

M-TECHNIQUE TOWARDS SEN STUDENTS' PERFORMANCE AND ANXIETY LEVEL IN MATHEMATICS

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ABSTRACT

Multiplication can pose significant challenges for primary school students, especially those with special educational needs (SEN). These challenges may contribute to Malaysia's low performance in mathematics, as measured by the Programme for International Student Assessment (PISA). Difficulties with multiplication may lead to anxiety and poor performance in mathematics overall, making it challenging for students to achieve proficiency at higher levels. This study aims to improve SEN students' performance in multiplication and reduce their anxiety level in mathematics by using the M-Technique. The central research question is whether the M-Technique can improve the multiplication performance and reduce anxiety levels among primary school students with special educational needs in Malaysia. The study employed quantitative methods to collect data on the students' performance and anxiety levels before and after using the M-Technique, utilizing two learning tools: the "nine-box grid tool" and the "easy column multiplication tool." The study participants were five SEN students from Year 3 at a school in Seremban, Negeri Sembilan. Data collection methods included a questionnaire, pre-post-test, and interview, with two intervention sessions utilizing the M-Technique. The data analysis conducted for this study indicates that the M-Technique significantly enhanced the students' proficiency in solving multiplication problems up to four digits by one digit without the need for teacher guidance. Specifically, the results revealed a remarkable improvement in the students' multiplication performance following the intervention, as evidenced by the significant increase in their post-test scores. The findings suggest that the M-Technique can serve as an effective alternative for inclusive students to learn multiplication. Therefore, the study contributes to the development of inclusive teaching methods and may assist in improving Malaysia's overall mathematics performance.

Keywords: Multiplication, SEN, anxiety, inclusive

INTRODUCTION

Anxiety toward mathematics, commonly called math anxiety (MA), has a negative relationship with students' performance (Barroso et al., 2021; Namkung et al., 2019). Those who have higher math anxiety are likely to do worse in math over a long period of time (Justicia-Galiano et al., 2017). This issue occurs in studies involving Asian students more frequently (J. Zhang et al., 2019). Students who struggle to understand math concepts and perform poorly in this subject may become anxious and stressed when faced with math-related tasks. This can further impact their achievement in math, creating a cycle of anxiety and poor performance.

SEN students refer to the students who have difficulty in learning Mathematics. However, they still have chance to improve their achievements in mathematics to a higher level through practice and exercise (Lambert, 2018). Previous studies have also shown that there are a lot of researchers who keeps trying to find a better method to help these SEN students improve their math ability (Ikhwanudin & Suryadi, 2018), specifically in the aspect of multiplication by comparing (Garain & Kumar, 2018) and exploring (Leonardou et al., 2021; D. Zhang et al., 2014). At the same time, researchers are also finding ways to reduce SEN students' MA levels (Samuel & Warner, 2021). Therefore, this research will focus on improving SEN students' performance in multiplication by using 'M-Technique', and at the same time decreasing their anxiety levels in mathematics.

Focus of the Study

The focus of this study is to elevate the SEN students' accuracy while doing multiplication questions and at the same time alleviate their anxiety level towards mathematics by using a new technique called 'M-Technique'. The main point of this technique is the arrangement of numbers in a nine-box grids tool to create a multiplication table. After the multiplication table is created, SEN students can solve the multiplication question by using an easy column multiplication tool.

This study focuses on a manageable number of SEN students who are struggling to memorize multiplication facts. Instead of attempting to generalize the findings to a larger population, researchers are concentrating on a small group of SEN students that have unique requirements and difficulties in their learning to closely monitor the development of each participant and collect more comprehensive data for analysis. Therefore, this study allows researchers to assess the effect of the M-Technique in a practical situation and uncover any variables that might affect its performance concentrated on a small sample of SEN students who have trouble memorizing multiplication.

This study is important because memorizing multiplication facts is a critical component of mathematical proficiency, which is a key skill to success in mathematics while the M-Technique acts as an alternative method, especially for SEN students who are weak in memorizing multiplication to achieve the same level of achievement as the other SEN students. This alternative method is easy to teach and learn, interesting, and practical as well as helping in alleviating SEN students' anxiety levels toward learning mathematics. By reflecting on the improvement of SEN students' performance and anxiety levels, researchers hope to provide valuable insights on how this technique can be applied as a long-term practical tool for both teachers and students.

Research Objective

- i. Identify the level of SEN students' performance and anxiety in solving multiplication questions involving one digit before and after the intervention.
- ii. Determine the effect of M-Technique towards the level of SEN students' performance and anxiety in solving multiplication questions involving one digit.

Research Question

- i. What is the level of SEN student performance level in solving multiplication questions involving one digit before and after the intervention?
- ii. What is the level of SEN student anxiety level in solving multiplication questions involving one digit before and after the intervention?
- iii. Is there any effect of M-Technique towards the performance of SEN students?
- iv. Is there any effect of M-Technique towards the anxiety level of SEN students?

METHODOLOGY

Kurt Lewin's Action Research Model is chosen to be applied in this research because it is relatively simple and easy to understand. It provides a clear structure for conducting action research. It places a strong emphasis on the value of reflection and feedback. This model refers to a cycle of the planning, action, observation, and reflection stages.

Figure 1: Kurt Lewin's Action Research Model



Study's participants

After reviewing the SEN students' worksheet and the result of the chapter quiz provided by a school teacher, researchers found that some SEN students are facing problems in memorizing multiplication facts. By interviewing those SEN students, this problem already made them struggle to understand math concepts and perform poorly in this subject, hence becoming anxious and stressed when faced with math-related tasks. This can further impact their achievement in math, creating a cycle of anxiety and poor performance (Gunderson et al., 2018). The difficulty in learning, which is related to mathematics, can potentially become a significant challenge in future studies due to the conditions of self-efficacy and value beliefs (Ardi et al., 2019).

The participants were taken from year three students in a Chinese government primary school in the area of Seremban, Negeri Sembilan. A total of five SEN students were chosen to participate in this study and their behavior or characteristic were shown in Table 1 below.

Table 1: Participants' behavior/characteristics

Participant	Behavior / Characteristic
1	Easily distracted and often struggles to stay focused such as doodling in books in class.
2	Appears tense and stressed during class, especially when faced with a challenging task. She avoids interaction in class.
3	Confused when presented with new or difficult material, leading to disruptive behavior.
4	He is complacent and disengaged, not putting much effort into improving his understanding of the material.
5	He appears distracted, making it difficult for him to stay focused on the task at hand.

Procedure of Action Plan

A flow chart had been created based on Kurt Lewin's action research model. Before the action planning, a pre-test had been conducted. The data collected in the pre-test will be analyzed with the post-test to make a comparison. In the planning stage, researchers prepared instruments including the interview, questions for the pre-test and post-test, questionnaire for the SEN students, and daily lessons plan (DLP) for the action stage. There are two sessions in the action stage. In the first session, the teacher introduces the M-Technique and the steps to use M-Technique. The teacher also gives full guidance during the exercise session. In the second session, the teacher revises the M-Technique and gives no guidance during the exercise session. After the action stage, SEN students are given a post-test with 20 multiplication questions to test whether there is any improvement in performance involving multiplication questions.

Introduction to M-Technique

This is the first implementation of M-Technique. M-technique is a modified version of two of the techniques included in a module collection of multiplication techniques, which are called "*Petak Sifir Pepenjuru*" and "Easy Column Multiplication". However, these techniques are created based on the understanding of mathematical operations (Kennedy et.al., 2008).

This technique only requires students to memorize the odd-numbered and even-numbered grids and the direction of the flow of the number arrangement. There are several rules for the grids:

1. The multiplication table always starts at the corner.
2. Always follow the direction of the arrow.
3. Start generating the multiplication table by writing down the number as the first number for its own multiplication table.
4. Always copy down the number in ones place unless the number is smaller than the number before it.
5. If the number is smaller than the number before it, add one to the tens place.

By using this tool, students can list out the multiplication facts. However, to solve the questions involving any digit number with a one-digit number, the easy column multiplication tool will be used together with the nine-box grid tool. Easy column multiplication tool is made up of a table that contains ten rows and a few columns.

Steps of Using M-Technique

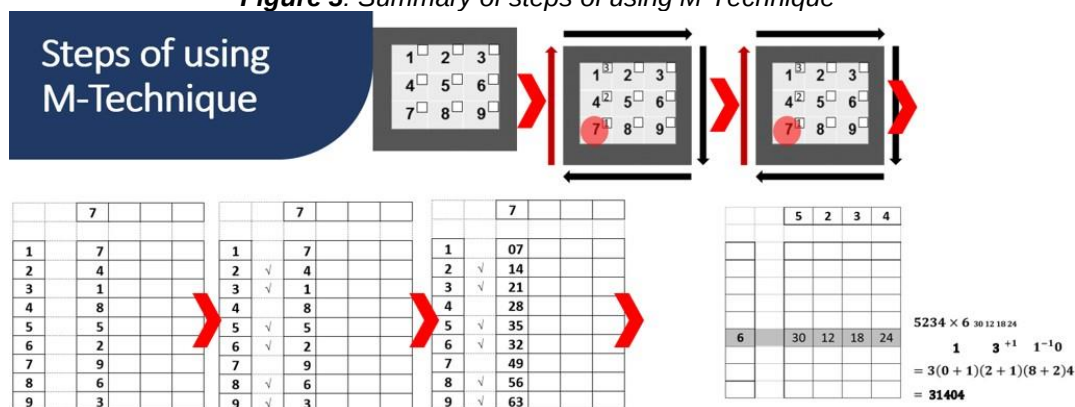
For a clearer explanation, every student is given an “M-Technique tool” which is the combination of the “Nine-box Grid tool” and the “Easy Column Multiplication tool”.

Figure 2: M-Technique Tool



The teacher explains the steps of using M-Technique by using several examples. One of the examples is how to do multiplication between 5234 and 6 by using M-Technique. The teacher explains the working steps one by one so that students can understand clearly. Here is the summary of the steps of using M-Technique to solve question 5234×6 .

Figure 3: Summary of steps of using M-Technique



There are some multiplication questions prepared. Students must use M-Technique to solve all the questions. The teacher gives full guidance during this session. In the second session, the teacher helps them to revise the M-Technique. However, there will be no guidance from the teacher to solve multiplication questions.

Data collection methods

Data collection in this study uses a triangulation method which includes a Pre-Post test, questionnaire and interview to cross-verify the information obtained. For the Pre-Post test, SEN students are given a test before receiving treatment which is called pre-test, and a test after the treatment which is called post-test. The questions in these tests are taken and adapted from a year-three activity book published by the Ministry of Education Malaysia (MOE). The pre-test and post-test scores provide quantitative data that can be analyzed and compared to assess the effect of the M-Technique in improving SEN students' multiplication skills.

The questionnaire is aimed to get feedback from SEN students, about their anxiety level towards Mathematics before and after learning M-Technique. By comparing the results, the study aims to determine whether there is a significant alleviation in SEN students' anxiety level after learning M-Technique. This data helps to provide a more comprehensive understanding of the impact of M-Technique on SEN students' anxiety level and inform future implementation strategies.

An interview was also conducted among the students. The purpose of the interview is to collect qualitative data. Specifically, the data collected through the interview includes two aspects: the level of satisfaction of SEN students with the M-Technique, and their perception of the usefulness of the M-Technique and the reasons behind it.

Last, we also prepared some checklists which are focused on teacher, SEN students and the technique itself. In the present study, the use of three distinct checklists enables a thorough and methodical approach to data collecting, guaranteeing that all pertinent aspects of the M-Technique are addressed during the observation process.

RESULTS AND FINDINGS

Performance Test Analysis

Researchers have administered the performance Pre-test and Post-test to the participants in this action research in order to answer the first and third research questions of this study. The evaluation of the SEN students' performance is done based on the results of the Post-Test after the intervention has been revealed to the participants. Figure 4 and Table 2 below show the score obtained by SEN students in Pre-Test and Post-Test.

Figure 28: Chart of comparison between the score of performance pre-test and post-test

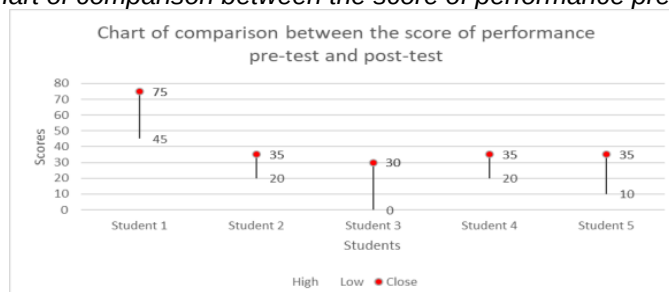


Table 2: Score obtained by SEN students in Pre-Test and Post-Test

SEN Students	Score in Pre-Test	Score in Post-Test	Differences
1	45	75	30
2	20	35	15
3	0	30	30
4	20	35	15
5	10	35	25

Based on Table 2, student 1 (45% to 75%) and Student 3 (0% to 30%) show a significant improvement in the post-test, which is 30%, followed by student 5 (10% to 35%), which is 25% and lastly student 2 and student 5 (20% to 35%) which is 15%. This indicates that all SEN students have an improvement after the implementation of the intervention process with M-Technique. The range of scores in pre-test (0% to 45%) and post-test (30% to 75%) is the same, which is 45%. However, both the minimum score and the maximum score in the post-test are much better than the scores in the pre-test. Next, Table 3 below shows the mean and standard deviation for the score of SEN students in pre-test and post-test.

Table 3: Mean and standard deviation for the score of SEN students in pre-test and post-test

Test	Mean (%)	Standard Deviation
Pre-test	19	16.733
Post-test	42	18.574

Based on Table 3, the mean score in the post-test (42%) is much higher than the mean score in the pre-test (19%). This means that the average performance in post-test is better than the average performance of pre-test. Besides, the standard deviation in post-test (18.574%) is higher than the standard deviation in pre-test (16.733%) and this indicates that the gap of difference among SEN students' scores in post-test is greater than the score in pre-test.

The inferential analysis, a Wilcoxon signed-rank test, has also been carried out based on the score obtained by SEN students in Pre-Test and Post-Test to determine the SEN students' performance after the intervention is introduced to them. The value of the test statistic is -2.041, which indicates that the performance in pre-test was generally lower than the performance in post-test. Besides, the p-value associated with the test statistic is 0.041, which is less than the significance level of 0.05. This indicates that there is a significant improvement between the mean score in the pre-test and post-test.

Questionnaire Analysis

Researchers have observed the anxiety level during the Pre-test and Post-test to the participants involved in this study to answer the second and fourth research questions of this study. Figure 5 and Table 4 below show the score obtained by SEN students in Pre-Test and Post-Test.

Figure 30: Chart of comparison between the score of performance pre-test and post-test

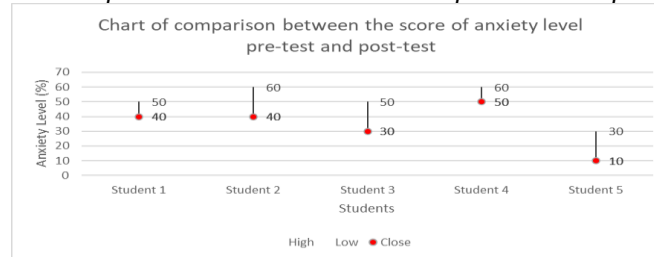


Table 4: Score obtained for anxiety level by SEN students in Pre-Test and Post-Test

SEN Students	Score in Pre-Test	Score in Post-Test	Differences
1	50	40	10
2	60	40	20
3	50	30	20
4	60	50	10
5	30	10	20

A higher score in the test means that the SEN student is more inclined to have anxiety towards Mathematics while a lower score is defined as having a low level of anxiety towards Mathematics. Based on Table 4, students 2 (60% to 40%), 3 (50% to 30%), and 5 (30% to 10%) have decreased their anxiety level by 20% while students 1 (50% to 40%) and 4 (60% to 50%) have decreased it by 10%. These results show that the anxiety level is lower after conducting the intervention session for all participating SEN students. The range has increased for the post-test (10% to 50%) when compared to the pre-test (30% to 60%) but both the minimum score and the maximum score in terms of anxiety level in the post-test are lower in comparison to the pre-test. Next, Table 5 below shows the mean and standard deviation for the score of SEN students in pre-test and post-test.

Table 5: Descriptive analysis of SEN students' anxiety level

Test	Mean (%)	Standard Deviation
Pre-test	50	12.25
Post-test	34	15.17

As observed in Table 5, the post-test has a lower score (34%) while the pre-test is higher (50%). Besides, the standard deviation in post-test (15.17%) is higher than the standard deviation in pre-test (12.25%).

Wilcoxon signed-rank test for inferential analysis was also carried out to determine the anxiety level of SEN students towards Mathematics. The value of the test statistic is -2.070, while the associated p-value is 0.038, which is less than the significance level of 0.05. This indicates that there is a significant improvement between the mean score in the pre-test and post-test.

Interview Analysis

Table 6 shows the interview analysis from each participant.

Table 6: Summary of Interview Analysis

Participant	Satisfaction level	Comments
1	High	Visual representations helped him understand the concepts better and increased their confidence in solving multiplication problems.
2	High	M-Technique can reduce the anxiety towards mathematics, making it easier for them to approach and solve multiplication problems.
3	Moderate	He highlighted the need for additional support and guidance to fully utilize the M-Technique's benefits
4	High	M-Technique provided them with a structured and organized approach to solving multiplication problems
5	Moderate	M-technique highly useful in breaking down complex multiplication tasks into manageable steps.

DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

The findings of research question 1 show the difference between the SEN student performance level in solving multiplication questions involving one digit before and after the intervention. The analysis demonstrates a significant improvement in performance after the implementation of the intervention, as evidenced by the higher scores in the Post-test compared to the Pre-test. Among the five participants, Student 1 and Student 3 displayed the most substantial improvement, with a 30% increase in their scores. This was followed by Student 5 with a 25% improvement and Students 2 and 4 with a 15% improvement. These results indicate that the M-Technique intervention has positively influenced the performance of all participating SEN students. Furthermore, when researchers examined the range of scores, both the Pre-test and Post-test showed a range of 45%. However, the minimum and maximum scores in the Post-test were significantly higher than those in the Pre-test, indicating an overall improvement in performance across all students. This suggests that the M-Technique has effectively contributed to enhancing the performance levels of SEN students in solving multiplication problems. The average performance in the Post-test (42%) exceeded that of the Pre-test (19%), indicating a considerable improvement in overall performance. Additionally, the higher standard deviation in the Post-test (18.574%) compared to the Pre-test (16.733%) suggests a greater variation in scores among SEN students in the Post-test. This variability could reflect the positive impact of the M-Technique on individual student progress and highlights the potential for personalized learning approaches to support SEN students' diverse needs.

The findings obtained from the descriptive analysis are supported by the Wilcoxon signed-rank test. The negative test statistic value (-2.041) suggests that the performance in the Pre-test was generally lower than in the Post-test. Furthermore, the p-value of 0.041, which is less than the significance level of 0.05, indicates a significant improvement in the mean scores between the Pre-test and Post-test. These findings provide strong evidence to support the conclusion that the implementation of the M-Technique has resulted in a notable enhancement of the performance levels of SEN students in solving multiplication problems. The findings of research question 2 show the difference between the SEN student anxiety level in solving multiplication questions involving one digit before and after the intervention. Individual student results were analyzed revealing that

students 2, 3, and 5 showed an impressive reduction of 20% in their anxiety level toward mathematics, while student 1 and 4 show a 10% decrease. The improvements prove how effective M-Technique can be in alleviating anxiety levelstowards mathematics among SEN students. The range of scores in the post-test also expanded,indicating a broader distribution of anxiety levels. The statistical analysis through the Wilcoxon signed-rank test also confirmed the significant improvement in anxiety levels after the intervention.The test statistic value of -2.070, coupled with a p-value of 0.038 (lower than the significance levelof 0.05). This indicates that there is a meaningful difference in the mean scores between the pre test and post-test, further supporting the effectiveness of the M-Technique in reducing anxiety levels.

The results and findings of research questions 3 and 4 show that M-Technique provides an engaging and interactive approach to learning multiplication that can enhance the learning experience of SEN students. It suggests that the M-Technique has significantly improved the performance of SEN students in solving multiplication problems. The statistical analysis showed a significant difference between the performance in the Pre-test and Post-test, with the Post-test performance being generally higher than the Pre-test performance.

The qualitative data such as interviews collected from the participants support thequantitative findings, as they reported finding the M-Technique helpful in improving their understanding of multiplication concepts and in solving multiplication problems. They are generally exhibited a positive level of satisfaction with the M-Technique.

In conclusion, the findings highlight the significance of employing innovative teaching methods, such as the M-Technique, to cater to the unique needs of SEN students. The intervention's positive impact on anxiety reduction and performance improvement demonstrates the potential of tailored interventions to create inclusive learning environments and promote positive outcomes for SEN students. The implementation of the M-Technique intervention has shown promising results in reducing anxiety levels and improving the performance of SEN students in mathematics. These findings emphasize the importance of incorporating targeted strategies and interventions to support SEN students' well-being and academic growth.

Recommendations

Based on the findings of this study, researchers encourage teachers and educators to integrate the M-Technique into their mathematics teaching technique to help students elevate theirperformance and alleviate anxiety levels in solving multiplication questions.

This study may be replicated not only with normal or typically developing students but also with more SEN students in different aspects such as bigger sample size, other grade levels, andgender. In addition, researchers can consider incorporating additional measures or instruments to capture a comprehensive understanding of student's interests, attitudes, and anxiety levels. Additionally, it would be beneficial to extend the intervention period to evaluate the long-term effects of the M-Technique on reducing anxiety in mathematics.

Conclusions

In conclusion, the implementation of the M-Technique has shown promising results in improving both the performance and anxiety levels of SEN students in mathematics. The findings indicated a significant elevation in the performance of SEN students in solving multiplication problems, as demonstrated by the Pre-Test and Post-Test results. The M-Technique provided SEN students with a visual and interactive approach to learning multiplication, enhancing their understanding and confidence in problem-solving.

Additionally, although the statistical analysis did not yield significant results in terms of anxiety alleviation, there was a noticeable decrease in anxiety levels after the intervention. The qualitative feedback from SEN students further supported this observation, highlighting the positive impact of the M-Technique on fostering a more supportive learning environment.

These findings are particularly significant for SEN students who may face additional challenges in mathematics. Improving their performance and reducing anxiety levels can have profound implications for their future success. By equipping SEN students with effective learning strategies like the M-Technique, educators can empower them to overcome barriers and develop essential mathematical skills that will support their academic and professional growth.

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