiati, W. (2022). Implementasi congklak-matika untuk meningkatkan kemampuan perkalian dasar siswa kelas 3 mi tarbiyatul mubtadiin. *Primary Jurnal Keilmuan dan Kependidikan Dasar*. DOI: <https://doi.org/10.32678/primary.v14i1.5453>
17. San Juan, A. (2021). Differentiated activities: An intervention to improve multiplication skills among grade VI pupils of Dela Paz Main Elementary School. https://www.depedbinan.com/media/research/SDORES_001.433_S2274_2017.pdf
18. Sepra, N. (2019). Developing automaticity multiplication facts in grade 4-Tulipat Tambo Elementary School. *Ascendens Asia Journal of Multidisciplinary Research Abstracts*. <https://www.ojs.aaresearchindex.com/index.php/AAJMRA/article/view/5403>
19. Sooknanan, J., & Seemungal, T. (2023). Mathematics education in the time of covid- 19: a public health emergency exacerbated by misinterpretation of data. *Teaching Mathematics and its Applications: An International Journal of the IMA*, hrac025. <https://doi.org/10.1093/teamat/hrac025>
20. Thomas, L. (2023). Quasi-experimental design | definition, types & examples. <https://www.scribbr.com/methodology/quasi-experimental-design/>
21. Umar, & Widodo, A. (2021). Analysis of literacy program based on ability level of students in elementary school. *Jurnal Scientia*. <http://infor.seaninstitute.org/index.php/pendidikan/article/view/185>.
22. Yuhatriati, Johar, R., Khairunnisak, C., Rohaizati, U., Jupri, A., & Zubaidah, T. (2022). Students' mathematical representation ability in learning algebraic expression using realistic mathematics education. *Jurnal Didaktik Matematika* 9(1):151-169. DOI:10.24815/jdm.v9i1.25434