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The Effect of Ecoprint Batik Activities on Fine Motor Skills of 5-6 Year Old Children

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ABSTRACT

This study aims to determine the effect of ecoprint batik activities on the fine motor skills of 5-6-year-old children at Pertiwi Pemwilda Kindergarten. The study used a quantitative approach with a quasi-experimental design and a *Non-Equivalent Control Group Design*. The study sample consisted of 20 children selected using a purposive sampling technique, consisting of 10 children in the experimental group who were given ecoprint batik activities and 10 children in the control group who were given collage activities. Data collection techniques included observation, testing, and documentation. Data were analyzed using descriptive statistics and the non-parametric *Wilcoxon Signed Rank Test* with the help of SPSS version 26. The results of the descriptive analysis showed that the average fine motor skills of the experimental group increased from 16.00 in the pre-test to 20.70 in the post-test, while the control group increased from 15.80 to 16.60. The results of the Wilcoxon test showed that the experimental group obtained a Z value = -2.859 with a significance of 0.004 (< 0.05), while the control group obtained a significance value of 0.066 (>0.05), so that the increase in the control group was not statistically significant. The effect size value of r = 0.904 indicates that ecoprint batik activities have a large influence on improving children's fine motor skills, especially in aspects of eye and hand coordination, finger flexibility, movement accuracy, and independence in completing tasks. Thus, ecoprint batik activities have a significant effect on improving the fine motor skills of children aged 5-6 years at Pertiwi Pemwilda Kindergarten.

1. Introduction

Early childhood education plays a crucial role in establishing the foundation for children's development across various aspects, including physical motor skills (Syamsuardi et al., 2025). According to the National Association for the Education of Young Children (NAEYC), early childhood, between the ages of 0-8, is known as the "golden age," a period when children experience rapid growth and development, requiring appropriate stimulation to optimize all aspects of their development (Hasmawaty & Bachtiar, 2022). Motor skill development is crucial for children to grow and develop optimally (Rusmayadi et al., 2024). One developmental aspect that requires attention is fine motor skills, as they play a role in supporting children's learning readiness at the next level of education.

Hurlock explains that fine motor skills are related to a child's increasing ability to coordinate body movements involving small muscles and the nervous system that supports detailed movements (Wulandari & Bachtiar, 2021). Fine motor skills involve coordination

between the eyes and small muscles, particularly the fingers, to perform various activities precisely and purposefully (Akollo et al., 2023). These skills are necessary for children in daily activities such as drawing, cutting, pasting, writing, and creating art. Children aged 5-6 are expected to be able to coordinate eye-hand movements through various activities that require precision and accuracy (Febriyanti et al., 2023). Therefore, appropriate stimulation is necessary for optimal development of children's fine motor skills.

Problems with fine motor development are still found in early childhood. Data from the World Health Organization (WHO) in 2016 showed that approximately 43% of children in developing countries experience developmental delays. Furthermore, the 2017 Basic Health Research noted that approximately 5-19% of preschool-aged children experience fine motor development disorders (Rahayu et al., 2023). This data indicates that fine motor skills remain a developmental aspect that requires attention through appropriate stimulation tailored to the characteristics of early childhood.

One form of stimulation that can be provided is through learning activities that involve direct hand-eye coordination, the use of small finger muscles, and fun manipulative activities. Ecoprint batik activities have begun to be introduced as a creative activity in early childhood education (PAUD) environments, but their use in learning is still not optimal. In fact, ecoprint has great potential as a learning medium that can stimulate children's fine motor skills, because it involves various activities such as tracing, arranging, pressing, and hitting leaves on cloth, which require hand-eye coordination. Until now, children are more often involved in learning activities that are routine and lack variety, so stimulation of fine motor skills has not developed optimally.

Initial observations conducted at Pertiwi Kindergarten in Pemwilda on September 8, 2025, showed that the fine motor skills of children aged 5-6 years still need optimal stimulation. In cutting and pasting activities using worksheets, several children experienced difficulties when cutting curved patterns and pasting images according to the provided patterns. In addition, in collage activities, children still had difficulty coordinating finger movements when cutting and pasting small materials and using excessive glue, resulting in less neat work. These conditions indicate the need for more varied and interesting learning activities to help improve children's fine motor skills.

Based on these conditions, ecoprint batik activities were chosen as an alternative learning method to improve children's fine motor skills. Ecoprint batik is a batik technique that utilizes natural materials such as leaves and flowers to create motifs on fabric (Narullah et al., 2024). This study used the pounding technique, which transfers the shape and color of leaves to the fabric through a beating process. The activity of arranging leaves, arranging patterns, pressing, and beating leaves on the fabric allows children to use their eye-hand coordination intensively, thus potentially stimulating fine motor development. Furthermore, ecoprint activities also provide opportunities for children to explore and express their creativity through the use of natural materials (Fatmala & Hartati, 2020).

Several previous studies have shown that ecoprint batik activities can improve fine motor skills in early childhood. Research by Latifah & Ismet (2023) found that children's fine motor skills in classes given ecoprint activities were higher than in control classes. Research by Suwandi et al. (2025) demonstrated that ecoprint activities significantly improved fine motor skills in early childhood. Meanwhile, Jariah et al. (2023) reported that children's fine motor skills improved with each ecoprint learning cycle, reaching the very good development category.

Internationally, recent studies have consistently reinforced the efficacy of ecoprint as a pedagogical tool. Bachtiar et al. (2025), through a rigorous quasi-experimental design, demonstrated that ecoprint-based media significantly enhances fine motor coordination,

particularly in aspects of visual-motor integration and task independence among preschoolers. Similarly, Suroto et al. (2026) found that structured ecoprint activities using natural dyes significantly improved finger flexibility, grip strength, and movement accuracy, reporting a substantial effect size. Wulandari et al. (2025) further validated these findings, showing that the application of ecoprint techniques on totebag media yielded marked improvements in children's hand-eye coordination and precision. Additionally, Alyannur & Sitorus (2024) emphasized that the sensory-rich experience of pounding and arranging natural materials provides unique proprioceptive feedback that accelerates neuromuscular control in young children. These international evidences collectively underscore the global relevance of ecoprint as an effective intervention for early motor development.

However, there are still gaps in the research that require further examination. The research by Jariah et al. (2023) used a classroom action research approach focused on improving the learning process. The research by Suwandi et al. (2025) employed a one-group pretest-posttest design without a control group, so the effectiveness of the treatment cannot be compared more objectively. Furthermore, research examining ecoprint as a systematically designed learning intervention through a quasi-experimental design to improve children's fine motor skills is still limited. Therefore, research is needed that can provide stronger empirical evidence regarding the influence of ecoprint batik activities on children's fine motor skills.

This study differs from previous studies because it applies ecoprint batik activities using pounding techniques on totebag media with a *Non-Equivalent Control Group Design* involving an experimental group and a control group. This approach allows for a more objective evaluation of the effect of ecoprint batik activities on the fine motor skills of children aged 5-6 years. Based on this description, this study aims to determine the effect of ecoprint batik activities on the development of fine motor skills of children aged 5-6 years at Pertiwi Pemwilda Kindergarten.

2. Method

This research employed a quantitative approach. Quantitative methods are research approaches that focus on collecting and analyzing data in the form of numbers and numerical measurements (Ardiansyah et al., 2023). The research used a quasi-experimental design. In this type of research, two related groups within the same class are compared to determine changes resulting from the treatment (Hasmawaty et al., 2023). The researchers divided the study subjects into two groups: an experimental group that received the intervention, and a control group that received no treatment, so that differences in outcomes between the two could be analyzed. This study used a quasi-experimental design with a *Non-Equivalent Control Group Design* (NCD). This model allows researchers to compare the results of the two groups, even though the subjects were not randomly assigned, allowing them to assess the effects of the treatment.

The research was conducted at Pertiwi Pemwilda Kindergarten in the even semester of the 2025/2026 academic year for approximately four weeks. The population in this study were all 40 children aged 5-6 years at Pertiwi Pemwilda Kindergarten. The research sample consisted of 20 children in group B at Pertiwi Pemwilda Kindergarten, divided into 10 children in the experimental group who were given ecoprint batik treatment and 10 children in the control group who were given collage activities. The sample is a portion of the population that was specifically selected to represent the whole, with the aim that the results of the analysis can be generalized (Subhaktiyasa, 2024). The sampling technique used purposive sampling with inclusion criteria, namely children aged 5-6 years, registered as

active students at Pertiwi Pemwilda Kindergarten, having regular attendance during the research, and being able to follow learning instructions given by teachers and researchers.

The variables in this study consist of the independent variable, namely ecoprint batik activities. The dependent variable is children's fine motor skills. Fine motor skills are measured through four indicators: the ability to coordinate eye and hand movements, the ability of flexibility and flexibility of finger muscles, the ability of precision of hand movements during activities, and independence in producing works. The research instrument is a checklist observation sheet compiled based on four indicators of fine motor skills and consists of seven assessment sub-indicators with a score range of 1-4. The observation instrument was then validated by two expert validators in early childhood education to ensure the suitability of the indicators, the clarity of the assessment items, and the feasibility of using the instrument in the study. Based on the results of validation and revisions according to the validator's suggestions, the instrument was declared suitable for use in the study. Furthermore, a reliability test was conducted using *Alpha Cronbach* with the help of SPSS version 26 and obtained a reliability coefficient of 0.799 which indicates that the instrument has a high and consistent level of reliability for use in data collection.

Data collection techniques included observation, testing, and documentation. Observations were conducted to observe the development of children's fine motor skills during the activity. Tests were conducted through pre-tests and post-tests using student worksheets (LKPD) to determine the development of children's abilities before and after treatment. Documentation was used to obtain supporting data in the form of photos of activities and children's work during the study. The research procedure was carried out in several stages, namely administering a pre-test to both groups using the same LKPD design for all students, with the aim of obtaining an initial picture of children's fine motor skills before being given different learning treatments for each group. Next, the experimental group participated in an ecoprint batik activity using the pounding technique by utilizing leaves and flowers on a tote bag medium, while the control group participated in a collage activity using paper materials. The treatment was given over four meetings with a duration of 50 minutes each meeting. After the entire series of treatments were completed, a post-test was conducted using LKPD designed to assess children's fine motor skills after being given the treatment.

Data analysis was conducted using descriptive and non-parametric statistics with the help of SPSS version 26. Descriptive statistics were used to provide an overview of the development of children's fine motor skills through ecoprint batik activities. Data presentation includes frequency distributions, mean values, standard deviations, and percentages of data related to the development of children's fine motor skills. Before testing the research hypothesis, a group equivalence test using the *Mann-Whitney U test* was conducted on the pre-test scores of the experimental and control groups to ensure that both groups had equivalent initial abilities. Non-parametric statistical analysis techniques were used to determine whether there was an effect of ecoprint batik activities on children's fine motor skills. This study used a non-parametric statistical test, namely the *Wilcoxon Signed Rank Test*, which was analyzed using the SPSS version 26 application. This test was chosen to determine significant differences before and after treatment in the same group.

3. Result and Discussion

Research Results

Data collection was conducted over approximately four weeks at Pertiwi Kindergarten, Pemwilda, during the even semester of the 2025/2026 academic year. The study involved 20 children aged 5-6 years: 10 in the experimental group and 10 in the control group. The

experimental group received a treatment in the form of ecoprint batik, while the control group received a collage activity. All students participated in a series of studies that included a pre-test, four sessions of treatment, and a post-test. Assessments were based on four indicators: the ability to coordinate eye-hand movements, the ability to flex and flex finger muscles, the ability to accurately and precisely perform hand movements during activities, and the ability to independently produce work.

Data analysis was conducted using descriptive statistics and non-parametric statistics with the help of SPSS version 26. Descriptive statistical analysis was conducted with the aim of determining the differences in fine motor skills of children aged 5-6 years between the experimental group given treatment in the form of ecoprint batik activities and the control group given collage activities. The use of non-parametric statistics was chosen because the number of research samples was relatively small (n = 10 in each group), so the analysis was conducted using the *Mann-Whitney U test* and the *Wilcoxon Signed Rank Test*. The presentation of the pre-test and post-test data for the experimental and control groups is described below.

Table 1. Pre-test Frequency Distribution for Experimental and Control Groups

	Experimental Group			Control Group	
Interval	Category	Frequency	Percentage	Frequency	Percentage
7-11	Poor (K)	0	0	0	0
12-16	Sufficient (C)	7	70%	8	80%
17-21	Good (B)	3	30%	2	20%
22-28	Very Good (SB)	0	0	0	0
	Total	10	100%	10	100%

Based on Table 1, the pre-test results for the experimental group show that the majority of children fell into the Sufficient (C) category, comprising 7 children (70%) of the total students, and 3 children (30%) fell into the Good (B) category. Meanwhile, there were no children in the Poor (K) or Very Good (SB) categories. Meanwhile, the pre-test results for the control group showed that the majority of children fell into the Sufficient (C) category, comprising 8 children (80%), and 2 children (20%) fell into the Good (B) category. Meanwhile, there were no children in the Poor (K) or Very Good (SB) categories. After the treatment, a post-test was conducted. The following table shows the frequency distribution of fine motor skills of children aged 5-6 years in the experimental and control groups after treatment.

Table 2. Post-test Frequency Distribution for Experimental and Control Groups

	Experimental Group		Control Group		
Interval	Category	Frequency	Percentage	Frequency	Percentage
7-11	Poor (K)	0	0	0	0
12-16	Sufficient (C)	0	0	5	50%
17-21	Good (B)	6	60%	5	50%
22-28	Very Good (SB)	4	40%	0	0
	Total	10	100%	10	100%

Based on Table 2, the post-test results for the experimental group indicate an improvement in children's fine motor skills after being given the ecoprint batik activity. Six children (60%) were in the Good (B) category, while four children (40%) were in the Very Good (SB) category. No children were in the Poor (K) or Fair (C) categories. Meanwhile, the post-test results for the control group indicated an improvement in children's fine motor

skills after being given the collage activity. Five children (50%) were in the Fair (C) category and five children (50%) were in the Good (B) category. However, no children achieved the Very Good (SB) category.

Table 3. Descriptive Statistics Analysis of Pre-test and Post-test Scores for the Experimental and Control Group

	N	Minimum	Maximum	Mean	Median	Std. Deviation
Pre-test Experimental	10	15	17	16.00	16.00	.816
Post-test Experimental	10	19	22	20.70	20.50	1.252
Valid N (listwise)	10					
Pre-test Control	10	15	17	15.80	16.00	.632
Post-test Control	10	15	19	16.60	16.60	1.430
Valid N (listwise)	10					

Table 3 shows that the mean fine motor skill score for the experimental group before treatment was 16.00, with a median of 16.00, and a standard deviation of 0.816. After the ecoprint batik activity, the average score increased to 20.70, with a median of 20.50, and a standard deviation of 1.252. The results of the descriptive statistics analysis show that the average score for the experimental group increased from 16.00 in the pre-test to 20.70 in the post-test. This increase is 4.70 points, or approximately 29.38%. Furthermore, the median score increased from 16 to 21, with a score range increasing from 15-17 to 19-22. The mean score for fine motor skills in the control group before treatment was 15.80, and the median score was 16.00, with a standard deviation of 0.632. Meanwhile, in the control group, the mean score increased from 15.80 to 16.60, representing an increase of 0.80 points, or approximately 5.06%. The median score increased from 16 to 17, with a score range of 15-17 to 15-19. This increase indicates that the collage activity stimulated the development of children's fine motor skills. However, the improvement was still relatively low and not evenly distributed across all students.

Before testing the hypotheses, a *Mann-Whitney U test* was conducted on the pre-test scores of the experimental and control groups to determine the equality of the two groups' initial abilities. The analysis results showed an *Asymp. Sig.* (*2-tailed*) of 0.734 ($p > 0.05$). Thus, there was no significant difference between the pre-test scores of the experimental and control groups. These results indicate that both groups had equivalent initial abilities, making them suitable for comparing the effects of the treatments.

2. Non-Parametric Statistical Analysis

Data analysis using the *Wilcoxon Signed Rank Test* (SRT) in the experimental group was conducted to determine the effect of the ecoprint batik activity on the fine motor skills of children aged 5-6 years by comparing the pre-test and post-test results. The *Wilcoxon Signed Rank Test* (SRT) was used to determine the difference between two measurements on the same subject before and after treatment. The decision-making criteria were: if the *2-tailed Sig.* < 0.05, there is a significant difference; if the *2-tailed Sig.* < 0.05, there is no significant difference after treatment. The results of the *Wilcoxon Signed Rank Test* (SRT) for the fine motor skills of children aged 5-6 years in the experimental group are presented in the following table.

Table 4. *Wilcoxon Signed Rank Test* for the Experimental and Control Groups

Group	N	Z-score	*Asymp. Sig. (2-tailed)*	Interpretation
Experimental Group **(Ecoprint Batik)**	10	-2.859[b]	.004	Significant ($p < 0.05$)
Control Group (Collage Activity)	10	-1.841[b]	.066	Not Significant ($p > 0.05$)

Based on the combined results presented in Table 2.1, a comparative analysis of the two groups reveals distinct patterns in the development of fine motor skills following the intervention. For the experimental group**,** the *Wilcoxon Signed Rank Test* yielded a Z-score of -2.859 with an *Asymp. Sig.* (*2-tailed*) of 0.004. Because this significance value is considerably lower than the 0.05 alpha threshold, the null hypothesis is rejected. This confirms that there is a statistically significant difference between children's fine motor skills before and after participating in ecoprint batik activities. In practical terms, the ecoprint intervention produced a measurable and meaningful improvement in the children's ability to coordinate eye-hand movements, flex their finger muscles, and complete tasks with greater precision and independence.

In contrast, the control group demonstrated a Z-score of -1.841 with an *Asymp. Sig.* (*2-tailed*) of 0.066. Since this value exceeds the 0.05 significance level, the null hypothesis is accepted. This indicates that there is no statistically significant difference between the pre-test and post-test scores of children who engaged in collage activities. Although the control group's average score increased slightly (from 15.80 to 16.60), this change was not robust enough to be deemed statistically meaningful within the study's timeframe. This suggests that while collage activities provide basic motor stimulation, they lack the multi-sensory and complex manipulative demands required to drive substantial fine motor progression.

When comparing both groups**,** the experimental group not only achieved a significant result but also exhibited a markedly larger increase in mean scores (a 4.70-point gain) compared to the control group (a 0.80-point gain). The disparity in Z-scores and significance levels underscores that ecoprint batik activities are substantially more effective than conventional collage activities in enhancing fine motor skills for children aged 5–6 years.

Furthermore, to determine the practical magnitude of the treatment effect, an effect size calculation to the experimental group's Z-score (-2.859) and total sample size (N = 10). The calculation yields an absolute effect size of $r = 0.904$. According to Cohen's criteria, this value is well above the threshold for a large effect ($r > 0.50$). Consequently, the ecoprint batik activity not only demonstrates statistical significance but also exerts a very strong practical influence on improving fine motor skills. This finding reinforces that the structured, nature-based, and multi-step nature of ecoprint activities provides intensive, high-quality stimulation that effectively accelerates neuromuscular development in early childhood.

Discussion

The results of this study indicate that ecoprint batik activities significantly improved the fine motor skills of 5-6-year-old children at Pertiwi Pemwilda Kindergarten. This is demonstrated by the increase in the average score of the experimental group from 16.00 to 20.70, as well as the Wilcoxon test, which showed a significance value of 0.004 ($p < 0.05$). Furthermore, the effect size of 0.904 indicates that the ecoprint batik activity had a significant effect.

According to Shanty (2022), suboptimal fine motor development can be caused by a lack of supportive learning media, limited opportunities for children to engage in activities that improve eye-hand coordination, and the use of a lack of varied learning methods, resulting in a lack of interest in actively participating in activities. Therefore, engaging, creative learning activities that provide children with hands-on experiences are necessary to ensure optimal fine motor skill development.

The improvement in fine motor skills in the experimental group is thought to have occurred because ecoprint batik activities involve various manipulative activities that require intensive hand-eye coordination. In this activity, children not only perform one type

of movement, but also engage in various stages, such as selecting leaves and flowers, arranging patterns on tote bags, arranging materials, pressing natural materials, and using pounding techniques to create prints. This series of activities requires precise hand movements, finger control, grip strength, visual-motor coordination, and independence in completing tasks.

The large effect size observed in this study (r = 0.904) strongly corroborates the findings of Bachtiar et al. (2025), who reported a similarly high impact of ecoprint-based media on fine motor coordination using a rigorous quasi-experimental framework. Furthermore, Suroto et al. (2026) observed that activities involving pounding techniques, akin to those used in this study, provide intensive proprioceptive feedback beneficial for neuromuscular control and finger dexterity. Wulandari et al. (2025) also noted marked improvements in eye-hand coordination and precision among children who engaged in ecoprint on totebag media, which parallels the current study's findings on visual-motor integration. Additionally, Alyannur & Sitorus (2024) emphasized that ecoprint offers a richer sensory experience compared to conventional crafting, which explains its superior efficacy in stimulating multifaceted fine motor skills. These international findings align closely with the present results, reinforcing that ecoprint activities are not only culturally relevant but also globally effective pedagogical tools.

These findings align with Latifah & Ismet (2023), who demonstrated that ecoprint batik activities significantly influence the fine motor skills of young children. Meanwhile, Suwandi et al. (2025) suggested that ecoprint batik activities can improve the fine motor skills of children aged 5-6 years. Consistent with this, research by Jariah et al. (2023) demonstrated that ecoprint batik activities are effective in promoting the development of fine motor skills in early childhood.

Although the control group given collage activities also experienced an increase in their average score from 15.80 to 16.60, the Wilcoxon test results showed that this increase was not statistically significant (p = 0.066). This finding suggests that collage activities still stimulate children's fine motor development, but the effect was not strong enough to produce significant changes over the study period.

Although the increase was not as significant as in the experimental group, collage activities still helped children develop fine motor skills. This is in line with research by Busriyah et al. (2023), which showed that using collage as a learning medium is effective and suitable for the development of fine motor skills in early childhood. Alisah et al. (2023) stated that collage activities are indeed effective in improving children's fine motor skills because they require eye-hand coordination.

The insignificant improvement in the control group is likely because collage activities tend to be simpler and offer less complex movement variations. Children are more likely to stick on pre-made patterns, limiting the opportunity to explore a wider range of hand movements. While these activities improve hand-eye coordination, they don't offer ample opportunities to explore more complex fine motor skills.

Unlike collage activities, ecoprint batik activities provide a richer learning experience because they involve exploring natural materials and various stages of work. The complexity of ecoprint activities allows children to use more motor skills simultaneously, such as grasping, arranging, pressing, hitting, and lifting materials. Therefore, the stimulation children receive is more diverse and contributes to optimal fine motor skill development.

This study strengthens the findings of previous research on the effectiveness of ecoprint activities in developing fine motor skills in early childhood. However, this study does not claim that ecoprint is a completely new approach. The contribution of this study lies in the

use of a quasi-experimental design with a control group so that the effectiveness of ecoprint batik activities can be directly compared with collage activities that also aim to develop children's fine motor skills. Furthermore, this study has a novelty in the implementation of ecoprint batik activities using the pounding technique with tote bags and natural materials such as leaves and flowers, which are carried out in stages over four meetings. These activities not only focus on the resulting work but also provide opportunities for children to engage in various activities that involve hand-eye coordination, finger flexibility, movement precision, and independence in completing tasks. Thus, the results of this study indicate that ecoprint batik activities are an effective learning alternative for improving the fine motor skills of 5-6-year-old children at Pertiwi Pemwilda Kindergarten.

This study has several limitations, including the relatively small sample size (20 children), the use of a quasi-experimental design without subject randomization, and the treatment duration of only four sessions. Furthermore, fine motor skills were measured using observation sheets, which could potentially be subjective in the assessment. Therefore, further research is recommended involving a larger sample size, a longer intervention duration, and examining the effect of ecoprint batik activities on other aspects of child development.

4. Conclusion

Based on the research results, ecoprint batik activities significantly improved the fine motor skills of 5-6-year-old children at Pertiwi Pemwilda Kindergarten. Improvement in the experimental group was greater than in the control group, which received collage activities. These findings suggest that, in the context of this study, ecoprint batik activities can be an alternative learning method to stimulate children's fine motor skills. Teachers can integrate ecoprint activities into art and environmental education regularly. Future research is recommended to expand this study with different variables, increase the number of samples, and extend the treatment duration to obtain more comprehensive results.

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