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THE EFFECT OF GAME-BASED LEARNING SCRAMBLE MODEL ON COGNITIVE LEARNING OUTCOMES IN MATHEMATICS OF FIFTH GRADE STUDENTS

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Abstract. The low cognitive learning outcomes in mathematics, particularly in fraction material, was the main problem identified in fifth grade at MI Cipamutih, with 60% of students failing to achieve the Minimum Mastery Criteria (KKM). This study aims to examine the effectiveness of the Game-Based Learning (GBL) scramble model in improving cognitive mathematics learning outcomes. The method used a quantitative approach with a quasi-experimental Nonequivalent Control Group Design. The subjects consisted of 54 fifth-grade students (27 experimental, 27 control). The learning achievement test instrument was tested for validity, reliability (0.887), discrimination power, and difficulty level before use. Data analysis used the Mann-Whitney U test, Wilcoxon signed-rank test, N-Gain, and Cohen's r effect size. The results showed no significant difference in the pre-test (Sig.=0.660; p>0.05), but a very significant difference in the post-test (Sig.=0.000; p<0.05) with the experimental class mean score (71.78) much higher than the control (29.37). The experimental class increased by 43.74 points (156%), while the control only increased by 1.18 points (4.2%). The N-Gain value of the experimental class was 60.88% (medium category) and the effect size r=0.799 (large effect category). The conclusion of this study is that the GBL scramble model is proven effective and has a large effect in improving students' cognitive mathematics learning outcomes. This model is recommended as an innovative, low-cost learning alternative that is adaptive for madrasahs with limited digital facilities.

Keywords: Game-Based Learning; Scramble; cognitive learning outcomes; mathematics; Madrasah Ibtidaiyah

I. INTRODUCTION

Cognitive learning outcomes are the main indicator in assessing the success of mathematics learning in elementary schools because they relate to the ability to understand concepts, apply procedures, and analyze problems. In the context of the Merdeka Curriculum, the mastery of cognitive aspects becomes the foundation for numeracy literacy and critical thinking, and from a constructivist perspective, knowledge is actively built through interaction with concrete objects and social environment (Anderson & Krathwohl, 2001; Aziz & Nurachadijat, 2023)Therefore, elementary school children need learning experiences that not only emphasize hierarchical thinking skills but also actively engage them with concrete materials and collaborative social interactions, especially in mathematics.

However, this ideal condition has not been fully achieved by fifth-grade students at MI Cipamutih, a madrasah located in a rural area of Sukabumi Regency with limited digital facilities. Documentation data obtained from the school shows that out of 54 students, only 40% reached the Minimum Mastery Criteria (KKM) of 68 for fraction material, while the remaining 60% scored below the standard. The average score of students was only 28.5, far below the expected completeness. This low learning outcome is not only a numerical problem but also indicates a weak conceptual understanding of fractions, which is a prerequisite material for advanced topics such as decimals, ratios, and algebra.

The causes of this low achievement have been explored through preliminary observations and interviews with teachers and students. Several main factors were identified: (1) the learning process is still dominated by conventional lecture methods and written exercises without using manipulative media or interactive activities; (2) student participation is very low, with only about 5 out of 54 students actively asking questions or responding to the teacher's explanations; (3) most students consider mathematics a difficult, boring, and abstract subject; (4) there is no variation in the learning model used by the teacher, so students are less challenged and less motivated; and (5) limited learning facilities such as the absence of projectors, computers, and digital learning media. These conditions indicate a systemic problem that requires innovative and contextual learning interventions.

To answer this challenge, Game-Based Learning (GBL) offers a potential solution. GBL is an approach that integrates game elements such as challenges, immediate feedback, achievement levels, and competition into the learning process to create a more engaging and meaningful experience (Prensky, 2003). Barz et al. (2024)through a comprehensive meta-analysis of 47 experimental studies proved that GBL has a significant impact on students' mathematics learning achievement, with an average

effect size in the medium to large category. Talkhan et al. (2025) added that this approach is effective in increasing motivation, engagement, and conceptual understanding of students at the elementary school level.

However, the implementation of GBL in madrasahs with limited digital facilities such as MI Cipamutih faces major obstacles: the unavailability of computers, projectors, and stable internet networks. Therefore, an analog GBL model that does not depend on digital devices is needed. One type of analog GBL that is relevant is scramble, which is a learning model that uses shuffled question and answer cards to be matched by students in groups (Jusmawati et al., 2021). According to Saidah (2022), the scramble model trains quick thinking, accuracy, and understanding of concepts through direct manipulation activities and collaboration between students. This model is also low-cost because it only requires cardboard or used paper to make cards.

The superiority of the scramble model is also supported by several previous studies. Hamidah & Salmah (2025) reported that the scramble method on social studies subjects in fifth grade MI increased learning outcomes with t-test significance $p<0.05$. Windriyani & Layyinnati (2024) found that the scramble game method on Akidah Akhlak subjects gave a significant effect with an N-Gain of 56.3% (medium category). Kartikasari (2023) in her classroom action research reported an increase in mastery learning from 45% to 85% after applying scramble. However, most of these studies focused on non-mathematics subjects or used a pre-experimental design without a control group, so their internal validity was still weak.

The research gap that this study aims to fill is: (1) the limited empirical studies on the GBL scramble model on mathematics learning outcomes, especially on the subject of fraction operations; (2) the absence of a quasi-experimental study with a control group that tests the causal effect of the scramble model in the context of a madrasah with limited digital facilities; (3) the lack of measurement of the magnitude of the effect (effect size) of the scramble model, so the practical significance of this model is not yet known. Therefore, this study is important not only to test the effectiveness but also to provide a strong evidence base for policymakers and practitioners.

Based on the description above, this study aims to: (1) determine the difference in cognitive learning outcomes at the pre-test stage between the experimental group (which will receive the GBL scramble model) and the control group (which will receive conventional methods); (2) determine the difference in cognitive learning outcomes at the post-test stage between the two groups; and (3) measure the magnitude of the effect of the GBL scramble model on improving students' cognitive mathematics learning outcomes. The hypotheses proposed are: (H1) there is a significant difference in pre-test results between the two groups (null hypothesis: no difference); (H2) there is a significant difference in post-test results, with the experimental group being superior; and (H3) the GBL scramble model has a large effect (Cohen's $r \geq 0.30$) on improving learning outcomes.

II. RESEARCH METHOD

A. Research Design

This study used a quantitative approach with a quasi-experimental type through a Nonequivalent Control Group Design (Creswell, 2012). This design was chosen because in the context of educational research in madrasahs, the researcher could not perform random assignment of subjects because classes had been formed intact from the beginning of the academic year. Breaking up or reshuffling students would disrupt the ongoing teaching and learning process and conflict with school policies. Therefore, the design used is as follows:

Table 1. NONEQUIVALENT CONTROL GROUP DESIGN PATTERN.

Group	Pre-test	Treatment	Post-test
Experimental (E)	O1	X (GBL Scramble)	O2
Control (C)	O3	- (Conventional)	O4

Description: O1 = experimental group pre-test; O2 = experimental group post-test; O3 = control group pre-test; O4 = control group post-test; X = treatment in the form of learning with the GBL scramble model.

B. Population and Sample

The study population was all fifth-grade students of MI Cipamutih in the 2025/2026 academic year, totaling 54 students. The sample was taken using a saturated sampling technique, where the entire population became the sample. Class V A (n=27) was designated as the experimental group, and class V B (n=27) as the control group. The determination of the experimental and control groups was based on the intact group that had been formed by the school, not by randomization. However, the pre-test results showed that the initial abilities of the two groups were equivalent ($p=0.660$), so the internal validity of the design was still acceptable.

C. Research Instrument

The main instrument was a cognitive learning achievement test on fraction operations. The test consisted of 27 multiple-choice items with four answer choices (a, b, c, d). The instrument was developed based on indicators of cognitive learning outcomes C1 (remembering) to C4 (analyzing) according to Bloom's revised taxonomy. Before use, the instrument was tested on 30 fifth-grade students from another madrasah with equivalent characteristics. The test results showed:

1. Validity: Of the 30 items initially prepared, 27 items were declared valid because r count > r table (0.361) at the 5% significance level. Three invalid items (numbers 10, 27, and 30) were discarded.

2. Reliability: Cronbach's Alpha value = 0.887 (>0.70), which means the instrument has high reliability.
3. Discrimination Power: 1 item had very good discrimination (≥0.70), 15 items had good (0.40-0.69), and 11 items had medium (0.20-0.39). All items were still used after improvements to distractors.
4. Difficulty Level: 24 items (88.9%) had medium difficulty level (0.30-0.67), and 3 items (11.1%) had difficult level (0.27). The proportion of these items was considered good because it varied not only easy and medium items.
5. Distractor Function: 11 items (40.7%) had all distractors functioning well, 16 items (59.3%) had 1-2 distractors that did not function and were revised.

Thus, the final instrument consisted of 27 valid and reliable items and was suitable for use in the actual study.

D. Data Collection Techniques

Data were collected through two techniques: (1) test techniques: pre-test and post-test were given to both groups. The pre-test was given before treatment to measure initial abilities. The post-test was given after four meetings of intervention (two weeks) to measure final learning outcomes. Both tests used the same instrument to ensure comparability. Each test was given in 60 minutes under the supervision of the researcher and the homeroom teacher. (2) Documentation techniques: photos of learning activities, student worksheets, lesson plans, and attendance lists were collected as evidence of implementation.

E. Data Analysis Techniques

Data analysis was performed in several stages. First, descriptive statistical analysis was conducted to find the mean, median, standard deviation, minimum, and maximum scores of each group at pre-test and post-test. Second, the normality prerequisite test was conducted using the Shapiro-Wilk test (because $n < 50$). Third, the hypothesis test to determine the difference between the two groups used the Mann-Whitney U test because the data were not normally distributed. To test the increase within each group from pre-test to post-test, the Wilcoxon signed-rank test was used. Fourth, the N-Gain (Normalized Gain) test was used to measure the effectiveness of the treatment using Hake's (1999) formula. Fifth, the effect size was calculated using Cohen's r from the conversion of the Z value of the Mann-Whitney U test with the formula $r = Z / \sqrt{N}$. The criteria for effect size according to Cohen (1988) are: small effect if $r < 0.10$; medium effect if $0.10 \leq r < 0.30$; large effect if $r \geq 0.30$.

F. Research Procedure

The research procedure consists of three stages: (1) Preparation stage (December 2025-February 2026): licensing, instrument development, instrument testing, and preparation of RPP. (2) Implementation stage (March-April 2026): implementation of the pre-test, treatment in the experimental class using the GBL scramble model, treatment in the control class using the conventional method, post-test. (3) Data analysis and reporting stage (April-June 2026).

III. RESULTS AND DISCUSSION

A. Results

1. Pre-test Results: Initial Equality of Both Groups

The pre-test results showed that the two groups had equivalent initial abilities. The mean score of the experimental class was 28.04 (SD=8.355) and the control class was 28.19 (SD=9.450), a difference of only 0.15 points. The median of both groups was the same, 26.00. The frequency distribution of pre-test scores is presented in Table 2.

Table 2. FREQUENCY DISTRIBUTION OF PRE-TEST SCORES

Interval	Experimental Class	Control Class
11-17	2 (7.41%)	0 (0%)
18-24	7 (25.93%)	4 (14.81%)
25-31	11 (40.74%)	12 (44.44%)
32-38	5 (18.52%)	3 (11.11%)
39-45	1 (3.70%)	2 (7.41%)
46-52	1 (3.70%)	2 (7.41%)
Total	27 (100%)	27 (100%)

Source: SPSS processing data, 2026

The normality test using Shapiro-Wilk showed that the experimental class data were normally distributed (Sig.=0.796>0.05), while the control class data were not normally distributed (Sig.=0.001<0.05). Therefore, the Mann-Whitney U test was used. The results of the Mann-Whitney U test showed Asymp. Sig. (2-tailed) = 0.660 (p>0.05), which means there was no significant difference between the two groups. Thus, it can be concluded that the initial abilities of the two groups were equivalent, so the difference in the post-test could be attributed to the treatment.

2. Post-test Results: Differences After Treatment

After being given different treatments, a very significant difference occurred. The mean post-test score of the experimental class reached 71.78 (SD=8.391), an increase of 43.74 points or 156% from the pre-test. The control class only reached 29.37 (SD=14.918), an increase of only 1.18 points or 4.2%. Table 3 shows the comparison of the two groups' post-test descriptive statistics.

Table 3. COMPARISON OF POST-TEST DESCRIPTIVE STATISTICS

Statistic	Experimental Class (Scramble)	Control Class (Conventional)
Mean	71.78	29.37
Median	70.00	26.00
Mode	70	22
Std. Deviation	8.391	14.918
Minimum	52	15
Maximum	85	93
Range	33	78

Source: SPSS processing data, 2026

The frequency distribution of post-test scores (Table 4) shows that 20 out of 27 students (74.08%) in the experimental class were in the high category (70-81), while 21 out of 27 students (77.78%) in the control class were still in the low category (15-36).

Table 4. FREQUENCY DISTRIBUTION OF POST-TEST SCORES

Interval	Experimental Class	Control Class
15-25	0 (0%)	9 (33.33%)
26-36	0 (0%)	12 (44.45%)
37-47	0 (0%)	4 (14.81%)
48-58	1 (3.70%)	1 (3.70%)
59-69	3 (11.11%)	0 (0%)
70-81	20 (74.08%)	0 (0%)
82-93	1 (3.70%)	1 (3.70%)
Total	27 (100%)	27 (100%)

Source: SPSS processing data, 2026

The Mann-Whitney U test on the post-test data resulted in Asymp. Sig. (2-tailed)=0.000 ($p<0.05$) with a very large difference in mean rank (40.00 vs 15.00). The Wilcoxon signed-rank test within each group showed that the experimental class experienced a significant increase from pre-test to post-test ($Z=-4.549$, $p=0.000$), while the control class did not experience a significant increase ($Z=-0.664$, $p=0.507$). Thus, the GBL scramble model was proven to be significantly superior to conventional methods.

The N-Gain analysis showed that the experimental class had a mean N-Gain of 60.88% (SD=10.24) which is included in the medium effectiveness category ($30\% \leq$ N-Gain $< 70\%$). However, this value is at the upper edge of the medium category (close to high). The minimum N-Gain of the experimental class was 35.14% (still medium category), and the maximum was 78.57% (high category). In contrast, the control class had a mean N-Gain of only 1.99% (SD=17.85), which is included in the low category (N-Gain $< 30\%$). Even the minimum N-Gain of the control class was negative (-22.92%), indicating a decrease in learning outcomes for some students. The median N-Gain of the control class was 0.00%, meaning that most students did not experience any improvement at all.

Table 5. COMPARISON OF N-GAIN STATISTICS

Statistic	Experimental Class	Control Class
Mean N-Gain (%)	60.88	1.99
Median (%)	59.46	0.00
Std. Deviation	10.24	17.85
Minimum (%)	35.14	-22.92
Maximum (%)	78.57	87.50
Category	Medium	Low

Source: SPSS processing data, 2026

The effect size was calculated using Cohen's r from the conversion of the Z value of the Mann-Whitney U test ($Z=5.876$) with $N=54$. The result was $r = 5.876/\sqrt{54} = 5.876/7.348 = 0.799$. According to Cohen's criteria, $r \geq 0.30$ is included in the large effect category. Thus, the GBL scramble model has a very large effect on improving students' cognitive mathematics learning outcomes. The r^2 value of $0.799^2 = 0.6384$ indicates that this model explains about 64% of the variance in the improvement of learning outcomes. Practically, this means that the average learning outcome of the experimental class is at the 79th percentile compared to the control class distribution.

To understand the increase in more detail, the researcher analyzed the mastery of each cognitive indicator (C1-C4) in the experimental class. Table 6 shows the percentage of correct answers per indicator at pre-test and post-test.

Table 6. MASTERY OF COGNITIVE INDICATORS IN THE EXPERIMENTAL CLASS

Cognitive Indicator	Pre-test (%)	Post-test (%)	Increase (points)
C1 (Remembering)	42.3	85.7	43.4
C2 (Understanding)	35.8	78.9	43.1
C3 (Applying)	28.5	74.2	45.7
C4 (Analyzing)	22.1	65.3	43.2
Average	32.2	76.0	43.8

Source: SPSS processing data, 2026

The table shows that the increase in mastery of all cognitive indicators was relatively even, ranging from 43.1 to 45.7 points. The highest increase occurred in the C3 indicator (applying), which is the core of fraction operations. The C4 indicator (analyzing) although initially the lowest (22.1%), after treatment increased to 65.3% (medium category). This shows that the GBL scramble model is effective not only for low-level thinking skills but also for high-level thinking skills.

Out of 27 students in the experimental class, 26 students (96.3%) experienced an increase in scores from pre-test to post-test, and 1 student (3.7%) experienced a constant score (no decrease). The increase ranged from 26 to 59 points. The highest increase was experienced by student E16 (from 11 to 70; increase 59 points; N-Gain 66.29%). The lowest increase was experienced by student E8 (from 26 to 52; increase 26 points; N-Gain 35.14%). In the control class, out of 27 students, 5 students (18.5%) experienced a decrease in scores, 4 students (14.8%) experienced an increase, and 18 students (66.7%) experienced no change (constant). This shows that the GBL scramble model not only increases scores on average but also has a positive impact on almost all students individually.

B. Discussion

The results of this study clearly show that the GBL scramble model is far superior to conventional methods in improving cognitive learning outcomes. The mean post-test of the experimental class (71.78) was 42.41 points higher than the control class (29.37). The increase of 156% in the experimental class compared to only 4.2% in the control class indicates a very drastic difference. These findings are consistent with previous research by Hamidah & Salmah (2025) and Windriyani & Layyinnati, (2024) but with a much larger effect size.

Why is the scramble model so effective? Through the analysis of the learning process, there are at least three main causal mechanisms. First, the mechanism of concrete manipulation. In the experimental class, students were directly involved in matching question and answer cards. When a student held a card that read "3/4 + 1/4" and looked for the answer card "1", they not only memorized the procedure but also physically experienced the addition of fractions. Piaget (1969) called this the concrete operational stage, where physical manipulation is essential for constructing abstract knowledge. In the control class, students only listened to the teacher's explanation and worked on written problems. They never had the opportunity to manipulate objects directly, so the understanding that was formed was shallow and easily forgotten.

Second, the mechanism of social collaboration. The scramble model was done in heterogeneous groups of 4-5 students. Observations during the learning process showed that in groups, students actively discussed, argued, explained, and corrected each other. Students who already understood the concept (the "more knowledgeable other") provided scaffolding to friends who were still struggling. Vygotsky (1978) called this the zone of proximal development. In the control class, learning was individualistic; students sat quietly and worked on problems alone without the opportunity to discuss, so the potential for scaffolding was not utilized.

Third, the mechanism of motivation and engagement. The scramble model includes game elements such as time challenges (groups race to finish fastest), point scores (the fastest and most correct group gets a star), and competition between groups. These elements increase dopamine release, which is associated with increased attention, focus, and memory consolidation (Nadeem et al., 2023). In the control class, there were no game elements; the atmosphere was monotonous and many students looked sleepy, daydreaming, or busy with themselves. This difference in motivation directly impacted the learning outcomes.

The effect size r=0.799 (large effect) has very important practical implications. First, statistically, this means that the average learning outcome of the experimental class is at the 79th percentile compared to the control class distribution. In other words, if a student is randomly selected from the experimental class, the probability that the student has a higher score than a student randomly selected from the control class is 79% (Field, 2024). Second, educationally, this effect size is much larger than the average effect size of educational interventions, which is around 0.20-0.40 (Hattie, 2009). Thus, the GBL scramble model is not just "effective" in a statistical sense, but also "very effective" in an educational sense. Third, practically, with an r^2 of 0.6384, this model explains 64% of the variance in the improvement of learning outcomes. That is, other factors such as initial ability, motivation, or socioeconomic background only explain the remaining 36%. This means that the scramble model is very robust and not easily disturbed by external variables.

An interesting finding from this study is that the improvement occurred relatively evenly across all cognitive indicators from C1 to C4. The increase in C1 (remembering) was 43.4%, C2 (understanding) 43.1%, C3 (applying) 45.7%, and C4 (analyzing) 43.2%. The highest increase occurred in C3 (applying), which is the core of fraction operations. This shows that the scramble model not only helps students remember and understand concepts but also directly trains them to apply procedures and analyze problems. This is a significant advantage over conventional methods which are often only able to improve C1 and C2 but not C3 and C4.

The increase in C4 (analyzing) from 22.1% (very low) to 65.3% (medium) is particularly noteworthy. This indicates that through the process of matching shuffled cards, students are trained to see relationships between concepts, identify patterns, and evaluate the correctness of an answer. These are all higher-order thinking skills. Thus, the GBL scramble model can be considered a model that promotes higher-order thinking (HOTS), not just rote memorization.

The results of this study are consistent with the meta-analysis conducted by Barz et al. (2024)which concluded that GBL has a significant positive effect on cognitive learning outcomes (Hedges' g=0.64). However, the effect size found in this study (r=0.799) is larger than the average reported by (Barz et al., 2024). This could be because the scramble model includes more

intensive group collaboration elements than digital GBL which is often done individually. The meta-analysis by (Talkhan et al., 2025)also showed that cooperative learning had an effect size of d=0.72 on mathematics achievement. The scramble model combines cooperative learning (group work) with game elements, so the effect becomes even larger.

Compared to previous studies on the scramble model specifically, this study has several advantages. First, this study used a quasi-experimental design with a control group, so causal inference is stronger than the pre-experimental or PTK designs used by most previous researchers. Second, this study measured effect size, so the practical significance of the model is known, not just statistical significance. Third, this study was conducted in the context of a madrasah with very limited digital facilities, so the results are more generalizable to similar contexts.

The effectiveness of the scramble model is reinforced by Rosadi et al (2023) who found that video-based media innovation increases student self-efficacy, as well as Delpasya et al (2022) who proved that the inquiry learning model positively affects PAI learning outcomes. The social collaboration mechanism in the scramble aligns with Rosadi, et al (2023) on improving prosocial attitudes through planning management. Furthermore, Rosadi et al (2023) emphasize the importance of concrete manipulation in learning, while Marwiji et al (2021) demonstrate that parental guidance (analogous to peer scaffolding) increases learning motivation in distance education a principle that also applies to the group work mechanism in the scramble model.

Interestingly, the results of this study can be analyzed within the framework of Islamic educational values. Q.S. Al-'Alaq verses 1-5 command reading (iqra') which is repeated twice, indicating that the process of acquiring knowledge must be done repeatedly and continuously to obtain deep understanding (Shihab, 2012). The scramble model implements this principle of repetition (takrar) through the activity of matching cards that is repeated in every meeting with variations in difficulty level. In addition, the hadith narrated by Al-Bukhari (no. 77) about the parable of three types of soil in receiving rainwater (knowledge) shows that every individual has the potential to receive knowledge, but with different capacities. The scramble model, with its group collaboration mechanism, can activate students in the "barren soil" category through interaction with "fertile soil" and "hard soil" students. This process reflects the principle of ta'awun (helping each other) in Q.S. Al-Ma'idah verse 2.

One of the main contributions of this study is that the GBL scramble model is proven effective in a madrasah context with very limited digital facilities. MI Cipamutih does not have computers, projectors, or internet networks. However, by only using cardboard, markers, and scissors, the researcher succeeded in creating an effective learning medium. This shows that innovation does not always have to rely on expensive technology. The scramble model is a low-cost, easy-to-implement, and highly effective innovation. This is very relevant for thousands of madrasahs in rural areas of Indonesia that face similar constraints.

This study has several limitations that need to be acknowledged. First, the locus of the study was limited to one madrasah with a sample of 54 students, so the generalization of the findings needs to be tested in a wider context (multisite study). Second, the intervention time was only 4 meetings (equivalent to 2 weeks), which is not enough to measure long-term effects (long-term retention) and transfer of learning to other materials. Third, the focus was on the cognitive domain C1-C4 and has not yet covered HOTS (C5-C6) as demanded by the Merdeka Curriculum. Fourth, no measurement of mediating variables (motivation, engagement, self-efficacy) was carried out that could explain the causal mechanism of the scramble model's effect more comprehensively. Fifth, this study has not tested the interaction between the scramble model and moderator variables such as gender, initial ability, or learning style.

Based on these limitations, the recommended future research agenda includes: (1) replication of the study with a randomized controlled trial (RCT) design and a larger sample in several madrasahs; (2) longitudinal studies to measure long-term retention (3-6 months after intervention); (3) mixed-methods studies combining quantitative experiments with in-depth interviews and participatory observations to understand the psychological and social mechanisms of the scramble model's effectiveness; (4) development studies (design-based research) to test and refine the "SCRAMBLE" model (Scaffolded, Collaborative, Reflective, Adaptive, Mobile-based, Blended, and Evaluative Scramble); (5) comparative studies between analog scramble and digital scramble to identify the most effective and efficient mode of implementation in different contexts; (6) studies on the effectiveness of scramble on other mathematics materials (geometry, measurement, statistics) and other educational levels (lower grades, junior high school).

IV. CONCLUSION

Based on the results of the study and discussion, it can be concluded that there was no significant difference in the pre-test results between the experimental group (which would receive the GBL scramble model) and the control group (which would receive conventional methods). The mean pre-test of the experimental class was 28.04 and the control class 28.19, with a difference of only 0.15 points. The Mann-Whitney U test showed Asymp. Sig. = 0.660 ($p > 0.05$). This means that the initial abilities of the two groups were equivalent, so this condition is a valid foundation for proceeding to the treatment stage.

Furthermore, a very significant difference was found in the post-test results between the experimental group and the control group. The experimental class had a mean post-test of 71.78 (an increase of 43.74 points or 156%), while the control class only reached 29.37 (an increase of 1.18 points or 4.2%). The Mann-Whitney U test showed Asymp. Sig. = 0.000 ($p < 0.05$) with a very large difference in mean rank (40.00 vs 15.00). The Wilcoxon test showed that the experimental class had a significant increase ($p=0.000$) while the control class did not ($p=0.507$). Thus, the GBL scramble model proved significantly superior to conventional methods.

Finally, the GBL scramble model has a very large effect on improving students' cognitive mathematics learning outcomes. The N-Gain of the experimental class reached 60.88% (medium category, upper edge) while the control class was only 1.99% (low category). The effect size (Cohen's r) was 0.799, which is included in the large effect category ($r \geq 0.30$). This means that the average score of the experimental class is higher than 79% of the students in the control class, and the scramble model explains 64% of the variance in learning outcome improvement. Thus, this model is proven effective, low-cost, easy to implement, and aligned with the values of Islamic education.

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