
Effectiveness Analysis of Cooking Class Learning on Early Childhood Fine Motor Development Based on N-Gain Scores

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Abstract— Fine motor development is an essential aspect of early childhood education because it supports children’s readiness for writing, drawing, and other daily learning activities. However, learning activities in many early childhood education institutions are still dominated by conventional approaches that provide limited opportunities for children to engage in direct and meaningful experiences. This study aimed to analyze the effectiveness of cooking class learning on early childhood fine motor development based on N-Gain scores at RA Baitul Ibadah. The study employed a quantitative approach using a quasi-experimental design involving 40 children aged 5–6 years divided into experimental and control classes. Data were collected through observation sheets, pretest-posttest assessments, and documentation, then analyzed using descriptive statistics, N-Gain analysis, normality tests, homogeneity tests, and independent sample t-tests. The results showed that the experimental class achieved a higher posttest mean score (37.55) compared to the control class (26.75). The average N-Gain score in the experimental class reached 66.35%, while the control class obtained 29.16%. Hypothesis testing indicated a significant difference between both classes with a significance value of $0.000 < 0.05$. These findings indicate that cooking class learning effectively improves children’s fine motor development through hands-on learning experiences. Therefore, cooking class activities are recommended as innovative and child-centered learning strategies in early childhood education.

Keywords: *Cooking Class Learning; Fine Motor Development; Early Childhood Education; N-Gain Analysis.*

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1. Introduction

Early childhood education plays a strategic role in optimizing children’s developmental potential during the golden age period. One of the important developmental aspects that must be stimulated from an early age is fine motor development because it is closely related to children’s readiness to perform academic and daily life activities such as writing, drawing, coloring, cutting, and coordinating hand movements. Fine motor skills involve the coordination of small muscles, particularly the fingers and hands, with visual control in a precise and organized manner. Therefore, learning activities that provide direct experiences and involve active hand movements are essential for supporting optimal child development.

In practice, fine motor stimulation in many early childhood education institutions is still dominated by conventional activities such as worksheets, tracing, and repetitive writing exercises. These activities often limit children’s opportunities to actively explore and manipulate objects directly. As a result, some children experience difficulties in holding pencils correctly, controlling hand movements, following writing directions, and coloring accurately. Learning environments that rely heavily on teacher-centered instruction may reduce children’s engagement and participation during classroom activities. Previous studies emphasized that meaningful and activity-based learning approaches are more effective in

improving children's developmental competencies, creativity, participation, and higher-order thinking skills compared to passive instructional methods [1]–[5].

Based on preliminary observations conducted at RA Baitul Ibadah, several children aged 5–6 years still demonstrated low fine motor abilities. Some children were unable to hold pencils properly, had difficulties connecting dots and coloring pictures neatly, and experienced limitations in coordinating hand movements during learning activities. Classroom learning was also found to provide limited practical activities that could stimulate children's finger flexibility and hand-eye coordination optimally. Consequently, children tended to become less enthusiastic and less actively involved during the learning process. This condition indicates the need for more innovative, interactive, and child-centered learning activities that encourage direct participation and experiential learning.

One learning activity considered relevant for stimulating fine motor development is cooking class learning. Cooking class activities involve children directly in practical experiences such as cutting, stirring, pouring, arranging, squeezing, rolling, and decorating food ingredients. These manipulative activities naturally stimulate finger strength, hand flexibility, movement precision, and hand-eye coordination. Cooking activities also encourage children's creativity, independence, collaboration, and problem-solving skills through enjoyable and contextual learning experiences. Previous studies reported that cooking-based activities effectively improved children's fine motor abilities and supported meaningful learning experiences in early childhood education settings [6], [7]. Furthermore, practical and project-based learning activities have been shown to enhance students' participation, creativity, critical thinking, collaboration, and learning achievement across educational contexts [3], [4], [8]–[15].

In addition, experiential and technology-supported learning approaches are increasingly recognized as important strategies for improving children's engagement and developmental outcomes. Studies on digital educational games, augmented reality learning media, virtual reality learning, and project-based learning demonstrated positive effects on children's cognitive engagement, analytical thinking, creativity, and learning participation [16]–[23]. Although these studies highlight the importance of innovative learning approaches, practical hands-on learning activities remain highly relevant for early childhood education because young children learn most effectively through direct physical interaction with learning materials.

The urgency of this study is closely related to the increasing need for developmentally appropriate and meaningful learning strategies in early childhood education. Fine motor skills are foundational competencies that support children's readiness for writing activities and further educational stages. If children receive insufficient stimulation during early childhood, they may experience difficulties in academic readiness and classroom participation in elementary education. Therefore, learning activities that actively engage children through concrete and enjoyable experiences, such as cooking class learning, are important to implement in early childhood education institutions.

Several previous studies have discussed cooking activities, culinary learning, project-based learning, and practical instructional approaches in educational settings [6], [24]–[27]. However, studies specifically analyzing the effectiveness of cooking class learning on early childhood fine motor development using N-Gain scores are still limited. Most previous studies only focused on descriptive improvements without quantitatively measuring the effectiveness category of learning outcomes. Therefore, the novelty of this study lies in the use of N-Gain analysis to measure the effectiveness level of cooking class learning on children's fine motor development quantitatively. In addition, this study implemented various contextual cooking activities such as making jasuke (corn with milk and cheese), rolled bread, banana compote, and fruit satay as practical learning experiences appropriate for children aged 5–6 years.

Based on these explanations, this study aims to analyze the effectiveness of cooking class learning on early childhood fine motor development based on N-Gain scores at RA Baitul Ibadah. Specifically, this

study seeks to: (1) identify differences in fine motor development between the experimental and control classes, (2) measure improvements in children’s fine motor skills before and after the implementation of cooking class learning, and (3) determine the effectiveness category of cooking class learning based on N-Gain analysis.

2. Method

2.1 Research Design

This study employed a quantitative approach using a quasi-experimental method with a non-equivalent control group design. The study involved two groups consisting of an experimental class and a control class. The experimental class received cooking class learning treatment, while the control class received conventional learning activities commonly implemented in the classroom. Both groups were administered a pretest before treatment and a posttest after treatment to measure children’s fine motor development. The research design is presented in Table 1.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experimental Class	O1	X	O2
Control Class	O3	-	O4

Description:

O1 = Pretest of experimental class

O2 = Posttest of experimental class

O3 = Pretest of control class

O4 = Posttest of control class

X = Cooking class learning treatment

2.2 Research Location and Participants

This study was conducted at RA Baitul Ibadah during the 2024/2025 academic year. The participants consisted of children aged 5–6 years in Group B. The total sample of the study was 40 children divided into two classes, namely 20 children in the experimental class and 20 children in the control class.

The experimental class participated in cooking class learning activities designed to stimulate fine motor skills through direct manipulation of tools and food materials. Meanwhile, the control class received conventional learning activities without cooking class intervention.

2.3 Research Procedure

The study was conducted through three stages, namely pretest, treatment, and posttest.

1. Pretest Stage

At the initial stage, both classes were given a pretest to determine the children’s initial fine motor abilities before treatment. The assessment was conducted through observation using a fine motor development instrument.

2. Treatment Stage

The experimental class received cooking class learning treatment for four meetings. Each activity was designed to stimulate children’s finger flexibility, hand-eye coordination, gripping ability, and hand movement control. The cooking class activities implemented in this study are presented in Table 2.

Before Table 2 is presented, it should be noted that each cooking activity involved practical movements such as cutting, arranging, stirring, pouring, decorating, and holding tools, which are closely related to fine motor stimulation.

Table 2. Cooking Class Activities in the Experimental Class

Meeting	Activity	Fine Motor Stimulation
1	Making jasuke (corn with milk and cheese)	Peeling, cutting, pouring, sprinkling cheese
2	Making rolled bread	Rolling, arranging fillings, decorating
3	Making banana compote	Cutting bananas, stirring ingredients, serving
4	Making fruit satay	Peeling, cutting, skewering fruits, decorating

During the learning process, children were guided directly by the teacher while remaining actively involved in every cooking step. The control class, on the other hand, participated in regular classroom learning activities without cooking class implementation.

3. Posttest Stage

After all treatments were completed, both classes were given a posttest using the same instrument as the pretest. The purpose of the posttest was to identify changes in children’s fine motor development after the learning intervention.

2.4 Research Instrument

The instrument used in this study was an observation sheet of fine motor development consisting of five indicators, namely: (1) ability to use writing tools, (2) ability to move writing tools, (3) ability to move hands following writing directions, (4) ability to copy letters, and (5) ability to connect dots.

Before Table 3 is presented, it is important to explain that the instrument used a four-point rating scale to measure the level of children’s fine motor achievement during learning activities.

Table 3. Fine Motor Development Assessment Criteria

Score	Criteria
1	Child is not yet able to write
2	Child is able to write with teacher assistance
3	Child is able to write correctly
4	Child is able to write correctly and neatly

The observation instrument was used during pretest and posttest activities to obtain quantitative data on children’s fine motor development.

2.5 Data Analysis Technique

The data obtained in this study were analyzed quantitatively using descriptive and inferential statistics. Descriptive analysis was used to determine the mean, minimum score, maximum score, and standard deviation of pretest, posttest, and N-Gain scores.

To determine the effectiveness of cooking class learning, the normalized gain (N-Gain) formula (1) was applied. The N-Gain formula used in this study is presented below.

$$N-Gain = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum Score} - \text{Pretest Score}} \times 100\% \quad (1)$$

The N-Gain results were interpreted into effectiveness categories as shown in Table 4. Before Table 4 is

presented, it should be emphasized that the N-Gain interpretation was used to determine the effectiveness level of cooking class learning in improving children’s fine motor development.

Table 4. N-Gain Interpretation Criteria

N-Gain Percentage	Interpretation
< 40%	Ineffective
40% – 55%	Less effective
56% – 75%	Moderately effective
> 76%	Highly effective

Furthermore, prerequisite tests consisting of normality and homogeneity tests were conducted before hypothesis testing. The normality test used the Kolmogorov–Smirnov and Shapiro–Wilk tests, while the homogeneity test used Levene’s test. Hypothesis testing was then conducted using an independent sample t-test with a significance level of 0.05 to determine whether there was a significant difference between the experimental and control classes.

3. Results and Discussion

3.1 Comparison of Pretest and Posttest Scores

Before the implementation of cooking class learning, both the experimental and control classes were administered a pretest to measure children’s initial fine motor abilities. After the treatment, a posttest was conducted to determine the improvement in fine motor development. The comparison of pretest and posttest scores is presented in Table 5.

Table 5. Comparison of Pretest and Posttest Scores

Class	Pretest Mean	Posttest Mean	Score Improvement
Experimental	23.8	37.55	13.75
Control	19.3	26.75	7.45

Based on Table 5, both classes experienced improvement in fine motor scores after the learning process. However, the experimental class showed a substantially higher increase than the control class. The score improvement in the experimental class reached 13.75 points, while the control class only improved by 7.45 points. These findings indicate that cooking class learning provided better stimulation for children’s fine motor development. To provide a clearer comparison, the mean score improvement between both classes is illustrated in Figure 1.

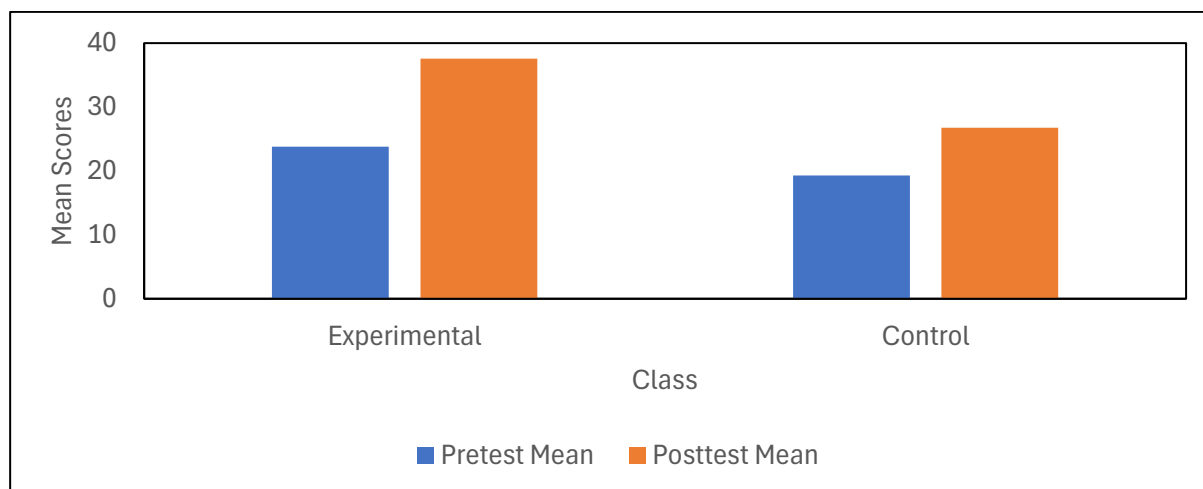


Figure 1. Comparison of Pretest and Posttest Mean Scores

Figure 1 shows that the posttest score increase in the experimental class was higher than in the control class, indicating the positive contribution of cooking class learning toward fine motor improvement.

3.2 N-Gain Analysis

The effectiveness of cooking class learning was analyzed using N-Gain scores. N-Gain analysis was used to determine the magnitude of improvement in children’s fine motor abilities after the learning treatment.

Before presenting the N-Gain analysis results, it should be emphasized that higher N-Gain percentages indicate higher learning effectiveness. The results of the N-Gain analysis are presented in Table 6.

Table 6. N-Gain Analysis Results

Indicator	Experimental Class	Control Class
Mean N-Gain (%)	66.35	29.16
Minimum (%)	4.76	6.67
Maximum (%)	95	58.33

Based on Table 6, the experimental class obtained an average N-Gain score of 66.35%, while the control class achieved only 29.16%. According to the N-Gain interpretation criteria, the experimental class was categorized as moderately effective, whereas the control class was categorized as ineffective. These results demonstrate that cooking class learning was more effective in improving early childhood fine motor development compared to conventional learning. The comparison of N-Gain scores between the two classes is illustrated in Figure 2.

Figure 2 demonstrates that the experimental class consistently achieved higher N-Gain scores than the control class. This finding confirms the effectiveness of cooking class learning in stimulating fine motor development.

3.3 Descriptive Statistics of N-Gain Scores

Further statistical analysis was conducted to examine the distribution of N-Gain scores in both classes. The descriptive statistics are presented in Table 7.

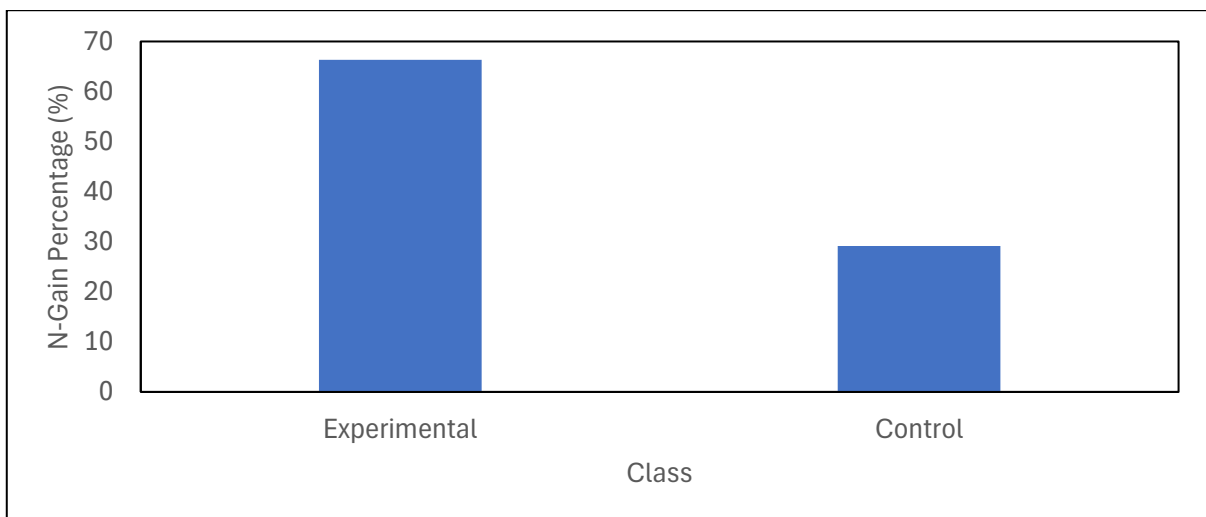


Figure 2. Comparison of N-Gain Scores

Table 7. Descriptive Statistics of N-Gain Scores

Statistic	Experimental	Control
Mean	66.35	29.16

Statistic	Experimental	Control
Median	65	26.25
Standard Deviation	21.33	13.87
Minimum	4.76	6.67
Maximum	95	58.33

Table 7 indicates that the experimental class obtained higher mean and median values than the control class. The maximum N-Gain score in the experimental class reached 95%, indicating very high improvement in several participants after participating in cooking class learning activities.

3.4 Normality and Homogeneity Tests

Before hypothesis testing, prerequisite analyses consisting of normality and homogeneity tests were conducted. The results of the normality test are presented in Table 8.

Table 8. Results of Normality Test

Class	Shapiro-Wilk Sig.	Interpretation
Experimental	0.05	Normal
Control	0.26	Normal

Based on Table 8, the significance values of both classes were greater than or equal to 0.05, indicating that the data were normally distributed.

After normality testing, the homogeneity test was conducted to determine the equality of variances between both classes. The results are presented in Table 9.

Table 9. Results of Homogeneity Test

Test Type	Class/Variable	Statistic	Sig. Value	Interpretation
Normality Test (Shapiro-Wilk)	Experimental Class	0.902	0.05	Normal
Normality Test (Shapiro-Wilk)	Control Class	0.942	0.26	Normal
Homogeneity Test (Levene Test)	N-Gain Scores	0.247	0.622	Homogeneous

Based on Table 9, the significance value was greater than 0.05, indicating that the data variances were homogeneous.

3.5 Hypothesis Testing

Hypothesis testing was conducted using an independent sample t-test to determine whether there was a significant difference between the N-Gain scores of the experimental and control classes. The t-test results are presented in Table 10.

Table 10. Independent Sample t-Test Results

Variable	Levene Sig.	t-value	df	Sig. (2-tailed)	Mean Difference	Interpretation
N-Gain Scores	0.622	6.547	38	0	39.401	Significant Difference

Based on Table 10, the significance value was 0.000, which was lower than 0.05. Therefore, there was a significant difference between the experimental and control classes. These findings indicate that cooking class learning significantly affected early childhood fine motor development based on N-Gain scores.

The findings of this study indicate that cooking class learning was effective in improving early childhood fine motor development. This effectiveness was demonstrated by the higher N-Gain score in the

experimental class compared to the control class. The average N-Gain score of 66.35% indicates that cooking class learning reached the moderately effective category.

The increase in fine motor development occurred because cooking class activities required children to perform repeated manipulative movements involving hand and finger coordination. Activities such as cutting, pouring, arranging, rolling, and decorating food ingredients stimulated children's small muscle movements intensively. These activities contributed to the improvement of hand flexibility, coordination accuracy, and movement control.

The significantly higher N-Gain score in the experimental class also indicates that practical and activity-based learning provides more effective stimulation than conventional classroom learning. Through direct involvement in learning activities, children had greater opportunities to practice fine motor coordination in meaningful situations.

Meanwhile, the lower N-Gain score in the control class suggests that conventional learning activities provided less intensive motor stimulation. Children in the control class had fewer opportunities to engage in manipulative and exploratory activities requiring active hand coordination.

The statistical analysis further strengthens these findings. The independent sample t-test showed a significance value of $0.000 < 0.05$, confirming that cooking class learning had a significant effect on children's fine motor development. Therefore, cooking class learning can be considered an effective learning strategy for improving fine motor skills in early childhood education.

Overall, the findings confirm that cooking class learning provides effective stimulation for early childhood fine motor development as indicated by the higher N-Gain scores achieved in the experimental class at RA Baitul Ibadah.

4. Conclusion

Based on the results of the study, cooking class learning was proven to be effective in improving early childhood fine motor development at RA Baitul Ibadah. This finding was indicated by the higher improvement in posttest scores and N-Gain scores in the experimental class compared to the control class.

The experimental class achieved an average N-Gain score of 66.35%, while the control class obtained 29.16%. In addition, the independent sample t-test showed a significance value of $0.000 < 0.05$, indicating a significant difference between the two classes. These results confirm that cooking class learning had a significant effect on children's fine motor development.

Cooking class activities effectively stimulated children's fine motor abilities through direct manipulative movements such as cutting, pouring, arranging, rolling, and decorating food ingredients. These activities enhanced hand-eye coordination, finger flexibility, and movement control through practical learning experiences.

Therefore, cooking class learning can be recommended as an effective and engaging learning activity to support fine motor development in early childhood education.

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