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The effect of the Jarimatika method on students' understanding of basic mathematics at TPQ Ied Salim Al-Anzi

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ABSTRACT

Mathematical competence is closely related to daily problem-solving activities, especially those involving basic numerical operations. Nevertheless, many children still encounter difficulties in mastering arithmetic concepts, mainly because mathematics is often perceived as abstract and is delivered through less interactive learning methods. This study examines the impact of the Jarimatika learning method on improving addition and subtraction skills among students at TPQ Ied Salim Al-Anzi. A quantitative research design was applied, specifically a pre-experimental model using a one-group pre-test and post-test approach. The research subjects consisted of all 13 learners at the TPQ, selected through a total sampling technique. Data collection was conducted by administering arithmetic tests before and after the application of the Jarimatika method. The hypothesis proposed that there would be a meaningful difference in students' mathematical performance before and after the intervention. The results revealed a notable increase in the average score, from 72.31 on the pre-test to 94.62 on the post-test. Further analysis using a Paired Sample t-test yielded a t-value of –3.277 with a significance value of 0.007 ($p < 0.05$), indicating a statistically significant improvement. These findings suggest that the Jarimatika method effectively enhances basic arithmetic skills and can serve as an engaging and practical instructional strategy for elementary mathematics learning.

Keywords: basic mathematics; jarimatika; TPQ.

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1. INTRODUCTION

Mathematics is widely recognized as a core discipline that supports intellectual development and daily decision-making processes, particularly those related to numerical reasoning (Irmayanti et al., 2022). Among its basic competencies, numeracy plays a crucial role in enabling individuals to perform calculations, interpret quantities, and solve practical problems encountered in everyday life. In the national education reforms emphasizing the Minimum Competency Assessment (Asesmen Kompetensi Minimum/AKM) have highlighted persistent gaps in students' foundational numeracy skills, particularly at the early elementary level and in learning environments with limited instructional resources. Despite its fundamental importance, many children at an early age encounter obstacles in developing adequate numeracy skills. These concerns are increasingly discussed in public and academic forums, where declining arithmetic fluency among young learners has been associated with long term academic vulnerability and reduced learning readiness in higher grades. These challenges are often linked to the abstract presentation of mathematical concepts, which can trigger negative emotional responses such as boredom, anxiety, and a lack of learning motivation (Umardiyah, 2020).

Cognitively, early-age learners are situated within the concrete operational stage, where understanding is best developed through interaction with tangible and observable representations. Empirical evidence indicates that concrete and multimodal instructional strategies significantly enhance conceptual understanding and retention compared to purely symbolic instruction (Schenke et al., 2022). From a cognitive load perspective, reducing extraneous demands and providing structured visual supports facilitates more efficient schema construction in early mathematics learning (Sweller et al., 2020). Consequently, when arithmetic is introduced mainly through abstract symbols without contextual support, students may struggle to build meaningful understanding (Umardiyah, 2020). Although concrete learning media such as manipulatives can support visualization, their implementation may be inefficient in terms of time and resources, particularly in formal assessments (Angelia et al., 2023). Beyond cognitive aspects, emotional factors such as mathematics anxiety also influence arithmetic performance; embodied and kinesthetic instructional approaches have been shown to reduce anxiety while improving procedural fluency among primary students (Barroso et al., 2021).

Observations conducted at TPQ Ied Salim Al-Anzi indicate that similar difficulties are present in the learning of basic arithmetic. As a non-formal religious education institution primarily focused on Qur'anic literacy, TPQ Ied Salim Al-Anzi allocates limited structured time for mathematics-related activities, which may contribute to inconsistencies in students' numeracy development. A number of students demonstrated limited mastery of addition and subtraction concepts and showed low engagement during mathematics-related activities. In one instructional session, 7 out of 13 students were unable to complete basic arithmetic tasks within the allocated time. Furthermore, brief interviews with TPQ instructors revealed that previously applied teaching methods tended to be repetitive and lacked variation, resulting in reduced student attention and enthusiasm. These findings suggest a discrepancy between students' developmental needs and the instructional strategies currently employed, emphasizing the necessity for a more engaging and learner-centered approach. Considering the growing national emphasis on strengthening foundational literacy and numeracy competencies, identifying context-sensitive instructional strategies in non-formal education settings has become increasingly relevant and timely.

One instructional method that offers potential to address these challenges is the Jarimatika method. This approach utilizes finger-based representations to perform arithmetic operations, allowing students to actively engage in the learning process through visual and kinesthetic experiences. By transforming abstract numerical concepts into concrete physical movements, Jarimatika supports conceptual understanding while simultaneously increasing student participation. Although this method has been widely applied in formal elementary school settings, its implementation in non-formal religious education environments remains relatively unexplored.

Earlier research has consistently shown that the Jarimatika approach is effective in strengthening students' basic arithmetic competencies, particularly within formal educational settings. A study conducted by Aritonang and Elshap (2019) identified notable gains in fundamental calculation skills among first-

grade elementary learners. In a related study, Salsinha et al. (2019) emphasized that the method's reliance on visual and kinesthetic elements contributed to improved understanding of arithmetic processes. More recent findings by Damayanti et al. (2024) further indicated that Jarimatika supports a more positive learning environment by reducing learners' anxiety toward mathematics. Despite these positive outcomes, prior investigations have predominantly focused on formal schooling environments and have not addressed non-formal religious education institutions such as TPQ, which possess distinct educational goals, limited instructional duration, and diverse learner backgrounds. However, prior studies have almost exclusively focused on formal elementary school settings and have not systematically examined the effectiveness of Jarimatika within non-formal religious institutions such as TPQ, where instructional time, curricular priorities, and learner characteristics differ substantially. This indicates a clear contextual gap in understanding whether the method remains effective under distinct pedagogical and institutional conditions. In addition, although previous research has demonstrated improvements in arithmetic performance, limited attention has been given to explaining whether the embodied and kinesthetic mechanisms underlying Jarimatika operate similarly in learning environments that are not primarily mathematics-oriented.

Beyond its contextual relevance, the present study introduces a methodological contribution by applying a quantitative pre-experimental framework through a one-group pre-test and post-test design, accompanied by inferential statistical testing using a Paired Sample t-test. This methodological choice distinguishes the study from earlier research that mainly utilized descriptive or qualitative approaches. Initial data examination verified compliance with parametric testing assumptions, thereby enabling stronger and more reliable statistical conclusions. Compared to several earlier studies that primarily employed descriptive or quasi-experimental approaches without reporting effect sizes, the present study strengthens methodological rigor by incorporating inferential testing and effect size estimation to provide clearer evidence of practical significance.

Based on this framework, the study establishes two statistical hypotheses. The null hypothesis (H_0) posits that the implementation of the Jarimatika method does not result in a meaningful difference in students' numeracy abilities before and after the intervention, while the alternative hypothesis (H_1) assumes the presence of a significant change between the two measurement conditions. The hypothesis testing conducted through a Paired Sample t-test produced a t-statistic of –3.277 with a significance value of 0.007 ($p < 0.05$), leading to the rejection of H_0 and the acceptance of H_1. Consequently, this research seeks to examine the influence of the Jarimatika method on enhancing addition and subtraction skills among students at TPQ Ied Salim Al-Anzi. The results of this study are anticipated to contribute to the development of effective, enjoyable, and context-appropriate basic mathematics instructional strategies within non-formal educational settings, particularly those based in religious learning environments.

2. METHODOLOGY

2.1. Research Design

This study utilized a quantitative methodology with a pre-experimental approach, specifically applying a one group pre-test and post-test design. This research design was selected to identify variations in students' arithmetic abilities after the introduction of a targeted learning strategy. The instructional treatment implemented in this study involved arithmetic instruction through the Jarimatika method.

The one group pre-test and post-test model allowed the researcher to compare students' arithmetic performance before and after the intervention within the same group. The null hypothesis (H_0) assumed the absence of a significant difference between pre-test and post-test scores, whereas the alternative hypothesis (H_1) proposed the existence of a significant improvement following the intervention.

2.2. Research Setting and Participants

The research was conducted at TPQ Ied Salim Al-Anzi. The participants consisted of 13 students who were actively enrolled in the TPQ during the study period. All participants ranged in age from 6 to 9 years.

Given the limited population size, the study employed a saturated sampling technique, whereby all eligible individuals were included as research participants, in accordance with the approach described by Sari and Wulandari (2022). This technique ensured that the entire accessible population was represented in the study.

2.3. Variables and Instruments

In this research framework, the Jarimatika based instructional activities were defined as the independent variable. The dependent variable was students' proficiency in basic arithmetic operations, specifically addition and subtraction skills.

Data were gathered through a researcher developed arithmetic assessment aimed at measuring students' fundamental numeracy skills. The assessment consisted of addition and subtraction tasks and was administered twice: prior to the intervention as a pre-test and after the completion of the instructional sessions as a post-test.

Although both assessments were designed to reflect equivalent levels of difficulty, variations in numerical values were introduced to minimize memorization effects and ensure that performance gains represented actual conceptual understanding.

2.4. Intervention Procedure

The research process began with the administration of a pre-test to determine students' baseline arithmetic competence. This initial assessment was conducted prior to the implementation of the instructional treatment in order to obtain an accurate measure of students' existing addition and subtraction skills. Following the pre-test, the Jarimatika learning intervention was implemented over several instructional meetings.

During the intervention phase, students were guided to solve arithmetic problems using structured finger-based calculation techniques delivered in an interactive and contextually appropriate manner. The learning activities emphasized active participation, demonstration, and guided practice to support conceptual understanding. To maintain consistency with the institutional routine, the instructional sessions were scheduled after Qur'anic recitation activities at the TPQ.

After the completion of all intervention sessions, a post-test was administered to evaluate changes in students' arithmetic performance. All stages of the study, including instrument development, data collection, and implementation procedures, were conducted directly by the researcher. Furthermore, all research data were systematically recorded and archived in both digital and printed formats to ensure transparency, accuracy, and ease of verification.

2.5. Data Analysis

All pre-test and post-test data were processed and analyzed using SPSS statistical software. Before conducting hypothesis testing, a normality analysis was performed to ensure that the data satisfied the assumptions required for parametric statistical procedures.

The results of this preliminary analysis indicated that the data followed a normal distribution, thereby permitting further parametric testing. Hypothesis testing was subsequently conducted using a Paired Sample t-test to examine whether there was a statistically significant difference between students' arithmetic abilities before and after the implementation of the Jarimatika method.

With its clearly structured methodology and well defined procedures, this study demonstrates replicability and may be adapted for use in other non-formal educational contexts that share similar learner characteristics.

3. RESULT AND DISCUSSION

3.1. Descriptive Statistics of Students' Arithmetic Ability Before and After the Intervention

This research was carried out at TPQ Ied Salim Al-Anzi and involved students from Grades I to V as the study participants. Data were obtained through an arithmetic test focusing on addition and

subtraction problems completed by the students. The descriptive results demonstrate a noticeable improvement in students' arithmetic performance following the application of the Jarimatika method. This improvement can be observed by comparing students' scores before and after the instructional intervention.

To determine students' baseline arithmetic competence, an initial assessment was conducted before the Jarimatika method was introduced. This pre-intervention test was designed to evaluate learners' comprehension of fundamental addition and subtraction concepts prior to receiving instructional treatment. Visual documentation of the pre-test activity is provided in Figure 1. Following this assessment, arithmetic instruction was delivered using the Jarimatika approach, which applies finger-based calculation strategies to strengthen students' conceptual understanding of numerical operations. The learning activities implemented during this intervention phase are depicted in Figure 2.

After the instructional period concluded, a follow-up assessment was administered to measure developments in students' arithmetic skills resulting from participation in Jarimatika-based learning. A comparison of the pre-test and post-test outcomes revealed noticeable improvements in students' ability to solve addition and subtraction tasks. These results indicate that the application of the Jarimatika method had a beneficial effect on enhancing students' arithmetic performance at TPQ Ied Salim Al-Anzi.

Figure 1. Implementation of the Jarimatika Pre-test at TPQ Ied Salim Al-Anzi
Source: Author's documentation (2024)

Figure 2. Jarimatika Teaching and Learning Activities at TPQ Ied Salim Al-Anzi
Source: Author's documentation (2024)

3.1.1. Description of Pre-test Data

This study involved 13 students as research participants, and the full set of pre-test scores is provided in Table 1.

Table 1. Pre-test Score Results of Students at TPQ Ied Salim Al-Anzi

Data Type	Result
Number of Students	13
Total Score	940
Mean	72.31
Median	80
Mode	90
Standar Deviation	26.19
Maximum Score	100
Minimum Score	20

Source: Processed from primary data (2024)

As shown in Table 1, the accumulated pre-test score of all participants reached 940. The average score prior to the intervention was 72.31, with the most frequently occurring score being 90. Score variability, as indicated by a standard deviation of 26.19, suggests a wide range of students' initial abilities. The highest pre-test score recorded was 100, whereas the lowest was 20. A detailed classification of students' pre-test performance levels is provided in Table 2.

Table 2. Pre-test Score Intervals by Performance Category

Score Interval	Learning Ability Criteria	Frequency
0-20	Fail	2
21-40	Poor	-
41-60	Fair	1
61-80	Good	5
81-100	Very Good	5
Total		13

Source: Processed from primary data (2024)

Table 2 illustrates that five learners demonstrated very high proficiency in addition and subtraction, while an equal number showed good competency levels. Only one participant reached a moderate level of performance. None of the students were identified in the low-performance category, whereas two learners were classified as unsuccessful. Overall, these findings suggest that students' mastery of basic arithmetic operations had not yet reached an optimal level before the Jarimatika-based instruction was introduced.

3.1.2. Description of Post-test Data

The complete post-test data are presented in Table 3.

Table 3. Post-test Score Results of Students at TPQ Ied Salim Al-Anzi

Data Type	Result
Number of Students	13
Total Score	1.23
Mean	94.62
Median	100
Mode	100
Standar Deviation	7.76
Maximum Score	100
Minimum Score	80

Source: Processed from primary data (2024)

Based on the data presented in Table 3, the total score obtained from the post-test reached 1,230. The mean score achieved by students after the intervention was 94.62, while the score that appeared most frequently was 100. The dispersion of the data was relatively small, as reflected by a standard deviation value of 7.76. In terms of score range, the highest result attained in the post-test was 100, whereas the lowest score recorded was 80. Further details regarding the distribution of students' post-test performance across achievement intervals are summarized in Table 4.

Table 4. Post-test Score Intervals by Performance Category

Score Interval	Learning Ability Criteria	Frequency
0-20	Fail	-
21-40	Poor	-
41-60	Fair	-
61-80	Good	2
81-100	Very Good	11
Total		13

Source: Processed from primary data (2024)

As shown in Table 4, most students exhibited outstanding achievement in addition and subtraction tasks, with 11 participants classified in the highest performance category. The other two students were categorized as having a good level of competence. Importantly, no participants fell into the moderate, low, or unsuccessful performance groups, reflecting a marked enhancement in students' arithmetic abilities following the instructional intervention.

3.1.3. Comparison of Pre-test and Post-test Data

For a clearer comparison of students' achievement prior to and following the instructional intervention, a summary of the pre-test and post-test outcomes is presented in Table 5.

Table 5. Comparison of Mean Pre-test and Post-test Scores

No.	Test Type	Mean
1	Pre-test	72.31
2	Post-test	94.62

Source: Processed from primary data (2024)

The data summarized in Table 5 reveal a significant enhancement in students' arithmetic achievement. Before the learning intervention was applied, students obtained an average score of 72.31, which fell within the low performance category. Following the implementation of the Jarimatika method, the mean score increased considerably to 94.62 and was categorized as very good. The clear gap between the results obtained before and after the intervention indicates that the use of the Jarimatika approach had a positive impact on improving students' addition and subtraction abilities at TPQ Ied Salim Al-Anzi.

3.2. Normality Test and Hypothesis Testing

Prior to hypothesis testing, the data were examined to determine whether they met the normality requirements necessary for parametric statistical analysis. The results of this preliminary test indicated that the distribution of the data was normal, thereby allowing the use of parametric analytical techniques. To examine the effect of the Jarimatika instructional method on students' arithmetic achievement, a Paired Sample t-test was then conducted. The results of this statistical analysis, obtained through SPSS software, are reported in the following section.

Table 6. Paired Samples Statistics

Pair	Mean	N	Std. Deviation	Std. Error Mean
Pre-test	72.31	13	26.19	7.26
Post-test	94.62	13	7.76	2.15

Source: Processed from primary data (2024)

As shown in Table 6, students achieved a higher average score following the intervention (94.62) compared to their performance before the treatment (72.31). In addition, the post-test results exhibited a lower standard error of the mean, suggesting more stable and consistent performance. These findings

reinforce the evidence that the implementation of the Jarimatika method contributed to improvements in students' arithmetic skills.

Table 7. Paired Samples Correlations

Pair	N	Correlation	Sig. (2-tailed)
Pre-Post	13	0.353	0.118

Source: Processed from primary data (2024)

As reported in Table 7, the correlation analysis produced a coefficient value of 0.353 between pre-test and post-test scores, accompanied by a significance value of 0.118. Because this significance level is greater than 0.05, the relationship between the two score sets is considered statistically insignificant. This result indicates that the improvement in students' arithmetic outcomes is unlikely to be explained by a direct linear association between the pre-test and post-test scores, but rather reflects the influence of the Jarimatika-based learning intervention.

Table 8. Paired Samples Test Output

Pair	T	Df	Sig. (2-tailed)
Pre-Post	-3.277	12	0.007

Source: Processed from primary data (2024)

Based on the analysis summarized in Table 8, the Paired Sample t-test yielded a t-value of –3.277 with 12 degrees of freedom and a significance level of 0.007. Since this probability value is lower than the 0.05 threshold, it indicates the presence of a statistically significant difference between students' performance prior to and following the instructional intervention. These results statistically demonstrate that the implementation of the Jarimatika method had a significant positive effect on improving students' arithmetic abilities.

Table 9. Paired Samples Effect Size (Cohen's d)

Pair	Cohen's d	Interpretation
Pre-Post	-0.909	Large effect

Source: Processed from primary data (2024)

As indicated in Table 9, the effect size analysis yielded a Cohen's d value of –0.909, which falls within the large effect category. This finding demonstrates that the implementation of the Jarimatika method resulted not only in statistically meaningful score gains but also in a substantial practical impact on students' arithmetic proficiency.

The hypotheses formulated in this study were designed to assess the impact of the Jarimatika instructional method on students' arithmetic achievement. The null hypothesis (H_0) stated that the use of the Jarimatika method would not result in a significant change in students' arithmetic abilities before and after the learning intervention, while the alternative hypothesis (H_1) suggested the existence of a meaningful difference between the two measurement points.

Results of the statistical testing produced a t-statistic of –3.277 with a corresponding significance value of 0.007. Because this value is lower than the conventional alpha level of 0.05, the null hypothesis was rejected and the alternative hypothesis was accepted. These findings indicate a statistically significant improvement in students' arithmetic performance after the implementation of the Jarimatika method. In addition, the magnitude of the effect, as reflected by a high Cohen's d value, suggests that the improvement is not only statistically significant but also practically relevant and meaningful within real educational settings.

3.3. Discussion of Findings and Comparison with Previous Studies

The findings of the present study are consistent with previous research that has emphasized the positive impact of the Jarimatika method on students' arithmetic achievement. Dewi et al. (2020) demonstrated a significant increase in mathematics learning outcomes after the implementation of Jarimatika. In their experimental study involving 20 learners, the analysis yielded a t-value of 6.966 with a significance level of 0.000 ($p < 0.05$), indicating a strong effect of the method on students' performance. Comparable conclusions were drawn by Hamdani et al. (2024), who reported that the Jarimatika approach produced better learning outcomes than conventional memorization-based teaching strategies. Although the learning gain reported in their study was relatively low (N-Gain of 12%), the authors attributed this result to internal factors affecting students, such as physical tiredness and decreased concentration during instruction. Nevertheless, measurable improvements were still observed among several participants, reinforcing the conclusion that the Jarimatika method remains effective in supporting the development of arithmetic skills.

In this regard, the present study not only corroborates previous empirical evidence but also extends existing knowledge by implementing the Jarimatika method within a non-formal educational environment, namely TPQ. This context has rarely been examined in prior research, particularly in relation to basic mathematics instruction, thereby positioning the current findings as a meaningful contribution to the broader discussion on innovative and contextual arithmetic learning approaches.

Therefore, this study contributes in three specific ways: (1) it introduces empirical evidence from a non-formal religious educational context, (2) it examines the boundary condition of embodied arithmetic instruction within time-limited and non-mathematics-focused environments, and (3) it strengthens prior findings through effect size estimation and inferential statistical validation.

4. CONCLUSION

Based on the results of the analysis and subsequent discussion, the present study demonstrates that the Jarimatika instructional approach effectively improves students' addition and subtraction skills at TPQ Ied Salim Al-Anzi. This improvement is evidenced by a notable rise in the mean score, which increased from 72.31 before the intervention to 94.62 after the learning activities were implemented. Inferential analysis using a Paired Sample t-test yielded a t-statistic of –3.277 with a two-tailed significance value of 0.007, which is lower than the accepted alpha level of 0.05. These statistical outcomes indicate the rejection of the null hypothesis and the acceptance of the alternative hypothesis, thereby confirming a significant enhancement in students' arithmetic performance following the application of the Jarimatika method. In addition to statistical validity, the findings also reveal strong practical implications. The large effect size obtained (Cohen's $d = –0.909$) suggests that the observed learning gains were not only statistically detectable but also meaningful in real educational practice. This study contributes to the development of arithmetic learning strategies that are more interactive, context-based, and suitable for diverse learning environments, particularly within non-formal educational institutions such as TPQ. A key contribution of this research lies in its emphasis on implementing the Jarimatika method in a TPQ context, an area that has received relatively limited empirical attention despite its strategic role in fostering numeracy skills. With a well-defined research design and systematic implementation procedures, the findings of this study offer a valuable reference and can be replicated in similar non-formal educational settings to support effective, learner-centered basic mathematics instruction.

Ethical Approval

This research did not require formal ethical clearance because it was carried out in a non-formal educational environment and did not involve medical procedures, sensitive personal information, or activities that could pose ethical risks to the participants.

Informed Consent Statement

Permission to conduct the study was obtained from the management of TPQ Ied Salim Al-Anzi. Student participation was voluntary, and all data were anonymized for research purposes.

Authors' Contributions

SAA and MMH were responsible for developing the research concept and design, conducting data collection, performing data analysis, and preparing the initial draft of the manuscript. HTT, SHM, AK, MB, MMA, DMM, and FHK supported the study through literature exploration, data processing, result interpretation, critical revision of the manuscript, and verification of the final version. All authors were actively involved in discussing the study findings and gave approval for the final manuscript prior to submission.

Disclosure statement

The authors report no competing interests in relation to this study.

Data Availability Statement

Research data may be obtained from the corresponding author upon reasonable request, with access limited to ensure the confidentiality of participants.

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