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THE EFFECT OF THE MATH MAGICAL WAY METHOD IN NUMBER PATTERN LEARNING ON EIGHTH-GRADE STUDENTS' MATHEMATICS ACHIEVEMENT AND ANXIETY

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Abstrak

Low learning outcomes and high mathematical anxiety remain persistent challenges in secondary school mathematics education, often limiting students' conceptual understanding, problem-solving ability, confidence, and participation. This study examined the effect of the Math Magical Way method—an instructional approach grounded in multisensory and constructivist learning principles that integrates creative activities, visualization, and interactive engagement—on the learning outcomes and mathematical anxiety of eighth-grade students at MTs Negeri 1 Barru on the topic of number patterns. A quantitative, pre-experimental approach was employed using a One Group Pretest-Posttest Design, which does not include a control group and therefore limits causal inference. The subjects comprised 24 students from class VIII.2, selected via purposive sampling from a larger eighth-grade population at the school. Data were collected through a learning outcome test, a mathematical anxiety questionnaire, observation sheets, and interview guides administered before and after treatment. Data were analyzed using descriptive statistics and inferential statistics, including normality testing, the Wilcoxon Signed-Rank test, and effect size calculation. Results showed those in the mean learning outcome score increased from 64.17 to 78.46, while mean mathematical anxiety decreased from 57.96 to 41.46. These findings suggest that the Math Magical Way method can serve as an effective alternative for fostering a more engaging, positive, and less anxiety-inducing mathematics learning experience. Future studies are recommended to employ a control group and larger, more diverse samples to strengthen generalizability.

Keywords : Math Magical Way; Number Pattern; Mathematics Achievement; Mathematics Anxiety

A. Introduction

Mathematics plays an important role in developing logical, critical, systematic, and creative thinking skills. These skills are needed by students to understand concepts, solve problems, and make rational decisions in daily life.

Therefore, mathematics learning should not only help students achieve good learning outcomes, but also build a positive attitude toward mathematics. However, in practice, mathematics learning still faces two main problems, namely low learning outcomes and high levels of students' mathematical anxiety (Khairunnisa & Fitri, 2023; Mulyati et al., 2023; Nugroho et al., 2023). Among the various topics that give rise to these two problems, number patterns is one that most frequently causes difficulty for students. This topic is important because it serves as the foundation for understanding the concepts of algebra, functions, and mathematical generalization. In learning number patterns, students are not only required to continue a sequence of numbers, but also need to identify regularities, explain the relationships between elements, and formulate general rules. However, several studies indicate that students still experience difficulties in formulating generalizations of number patterns, even though they are able to recognize the initial form or characteristics of a pattern (Sartika et al., 2022). This condition indicates that students' understanding still tends to be procedural and has not yet reached a deep conceptual understanding.

Difficulties in understanding number patterns are also related to mathematical representation ability. Number patterns require students to connect concrete, visual, verbal, and symbolic representations. Students need to understand patterns from images, tables, objects, or particular situations, and then translate them into mathematical symbols or formulas. However, many students still experience difficulties in making such representational shifts(Ismiyati et al., 2024; Musyarofah et al., 2025; Nurhadida et al., 2025). As a result, students tend to guess answers without understanding the underlying regularity, which can hinder their ability to construct mathematical arguments and understand more advanced material.

This problem was empirically confirmed among eighth-grade students at MTsN Barru. Based on a preliminary study conducted by the researcher, around 56% of students had not yet reached the Minimum Completeness Criteria on the topic of number patterns. Students still had difficulty identifying the rule of a pattern, formulating generalizations, and writing mathematical formulas from a given pattern. Interview results with the mathematics teacher showed that some students only memorized examples, were reluctant to try their own strategies, and

were afraid of making mistakes. This condition indicates a gap between the competencies expected in learning number patterns and the students' actual learning outcomes in class.

In addition to being related to learning outcomes, mathematics learning is also related to students' affective aspects, one of which is mathematical anxiety. Mathematical anxiety is an emotional condition characterized by feelings of fear, nervousness, worry, and a lack of confidence when students face mathematical activities. This anxiety can disrupt concentration, reduce learning motivation, and hinder students' ability to solve mathematical problems (Jalal, 2020; Nuraeni & Munandar, 2023; Sari & Abadi, 2024). This phenomenon was also confirmed at MTsN Barru: based on preliminary observations, several students displayed passive attitudes, responded slowly to questions, and felt afraid when asked to work on problems in front of the class. The results of the initial questionnaire showed that 17 students (70.83%) were in the moderate anxiety category, while 7 students (29.17%) were in the high anxiety category, with no students in the low anxiety category. This data indicates that students' mathematical anxiety prior to instruction still requires serious attention.

Low learning outcomes and high mathematical anxiety are two interrelated problems: students with high anxiety tend to find it difficult to concentrate, lack confidence, and hesitate when solving problems, while repeated failure in understanding material can, in turn, reinforce fear and anxiety. This reciprocal relationship indicates that an intervention is needed which simultaneously targets both the cognitive dimension (learning outcomes) and the affective dimension (anxiety), rather than addressing them in isolation. One method proposed to address these interrelated problems is Math Magical Way.

Math Magical Way is a mathematics learning method that deliberately combines four core components: (1) storytelling, in which mathematical concepts are embedded within narrative contexts to make abstract ideas more relatable; (2) visualization, using pictorial or concrete representations (e.g., pattern cards, diagrams) to bridge concrete and symbolic understanding; (3) number games and imaginative "magic tricks," which reframe mathematical procedures as playful discovery activities rather than rote drills; and (4) interactive, student-centered

activities that position students as active constructors of concepts rather than passive recipients of explanation (Himmawan & Juandi, 2023; Wati et al., 2024; Yustina & Yahfizham, 2023). By integrating these four elements, Math Magical Way is designed to lower the psychological pressure typically associated with mathematics learning while simultaneously scaffolding conceptual understanding through multisensory engagement.

In learning number patterns specifically, Math Magical Way has strong relevance because this topic requires students to identify regularities, predict subsequent terms, and formulate general rules—processes that align naturally with the method's visual and game-based components. For instance, pattern cards can be used to let students physically arrange and rearrange visual sequences before translating them into symbolic notation, while number games can turn the search for a generalization into a challenge-and-discovery activity rather than a memorization task. Such activities have the potential to help students understand number patterns more meaningfully, both cognitively—by involving them directly in the process of discovering concepts and generalization—and affectively, by fostering a safe environment in which students feel free to try, ask questions, and make mistakes without fear of judgment.

Several previous studies have shown that learning that utilizes elements of games, visualization, and enjoyable activities can increase students' motivation and learning outcomes (Sa'adah et al., 2024; Sinaga et al., 2023). Other studies have also shown that a positive learning atmosphere can help reduce students' mathematical anxiety (Aisyah & Galih Adirakasiwi, 2025; Nuraeni & Munandar, 2023; Setyawati & Ratu, 2021). However, most studies still examine learning outcomes and mathematical anxiety separately. In addition, research on the application of Math Magical Way in learning number patterns remains limited, particularly among junior high school-level madrasah students. Based on this gap, this study was conducted to examine the application of the Math Magical Way method in learning number patterns on the learning outcomes and mathematical anxiety of eighth-grade students at MTsN Barru. This study is important because it integrates cognitive and affective aspects within a single research framework. Thus, the results of this study are expected to provide empirical evidence regarding the

use of Math Magical Way as an alternative approach to mathematics learning that supports conceptual understanding while also reducing students' mathematical anxiety.

B. Method

Settings

This study used a quantitative approach with a pre-experimental design, namely a one-group pretest-posttest design. This design was used to analyze changes in students' mathematics learning outcomes and mathematical anxiety before and after the implementation of the Math Magical Way method in learning number patterns. The research context was chosen because the results of the preliminary study showed that students still experienced difficulties in understanding the topic of number patterns, particularly in identifying pattern rules, determining the nth term, and formulating mathematical generalizations.

Participants

The research participants were students of class VIII.2 at MTs Negeri 1 Barru in the 2025/2026 academic year. The number of participants was 24 students. The sampling technique used was purposive sampling. The selection of class VIII.2 was based on several considerations, namely the suitability of the learning material, the recommendation of the mathematics teacher, the class's readiness to participate in the series of learning activities, and student characteristics that matched the research objectives. All students in the class took part in the pretest, treatment, and posttest. Class VIII was selected because students at this level had already studied the prerequisite material related to number patterns. The topic of number patterns is also important as a foundation for understanding the concepts of algebra, functions, and mathematical generalization in subsequent mathematics learning.

Instruments

This study used four instruments, namely a mathematics learning outcome test, a mathematical anxiety questionnaire, a learning implementation observation sheet, and an interview guide. The two main instruments were the learning outcome test and the mathematical anxiety questionnaire, while the observation and interview served as supporting data.

Mathematics Learning Outcome Test

The learning outcome test was used to measure students' ability to understand the topic of number patterns before and after the implementation of Math Magical Way. The test was administered in the form of a pretest and a posttest. The instrument consisted of essay questions developed based on the learning indicators for number patterns.

Mathematical Anxiety Questionnaire

The mathematical anxiety questionnaire was used to measure students' level of anxiety before and after learning using Math Magical Way. The questionnaire consisted of 20 statements using a four-point Likert scale, namely strongly agree, agree, disagree, and strongly disagree.

Learning Implementation Observation Sheet

The observation sheet was used to monitor the implementation of learning and student activities during the application of Math Magical Way. Observations were conducted by an observer at each meeting. The aspects observed included introductory activities, problem orientation, group work, pattern exploration, presentation of results, reflection, and closing. The observation instrument was used to ensure that learning proceeded in accordance with the design of the Math Magical Way method.

Interview Guide

The interview guide was used as supporting data to obtain information about students' experiences during the learning process. The interviews focused on three aspects, namely mathematical anxiety, courage in participating in learning, and students' understanding of the number pattern material. Interview subjects were selected purposively based on their learning outcome or anxiety category, namely students in the high, moderate, and low categories. The interview data were used to strengthen the interpretation of the quantitative results.

Data Collecting

Data collection was carried out in three stages, namely the preparation stage, the implementation stage, and the final stage. In the preparation stage, the researcher conducted a preliminary study to identify problems related to learning

outcomes and students' mathematical anxiety on the topic of number patterns. The researcher then developed learning tools, including a teaching module, teaching materials, and student worksheets. The research instruments, namely the learning outcome test, the mathematical anxiety questionnaire, the observation sheet, and the interview guide, were also prepared and validated by experts before use. In the implementation stage, students were first given a learning outcome pretest and a mathematical anxiety questionnaire. The pretest was used to determine students' initial ability in the number pattern material, while the initial questionnaire was used to measure the level of mathematical anxiety before treatment. After the pretest, students participated in learning using the Math Magical Way method over three meetings. During the learning process, students were guided to discover patterns through number games, visualization, exploratory activities, and group discussions. The learning activities emphasized students' ability to recognize pattern regularities, determine the relationships between terms, and formulate patterns into mathematical form. After the entire series of learning sessions was completed, students were given a learning outcome posttest and a final mathematical anxiety questionnaire. The posttest was used to determine students' learning outcomes after treatment, while the final questionnaire was used to observe changes in students' mathematical anxiety. In the final stage, the researcher processed the pretest and posttest learning outcome data, the mathematical anxiety questionnaire data before and after treatment, and the supporting observation and interview data. This data was then analyzed to answer the research questions and test the research hypotheses.

Analysis

Data analysis was carried out through descriptive statistics and inferential statistics.

Descriptive Statistical Analysis

Descriptive analysis was used to describe students' learning outcomes and mathematical anxiety before and after the implementation of the Math Magical Way method. The statistics used included the mean, standard deviation, minimum value, maximum value, completeness percentage, N-Gain category, and the distribution

of mathematical anxiety categories. Learning outcomes were analyzed based on the pretest and posttest scores.

Inferential Statistical Analysis

Before hypothesis testing, the data were tested for normality using the Shapiro-Wilk test, as the sample size was fewer than 50 students. If the data were normally distributed, the difference between the pretest and posttest scores was analyzed using a paired-sample t-test. If the data were not normally distributed, the analysis was conducted using the Wilcoxon signed-rank test. The test was conducted at a significance level of 0.05. To determine the magnitude of the change after treatment, this study also calculated the effect size. If the data were analyzed using a paired-sample t-test, the effect size could be calculated using Cohen's dz.

C. Results and Discussion

Students' Mathematics Learning Outcomes Before and After Instruction

Description of Pre-test and Post-test Scores

Based on the research results, pre-test and post-test data were obtained from students on the topic of number patterns. This data was used to determine the change in students' learning outcomes after the implementation of the Math Magical Way method. Based on the analysis results, the average pre-test score was 64.17, while the average post-test score was 78.46. This indicates an increase in students' average learning outcomes after participating in learning with the Math Magical Way method. Quantitatively, there was an average increase of 14.29 points after treatment was given. In addition, the minimum score on the pre-test of 45 increased to 58 on the post-test, representing an increase of 13 points, while the maximum score also increased from 82 to 91, an increase of 9 points. This data indicates that improvements in learning outcomes occurred among students with various levels of ability. In terms of data spread, the standard deviation on the pre-test was 11.35, while on the post-test it was 10.68. The decrease in standard deviation of 0.65 indicates that the variation in students' scores became smaller after instruction. This suggests that students' abilities not only improved, but also became more evenly distributed.

Overall, the descriptive analysis results indicate an improvement in students' mathematics learning outcomes on the topic of number patterns after the implementation of the Math Magical Way method. This improvement is evident from the increase in the average score, minimum score, and maximum score, as well as the decrease in standard deviation in the post-test results compared to the pre-test results.

The descriptive analysis of learning outcomes aims to provide a general overview of students' abilities before and after the implementation of the Math Magical Way method on the topic of number patterns. The data analyzed included the mean, maximum score, minimum score, and standard deviation of the pre-test and post-test results. The data are shown in Table 1.

Table 1. Statistics of Pre-test and Post-test Results

Statistic	Pre-test	Post-test
Number of Students	24	24
Minimum Score	45	58
Maximum Score	82	91
Mean	64,17	78,46
Standard Deviation	11,35	10,68

Category of Students' Learning Outcomes

Based on the pre-test and post-test results, the category of students' learning outcomes shows a change after the implementation of the Math Magical Way method. At the pre-test stage, most students were in the low category, namely 9 students, followed by the moderate category with 8 students, and the high category with 7 students. This condition indicates that before instruction, most students were still in the low and moderate learning outcome categories.

After instruction, there was a change in the distribution of students' learning outcome categories. The number of students in the high category increased to 16 students, while the number of students in the moderate category decreased to 4 students. Similarly, in the low category, the number of students decreased from 9 students to 4 students. This change indicates a shift in students' learning outcome categories toward a better direction after participating in instruction. Overall, the categorization results show that the number of students in the high category

increased, while the number of students in the moderate and low categories decreased. This condition illustrates that students' learning achievement after instruction was better than before instruction. The data are shown in Table 2.

Table 2. Category of Students' Learning Outcomes

Statistic	Score Interval	Pre-test	Post-test
High	≥ 75	7 Students	16 Students
Moderate	60–74	8 Students	4 Students
Low	< 60	9 Students	4 Students
Total		24	24

To facilitate understanding of the changes that occurred, students' learning outcome data were categorized into three categories, namely the high category (≥ 75), the moderate category (60–74), and the low category (< 60). In the high category, the number of students increased from 7 students in the pre-test to 16 students in the post-test. Meanwhile, in the moderate category, the number of students decreased from 8 students to 4 students, and in the low category, there was also a decrease from 9 students to 4 students. The comparison results of students' learning outcome categories before and after instruction can be seen in the following graph.

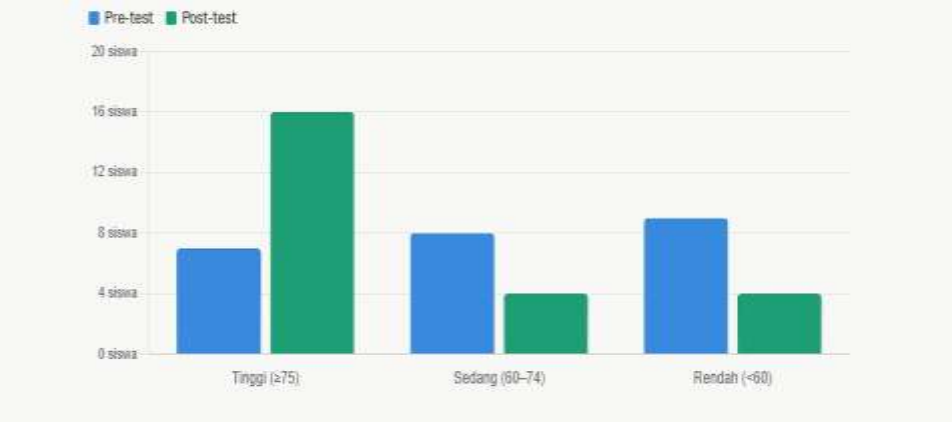

Figure 1. Graph of Learning Outcome Categories

Analysis of KKM Achievement

Students' achievement of learning outcomes was analyzed based on the Minimum Completeness Criteria (KKM) applied at MTs Negeri 1 Barru, namely

75. Students were declared to have passed if they obtained a score ≥ 75, while students who obtained a score < 75 were declared not to have passed.

Table 3. Category of KKM Achievement

Category	Pre-test	Post- test
Passed	8	21
Not Passed	16	3
Total	24	24

Based on Table 3, at the pre-test stage, there were 8 students (33.33%) who achieved the KKM and 16 students (66.67%) who had not yet achieved the KKM. After instruction using the Math Magical Way method, the number of students who achieved the KKM increased to 21 students (87.50%), while the number of students who had not yet achieved the KKM decreased to 3 students (12.50%). This data indicates an increase in the number of students achieving the KKM after the implementation of the Math Magical Way method. Thus, the majority of students had reached the completeness standard set by the school at the time of the post-test.

Classical Completeness

Classical completeness was calculated based on the percentage of students who achieved the KKM. Instruction was declared classically complete if at least 85% of students obtained a score meeting or exceeding the established KKM.

Table 4. Classical Completeness

Test	Completeness Percentage	Criteria
Pretest	33,33%	Not Complete
Posttest	87,50%	Complete

Based on Table 4, the classical completeness percentage on the pre-test was 33.33%, which did not yet meet the established classical completeness criteria, namely at least 85% of students achieving the KKM. After the implementation of the Math Magical Way method, the classical completeness percentage increased to 87.50%.

These results indicate that the classical completeness on the post-test met the established criteria. Thus, based on the percentage of students who achieved the

KKM, students' learning outcomes after instruction had reached classical completeness.

Test of Difference in Learning Outcomes

To determine whether there was a difference in students' learning outcomes before and after the implementation of the Math Magical Way method, a Wilcoxon Signed Rank Test was conducted. This test was used because the data were paired (pre-test and post-test) and did not require a normal distribution.

Table 5. Wilcoxon Signed Ranks Test

		N	Mean Rank	Sum of Ranks
Post-test – Pre-test	Negative Ranks	4[a]	5,13	20,50
Posttest	Positive Ranks	20[b]	13,98	279,50
	Ties	0[c]		
	Total	24		

Tabel 6. Test Statistics

	Post-test – Pre-test
Z	-3,702[b]
Asymp. Sig. (2-tailed)	<0,05

Based on the results of the Wilcoxon Signed Rank Test, the significance value (Asymp. Sig. 2-tailed) obtained was < 0.05. Since the significance value was smaller than 0.05, H_0 was rejected and H_1 was accepted. Thus, there was a significant difference between students' learning outcomes before and after the implementation of the Math Magical Way method.

Based on the Ranks table, there were 20 students who experienced an increase in scores (positive ranks) and 4 students who experienced a decrease in scores (negative ranks), while no students obtained the same score (ties). The Z statistic value of -3.702 indicates a difference in learning outcomes between before and after instruction. These results show that the majority of students obtained higher scores after participating in learning using the Math Magical Way method.

Improvement in Learning Outcomes Based on N-Gain

N-Gain analysis was used to determine the level of improvement in students' learning outcomes after the implementation of the Math Magical Way method.

Based on the N-Gain calculation results, categories of improvement in students' learning outcomes were obtained, describing the change in students' abilities after instruction.

The analysis results show that the improvement in students' learning outcomes was dominated by the moderate category, namely 12 students (50.00%), followed by the low category with 9 students (37.50%), and the high category with 3 students (12.50%). The average N-Gain value obtained was 0.40, which falls into the moderate category.

Based on these results, most students experienced an improvement in learning outcomes in the moderate category after participating in learning using the Math Magical Way method. In addition, there were 3 students who reached the high category and 9 students who were in the low category. The data are shown in Table 7.

Table 7. N-Gain Category of Students

Category	Score Interval	Number of Students	Percentage
High	$g \geq 0,70$	3 Students	12,50%
Moderate	$0,30 \leq g < 0,70$	12 Students	50,00%
Low	$g < 0,30$	9 Students	37,50%
Total		24	100%

Students' Mathematical Anxiety Before and After Instruction

Description of Mathematical Anxiety Scores

Based on the results of the students' mathematical anxiety questionnaire, data on the level of anxiety before and after instruction using the Math Magical Way method were obtained. The analysis results show that the average mathematical anxiety score of students before instruction was 57.96, while after instruction it was 41.46. This indicates a decrease in the average mathematical anxiety score of 16.50 points. Given that a higher score indicates a higher level of anxiety, this decrease in the average score indicates a reduction in students' mathematical anxiety after participating in instruction.

In addition, the minimum score decreased from 50 to 33, and the maximum score decreased from 75 to 65. This data shows that students' level of mathematical anxiety after instruction was lower than before instruction. In terms of data spread,

the standard deviation before instruction was 6.53, while after instruction it was 8.04. This indicates that the variation in students' mathematical anxiety scores after instruction was greater than before instruction.

Overall, the descriptive analysis results show a decrease in students' mathematical anxiety scores after instruction. This decrease is evident from the reduction in the average score, minimum score, and maximum score after the implementation of the Math Magical Way method. The descriptive statistics of students' mathematical anxiety are presented in Table 8.

Table 8. Statistics of Students' Mathematical Anxiety

Statistic	Before Instruction	After Instruction
Number of students	24	24
Minimum score	50	33
Maximum score	75	65
Mean	57,96	41,46
Standard deviation	6,53	8,04

Category of Mathematical Anxiety

Based on the results of the students' mathematical anxiety questionnaire before and after instruction, a change was found in the distribution of students' anxiety categories after the implementation of the Math Magical Way method. Before instruction, most students were in the moderate anxiety category, namely 17 students (70.83%), while 7 students (29.17%) were in the high anxiety category. At this stage, no students were yet in the low anxiety category. This condition indicates that before instruction, most students were in the moderate and high anxiety categories.

After instruction, the distribution of mathematical anxiety categories changed. The number of students in the low anxiety category increased to 14 students (58.33%), while the moderate category decreased to 8 students (33.33%), and the high category decreased to 2 students (8.33%). Overall, the categorization results show a change in the distribution of students' mathematical anxiety levels after instruction. The number of students in the low category increased, while the number of students in the moderate and high categories decreased. The data on students' mathematical anxiety categories are presented in Table 9.

Table 9. Category of Students' Mathematical Anxiety

Category	Score Interval	Before	%	After	%
High	61-80	7 Students	29,17%	2 Students	8,33%
Moderate	41 – 60	17 Students	70,83%	8 Students	33,33&
Low	20-40	0 Students	0%	14 Students	58,33%
Total		24	100%	24	100%

Based on Table 9, the number of students in the high anxiety category decreased from 7 students to 2 students. In the moderate anxiety category, the number of students decreased from 17 students to 8 students. Meanwhile, in the low anxiety category, there was an increase from 0 students to 14 students after instruction. The comparison results of students' mathematical anxiety categories before and after instruction can be seen in Figure 2.

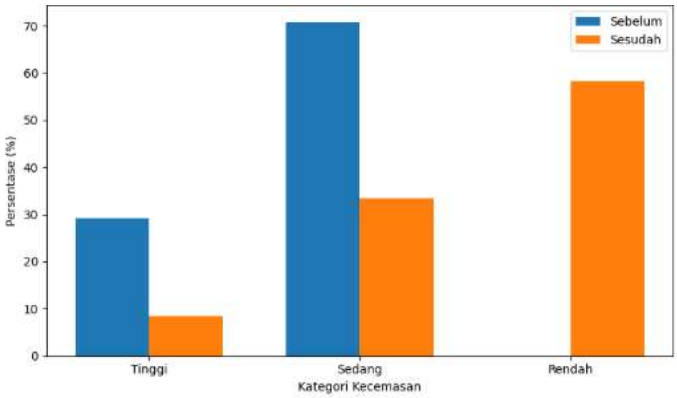

Figure 2. Graph of Mathematical Anxiety Categories

Results of the Test for Difference in Mathematical Anxiety

To determine the difference in students' mathematical anxiety before and after instruction, a Wilcoxon Signed Rank Test was used because the data were paired.

Table 10. Wilcoxon Signed Ranks Test for Difference in Mathematical Anxiety

		N	Mean Rank	Sum of Ranks
Post-Instruction Questionnaire – Pre-Instruction Questionnaire	Negative Ranks	24[a]	12.50	300.00
	Positive Ranks	0[b]	,00	,00
		0[c]		
		24		

Table 11. Test Statistics for Difference in Mathematical Anxiet

	Post-Instruction Questionnaire – Pre-Instruction Questionnair
Z	-4.334[b]
Asymp. Sig. (2-tailed)	< 0.05

Based on the results of the Wilcoxon Signed-Rank Test, the significance value (Asymp. Sig. (2-tailed)) obtained was < 0.05. Since the significance value was smaller than the significance level of 0.05, H_0 was rejected and H_1 was accepted. Thus, there was a significant difference between students' levels of mathematical anxiety before and after the implementation of the Math Magical Way method.

Based on the Ranks table, all students (24 students) were in the negative ranks category, indicating that mathematical anxiety scores after instruction were lower than before instruction. No students experienced an increase in anxiety scores, nor did any students have unchanged anxiety scores.

The Z statistic value of -4.334 indicates a difference in the level of mathematical anxiety between before and after instruction. This result is supported by the descriptive analysis, which shows a decrease in the average mathematical anxiety score after the implementation of the Math Magical Way method. Thus, it can be concluded that there is a significant difference between students' levels of mathematical anxiety before and after the implementation of the Math Magical Way method.

Inferential Analysis of the Math Magical Way Method

Descriptive Statistics

The following is a summary of the descriptive statistics for the data on students' learning outcomes and anxiety before and after the implementation of the Math Magical Way method.

Table 12. Descriptive Statistics

Variabel	N	Mean	SD	Change
Learning Outcome Pre	24	64.17	11.35	—
Learning Outcome Post	24	78.46	10.69	+14.29 ↑
Anxiety Pre	24	57.96	6.54	—
Anxiety Post	24	41.46	8.05	-16.50 ↓

Based on Table 12, students' average learning outcomes increased from 64.17 to 78.46 after the implementation of the Math Magical Way method. Meanwhile, students' average mathematical anxiety decreased from 57.96 to 41.46. These results indicate a positive change in both the cognitive and affective aspects of students after instruction.

Normality Test (Shapiro-Wilk)

The normality test was conducted using the Shapiro-Wilk method to determine whether the data were normally distributed. Hypothesis: H_0 = the data are normally distributed; rejected if $p < 0.05$.

Table 13. Normality Test

Variabel	W Statistik	p-value	$\alpha = 0.05$
Learning Outcome Pre	0.9411	0.1729	$p > 0.05$
Learning Outcome Post	0.92432	0.1083	$p > 0.05$
Anxiety Pre	0.9318	0.1154	$p > 0.05$
Anxiety Post	0.9187	0.1021	$p > 0.05$

Based on the results of the normality test in Table 13, all significance values were greater than 0.05. Thus, the data on learning outcomes and mathematical anxiety were normally distributed.

Wilcoxon Signed-Rank Test (Non-Parametric Confirmation)

The Wilcoxon Signed Rank Test was used to determine the difference in students' learning outcomes and mathematical anxiety before and after the implementation of the Math Magical Way method.

Table 14. Wilcoxon Signed-Rank Test

Variabel	Z	p-value
Learning Outcome	-3,702	<0,05
Anxiety	-4,334	<0,05

Based on the results of the Wilcoxon Signed Rank Test, a significance value of less than 0.05 was obtained for both variables. This indicates that there was a significant difference in both students' learning outcomes and mathematical anxiety after the implementation of the Math Magical Way method. For the learning outcome variable, 20 students experienced an increase in scores and 4 students experienced a decrease in scores. Meanwhile, for the mathematical anxiety variable, all students experienced a decrease in anxiety scores after instruction.

Effect Size (Cohen's d)

Effect size was used to determine the magnitude of the effect of implementing the Math Magical Way method on students' learning outcomes and mathematical anxiety.

Table 15. Effect Size Test

Variabel	Cohen's d	Category	Interpretation
Learning Outcome	1.30	Large Effect	Meaningful improvement in learning outcomes
Anxiety	-2,25	Large Effect	Very consistent reduction in anxiety

Based on the effect size calculation using Cohen's d formula, a value of 1.30 was obtained for the learning outcome variable. This value falls into the large effect category because it exceeds the threshold of 0.80. This result indicates that the implementation of the Math Magical Way method had a strong effect on improving students' learning outcomes on the topic of number patterns.

For the mathematical anxiety variable, a Cohen's d value of -2.25 was obtained. The negative sign indicates that the direction of the change occurring was a decrease in students' level of mathematical anxiety after the implementation of the Math Magical Way method. Based on Cohen's d interpretation criteria, this value also falls into the large effect category because it exceeds the threshold of 0.80.

Discussion

Students' Learning Outcomes Before and After Implementation

The findings show that Math Magical Way improved students' learning outcomes on the topic of number patterns, as reflected in students' increased ability to identify regularities and formulate simple generalizations after instruction. Number patterns require more than memorization; students must recognize relationships between numbers and construct general rules. Conventional instruction often reduces this process to guesswork, whereas Math Magical Way guided students to discover patterns through visual and exploratory activities, allowing understanding to develop rather than be transmitted. This improvement paralleled a visible shift in classroom behavior: students who were initially passive and teacher-dependent became increasingly willing to discuss, attempt problems, and voice their reasoning. This pattern aligns with constructivist theory, which holds that knowledge is built through active engagement rather than passive reception. It also corroborates prior findings that activity-based learning strengthens

conceptual understanding in mathematics (Muntazhimah, 2023; Nainggolan et al., 2022; Rosita et al., 2024; Setiawan, 2024). The gains were not uniform, however. A few students showed minimal improvement or slight score declines, suggesting that an engaging method alone does not guarantee equal outcomes for all learners. Differences in prior ability, motivation, and confidence likely moderated individual results, indicating that Math Magical Way should be paired with scaffolding and targeted support for struggling students rather than applied as a one-size-fits-all solution. Interview responses reinforced these quantitative gains: students described the material as easier to follow and less monotonous, suggesting the improvement was experiential as well as measurable.

Students' Mathematical Anxiety Before and After Implementation

Mathematical anxiety declined following the intervention, with students showing fewer signs of fear, hesitation, and low confidence. This reduction can be attributed to the psychological safety Math Magical Way affords: by introducing patterns through games and visualization rather than abstract procedures, the method delayed the point at which students confronted formal, high-pressure tasks, giving them room to build competence gradually. Anxiety typically intensifies when classrooms demand immediate correctness; students then withdraw to avoid embarrassment. Math Magical Way reversed this dynamic by normalizing trial and error. Observations showed this shift was gradual—students needed initial adjustment before actively participating—indicating that anxiety reduction is a cumulative process, not an instantaneous effect of a single technique. This is consistent with research linking enjoyable, low-stakes learning environments to reduced mathematical anxiety (Berliani & Persada, 2024; Dina et al., 2022; Setiawan, 2024). Notably, not all students reached the low-anxiety category post-treatment, underscoring that anxiety rooted in long-term negative experiences may require sustained, rather than short-term, intervention.

The Effect of Math Magical Way on Learning Outcomes

Math Magical Way's effect on learning outcomes is best explained by the quality of cognitive engagement it fostered rather than its entertainment value alone. By requiring students to move between concrete, visual, and symbolic representations of number patterns, the method addressed a core difficulty

identified earlier: students who memorize formulas without understanding the underlying pattern-formation process often fail to transfer that knowledge to novel problems. Active participation—asking questions, discussing, attempting solutions—correlated with deeper understanding, suggesting that engagement, not novelty, drove the improvement. This effect should nonetheless be interpreted cautiously. Because the study used a one-group pretest-posttest design without a control class, the observed gains cannot be attributed to Math Magical Way alone; practice, instructional time, and teacher guidance may have contributed independently. Confirming the method's specific causal effect requires future studies incorporating a control group.

The Effect of Math Magical Way on Mathematical Anxiety

The anxiety-reducing effect appears to stem from the psychological safety inherent in the method's design. By lowering the immediate demand for correct answers, Math Magical Way allowed students to engage with mathematics without the fear of failure that typically reinforces anxiety over time. This is consistent with theoretical accounts linking mathematical anxiety to repeated negative experiences and eroded self-confidence—Math Magical Way disrupts this cycle by replacing high-stakes exposure with gradual, low-pressure practice. Behavioral observations supported the questionnaire data: students reported feeling calmer and more willing to participate, indicating the change extended beyond self-report into observable classroom conduct. Yet since some students remained in moderate or high anxiety categories after treatment, a single instructional intervention appears insufficient to fully resolve anxiety built over years of prior experience, pointing to the need for sustained, longer-term application.

Synthesis of Findings

Together, these results suggest that Math Magical Way addresses cognitive and affective dimensions of mathematics learning simultaneously rather than treating them as separate problems. Instruction focused solely on content delivery risks producing procedural understanding without emotional readiness, while instruction designed only to be enjoyable risks failing to build genuine competence. Math Magical Way's value lies in combining both: structured conceptual activities embedded within a psychologically safe environment. Its effective implementation

nonetheless depends on deliberate design—clear alignment between activities and learning objectives, and targeted support for students with low prior achievement or high anxiety—rather than treating engagement alone as sufficient for learning success.

D. Conclusion

The implementation of Math Magical Way in learning number patterns improved both learning outcomes and reduced mathematical anxiety among eighth-grade students at MTsN Barru. Cognitively, students showed better understanding of number patterns, including recognizing regularities and formulating generalizations, along with a higher rate of achieving completeness after instruction. Affectively, students became calmer, more confident, and more willing to try, indicating that the method created a comfortable atmosphere that supported active engagement alongside conceptual understanding. This study has three main limitations. The one-group pretest-posttest design without a control group means the observed changes cannot be fully attributed to Math Magical Way alone, while the small sample of one class limits generalizability to other schools or grade levels. The short treatment duration also leaves the method's long-term impact unknown, and since some students showed limited improvement, factors such as initial ability and motivation likely still influence outcomes. Future research should use a quasi-experimental or control-group design with larger and more diverse samples over a longer instructional period to test the method's effect more rigorously. Researchers could also explore Math Magical Way's application to other topics, such as algebra or geometry, and incorporate deeper qualitative analysis to better understand its influence on students' thinking processes and anxiety during instruction.

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