JPUD-PB-191-1-10.pdf

by Pascasarjana PSUB Turnitin

Submission date: 22-Apr-2025 08:33AM (UTC-0700)
Submission ID: 2653567913
File name: JPUD-PB-191-1-10.pdf (301.32K)
Word count: 5586
Character count: 31336

JURNAL PENDIDIKAN USIA DINI
2025, VOL. 19, No. 1, 01-10
e-ISSN (Online Media): 2503-0566
P-ISSN (Print Media): 1693-1602
http://journal.unj.ac.id/unj/index.php/jpud

Exploring Ecoprint-Based Media: Enhancing Fine Motor Skills in Early Childhood Education

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ABSTRACT:
Fine motor skills are an important aspect in early childhood development, but are often not optimal due to limited interesting and effective learning methods. This study aims to analyze the effect of ecoprint activity-based learning media methods on fine motor skills in early children. The research method used is quantitative with a quasi-experimental design using two groups, namely the experimental group and the control group with a sample size of 20 children. Data analysis used the Wilcoxon Signed Ranks Test which is a non-parametric statistical test. The results showed a significant increase in children's fine motor skills in the experimental group compared to the control group. In the experimental group, 60% reached the category of "very well developed" on the indicators of eye-hand coordination, movement accuracy, and self-expression. Ecoprinting activities involving natural materials such as leaves and flowers have been proven effective in training children's fine motor skills through fun creative process. Therefore, this method is recommended for early childhood learning to improve children's fine motor skills, creativity, and environmental awareness

Artikel History
Submission : December 6, 2024
Received : April 16, 2025
Accepted : April 30, 2025

Keywords:
Ecoprint, learning Media, fine motor skills, early childhood
Doi: 10.21009/jpud.v19i1.50549

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1. Introduction

Early Childhood Education (ECE) is a critical foundation in a child's development, encompassing physical, cognitive, emotional, social, and motor aspects. Early childhood, particularly for children aged 5-6 years, is referred to as the "golden age," during which proper stimulation can optimize the child's developmental potential. ECE serves as the precursor to shaping children's character, which becomes the cornerstone for creating quality human resources with broad knowledge, noble morals, resilient personalities, responsibility, creativity, and independence (Muhammad Yusri Bachtiar, 2022) Education that begins at an early age enables children to develop their potential to the fullest. Children who attend ECE tend to be more independent, disciplined, and easily directed, allowing them to absorb knowledge more effectively on their own (Safira Hidayah, 2022; Sartika & Wulandari, 2023).

One crucial aspect of development is fine motor skills. These skills involve the coordination of small muscles, particularly in the hands and fingers, to perform precise movements such as drawing, cutting, and assembling objects. These activities are important for preparing children to face school tasks such as writing and coloring, which are part of the formal learning process at the next educational level (Hurlock, 2011; Syazana et al., 2024). However, many young children face challenges in developing fine motor skills. These difficulties often

manifest as the inability to hold a pencil correctly, cut neatly, or perform activities requiring precision. The contributing factors are diverse, ranging from the lack of appropriate stimulation to limited variation in learning media used by educators. Research shows that the lack of diverse teaching methods can hinder children's fine motor development, which in turn affects their readiness for further learning (Nurmala & Zulfahmi, 2024). Therefore, an innovative approach is needed to provide effective stimulation while capturing children's interest to actively engage in learning.

One innovative teaching method that can address this challenge is ecoprint. Ecoprint is an art technique that utilizes natural materials such as leaves and flowers to create patterns on fabric or paper. This method is not only environmentally friendly and safe for children but also provides a learning experience involving experimentation, observation, and exploration. In the ecoprint process, children are encouraged to collect materials from their surroundings, such as leaves, which are then used to print patterns. This activity trains eye-hand coordination, improves accuracy, and stimulates children's creativity. Furthermore, ecoprint provides profound educational value by teaching children about the importance of environmental conservation and introducing art based on local culture (Adibah & Iffatur Rocmah, 2024; Hatmawati Et Al., 2023; Syafitri Utari & Khotimah, 2022).

The advantages of ecoprint as a teaching method lie not only in its benefits for fine motor development but also in its ability to integrate elements of art and local culture. In the context of Indonesian education, this approach is relevant as it helps introduce cultural values to children from an early age. By involving children in creative activities using natural materials, ecoprint also fosters curiosity and a sense of closeness to their environment. Previous studies have shown that ecoprint activities can enhance children's fine motor skills, creativity, and self-confidence. For instance, research by Jariah et al. (2022) revealed that children engaged in ecoprint activities showed significant improvements in hand-eye coordination. Similar results were found by Diana Shanty et al. (2022), who noted increased creativity and self-confidence among children participating in ecoprint activities.

The implementation of ecoprinting activities has been proven to significantly enhance the fine motor skills of young children. Research indicates that involving children in direct activities such as ecoprinting with natural materials promotes their motor development through creative expression (Anang Setiyo Waluyo et al., 2019; Hatmawati et al., 2023). Ecoprint as a learning medium encourages children to control hand movements using fine motor muscles, such as poking, stroking, piercing, squeezing, twisting, and kneading. These activities not only train eye-hand coordination but also integrate fine motor skills into the creative process. In ecoprint activities, children are invited to express themselves through art, including tracing shapes, creating vertical, horizontal, and curved lines, and making patterns using leaves, flowers, or other natural materials (Hasmawaty, 2022). The ecoprint-based learning method also integrates aspects of art and local culture, which can enhance children's knowledge of their surroundings. Children can interact with nature by exploring natural materials, fostering curiosity and a sense of connection to the environment (Fitra Adelya et al., 2023; Yusri Bachtiar et al., 2024).

Although many studies demonstrate the effectiveness of ecoprint in enhancing fine motor skills, existing research has certain limitations. First, most studies focus only on the general benefits of the ecoprint method without exploring how it can be adapted to local contexts. In fact, integrating local cultural elements can add educational value to this method while strengthening children's cultural identity from an early age. Second, previous research tends to be limited to short-term outcome measurements, such as improvements in fine motor skills over weeks or months. Few studies evaluate the long-term impact of ecoprint on children's development, including how this method influences their ability to complete more complex tasks in the future. Third, existing studies have not systematically analyzed how ecoprint can be implemented in ECE curricula to create holistic learning experiences. As a teaching method, ecoprint has the potential to integrate various developmental aspects, from fine motor skills to aesthetic, environmental, and cultural values. This research aims to fill these gaps by analyzing the impact of ecoprint-based play methods on the fine motor skills of children at TK Al Biruni, Kecamatan Rappocini.

Fine motor skills are physical skills that involve the coordination of small muscles, especially between the eyes and hands, to produce precise and directed movements. (Sagnay Illapa & Soledispa Chico, 2024). Hurlock (1998) explains that motor processes involve muscle movements that require repetition and guidance as part of learning. These skills are important to help children complete everyday activities, such as drawing, writing, or holding small objects, that require concentration, precision, and coordination (Sartika & Wulandari, 2023). By practicing fine motor skills, children can use their hands and fingers skillfully, while coordinating movements with their eyes in a balanced manner. This not only supports physical development but also has a positive impact on their cognitive, social-emotional and creative aspects.

Proper stimulation is necessary to help children achieve optimal fine motor development. Nhu Mai, (2024) states that this ability can be trained through various activities, such as weaving, paper folding, coloring, or counting, which provide direct stimulation to the small muscles. Hatmawati et al, (2023) show that skills such as holding small objects or performing other fine movements are indicators that show good fine motor development. confirms that

coordination between eyes and hands plays an important role in selecting objects and organizing movements. Children who receive targeted stimulation from educators tend to develop faster than those who are less stimulated, so it is important to pay attention to the development of this ability from an early age.

The function of fine motor development also covers various important aspects of early childhood life. Santrock (2007) states that fine motor skills support children's independence in helping themselves, interacting socially, playing, and completing school tasks. Anggraeni & Safitri, (2024) show that fine motor skills help children move from helplessness to independence and support their ability to adjust to the school environment. Activities such as drawing, cutting, assembling and weaving are effective tools to train children's finger and hand muscle flexibility and coordination. By providing the right stimulation, fine motor development can contribute significantly to children's physical, social and emotional abilities, all of which are essential for their readiness to learn and live in the future.

The ecoprint based learning media technique is a method of decorating fabrics using natural colors obtained from plants, such as leaves and flowers, to create patterns or patterns on fabrics by Waluyo dkk, (2019). Ecoprint is defined as the process of transferring shapes and colors from plants to fabric surfaces through direct contact (Saraswati & Sulandjari, 2018). This activity not only produces beautiful artwork, but also involves natural materials that are environmentally friendly and safe for children. According to Latifah & Ismet, (2023) This technique can be used in early childhood learning, where they interact with natural materials such as plants, which can enhance their fine motor development.

The e ecoprint based learning media process involves simple steps that children can do, such as placing the leaves or flowers on the fabric, wrapping them in plastic, and hitting them to transfer the colors. This activity provides an opportunity for children to imagine and be creative, as they can choose leaves and flowers of different shapes, sizes, and colors (Luailiya et al., 2024). By ecoprinting, children learn to create their own patterns and designs, which can gradually improve their self-confidence and creative skills. This technique still has many advantages, especially in developing children's fine motor skills, which are essential for their future independence and creativity. Arief Setyo Nugroho et al, (2023) also emphasized that ecoprinting provides opportunities for children to experiment and create unique and personalized artworks. It also supports children's cognitive and social-emotional development as they learn to create and work together in groups. Therefore, ecoprinting can be an effective method in early childhood education, providing long-term benefits in developing fine motor skills and other aspects such as creativity and independence. (Ummah & Fitri, 2024).

2. Method

This research uses a type of quantitative research with a quasi-experimental design or Quasi Experimental Design. The experimental research design used in this study is Nonequivalent Control Group Desing. According to (Sugiyono, 2015). This design consists of one experimental group and one control group, and is measured only once, namely after treatment. This design is used because researchers want to compare between groups that are given the treatment of ecoprint activity-based game methods and not given treatment to improve children's fine motor skills in kindergarten.

2.1 Instrument

Quantitatively, the main variables in this study are as follows: The independent variable in this study is the ecoprint activity-based game method, while the dependent variable is children's fine motor skills. Instruments to measure fine motor skills are presented in Table 1.

Tabel 1. Fine Motor Instrument for 5-6 Year Old Children

Indikator													
Fine Motor Skills of Children													Total
No.	Ability to coordinate eyes and hands				Ability to perform movements precisely and accurately (Accuracy)				Ability to express oneself using various media and control media and control Hand movements that use fine muscles				
	1	2	3	4	1	2	3	4	1	2	3	4	
1													
2													
3													
…													

Description:

1. Not Developing (BB) : 1
2. Still Developing (MB) : 2
3. Developing as expected (BHS) : 3
4. Developing Very Well (BSB) : 4

2.2 Research Design

Quantitative research with an experimental design used in this study, namely Nonequivalent Control Group Design. Sugiyono (2014) This design consists of one experimental group and one control group, and is measured only once, namely after treatment. This research design is described in Table 2.

Tabel 2 Quasi- Experimental Design

Pre-Test	Treatment	Post-Test
O1	X	O2
O3		O4

2.3 Participant and Data Collection

The sampling technique in this study was random sampling, which was conducted by listing all 36 childrenin class A and B in the population and assigning each child a unique identification number. These numbers were then randomly selected using a lottery method to ensure each child had an equal chance of being chosen. From this process, 20 samples of group B children at Al Biruni Kindergarten, Rappocini District, were obtained. The selection focused on children in the 5–6-years age group who met specific criteria, including those whose fine motor skills were either not yet developed or starting to develop. Before data collection, the researcher obtained informed consent from the parents or guardians of the children and permission from the school. The parents or guardians were provided with an explanation of the purpose and procedures of the study. The data collected was kept confidential and used solely for research purposes. The data collection technique in this study involved observation, which aimed to directly observe the use of Ecoprint learning media and systematically record phenomena related to the activities provided. Additionally, data collection utilized tests, wherein treatment or action tests were conducted to assess children's fine motor skills through simple science experiment methods with pretest and posttest. Supporting data was also gathered through documentation to track the process of improving children's fine motor skills via science experiment activities.

2.4 Analysis Data

The data analysis used is descriptive analysis with non-parametric statistics because the number of samples cannot be assumed to be normal (Azwar, 2015). The non-parametric statistical test used in this study is the difference test (Wilcoxon signd rank test) using the SPSS application. The Wilcoxon signad rank test is used because it is to test two related samples, to test the difference between two samples and to determine the size of the difference in

ranking (Sugiyono, 2014). Based on this quantitative descriptive analysis, it can provide an overview of the effect of using the Ecoprint Activity-Based Game Method in Improving Children's Fine Motor Skills at Al Biruni Kindergarten, Rappocini District.

3. Result

The data collected in this study include pre-test scores that describe children's fine motor skills before being given treatment through the ecoprint activity-based game method, and post-test scores that reflect children's fine motor skills after receiving the treatment. The pre-test was used to evaluate the initial ability of the research subjects, while the final test was used to evaluate the final ability of the research subjects as well as determine whether the ecoprint activity-based game method had an effect on improving fine motor skills. This study involved 20 students of Al Biruni Kindergarten, Rappocini Subdistrict as research subjects.

Table 3. Pre-test Results of Fine Motor Skills of 5-6 Year Old Children in the Control Group

No	Indicator	Category	Fequency	Percentage
1	Ability to coordinate eyes and hands	BB	11	55%
		MB	9	45%
		BSH	0	0%
		BSB	0	0%
2	Ability to perform movements precisely and accurately (Accuracy)	BB	9	45%
		MB	11	55%
		BSH	0	0%
		BSB	0	0%
3	Ability to express oneself using various media and control media and control Hand movements that use fine muscles	BB	8	40%
		MB	12	60%
		BSH	0	0%
		BSB	0	0%

Based on Table 3, the results of the initial test of children's fine motor skills show that the majority of children are still in the "undeveloped" and "beginning to develop" categories in all indicators. In the indicator of the ability to coordinate the eyes and hands, 55% of children (11 children) are in the undeveloped category, indicated by the inability to make lines on the tracing of leaves and flowers, use crayons, or color neatly, while 45% of children (9 children) are in the category of starting to develop, able to do these activities with the help of teachers and friends. No child reached the category of developing as expected or developing very well. In the indicator of the ability to make precise and careful movements (accuracy), 45% of children (9 children) are in the undeveloped category, with difficulty pressing leaves or flowers when tracing and accurate positioning of leaves and flowers on paper, while 55% of children (11 children) are in the category of starting to develop with teacher assistance. In the indicator of the ability to express themselves using various media and control hand movements with fine muscles, 40% of children (8 children) are in the undeveloped category because they have not been able to create works with leaf and flower motifs, while 60% of children (12 children) are in the category starting to develop with teacher assistance. No child reached the category of developing as expected or developing very well in any indicator.

Table 4. Descriptive Analysis Test Results of Fine Motor Fine Age 5-6 Years in the Control Group

	Descriptive Statistic						
	N	Range	Min	Max	Mean	Std. Deviation	Variance
Sample	20	3.00	3.00	6.00	4.4000	1.09904	1,208
Valid N (listwise)	20						

Based on table 4, the results of descriptive statistical analysis, data from 20 samples before treatment showed a relatively narrow distribution. The minimum value obtained is 3, while the maximum value reaches 6, with an

average of 4.4. The standard deviation of 1.09904 indicates a moderate spread of data around the mean value, while the variance of 1.208 indicates a good level of data diversity.

Table 5 Motor Skills Results of 5-6 Years of Age in the Experiment Group

No	Indikator	Kategori	Frekuensi	Persentase
1	Ability to coordinate eyes and hands	BB	0	0%
		MB	0	0%
		BSH	4	40%
		BSB	6	60%
2	Ability to perform movements precisely and accurately (Accuracy)	BB	0	0%
		MB	0	0%
		BSH	4	40%
		BSB	6	60%
3	Ability to express oneself using various media and control media and control Hand movements that use fine muscles	BB	0	0%
		MB	0	0%
		BSH	3	30%
		BSB	7	70%

Table 5 shows that the fine motor skills of experimental group children after being treated with Ecoprint learning mediashowed a significant increase in all indicators, with most children reaching the categories of "developing as expected" and "developing very well." In the indicator of the ability to coordinate the eyes and hands, no children were in the "undeveloped" or "beginning to develop" category (0%). A total of 40% of children were in the category of "developing as expected," characterized by the ability to make lines on tracing, use coloring, and coloring without teacher assistance. Meanwhile, 60% of children reached the category of "developing very well," being able to do these activities independently and even help their friends. On the indicator of the ability to perform movements precisely and carefully (accuracy), 40% of children are in the category of "developing as expected," showing the ability to trace with high accuracy without teacher assistance, and 60% of children reach the category of "developing very well," performing these tasks independently and helping friends. As for the indicators of the ability to express themselves and control fine muscle movements, 30% of children were in the category of "developing as expected," with the ability to complete tracing activities independently, while 70% of children were in the category of "developing very well," creating interesting works with various motifs of leaves and flowers without teacher assistance and helping friends. Overall, these results show that Ecoprint learning mediaare effective in improving children's fine motor skills, with the majority of children showing optimal development, both in coordination, accuracy, and self-expression.

Table 6 Descriptive Analysis Test Results of Fine Motor Skills for 5-6 Years of Age in the Experiment Group

	Descriptive Statistic						
	N	Range	Min	Max	Mean	Std. Deviation	Variance
Sample	10	2.00	10.00	12.00	10.9000	0.87560	0.767
Valid N (listwise)	10						

Based on table 6, the results of the descriptive statistical analysis calculation show that of the 10 experimental group variable data after being given treatment shows a minimum value of 10, a maximum value of 12, an average of 10.9000 as for 4.6 standard deviation of 0.87560 and a variance of 0.767.

Table 7 Wilcoxon Test Results of Fine Motor Skills Results for 5-6 Years of Age in the Control Group

Test Statistics [a]	
Z	Posttest-Pretest
	-1.633[b]
Asymp.Sig. (2-tailed)	.102

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Based on Table 7 of the Wilcoxon test results for children's fine motor skills in the control group, the Zhitung value is -1.633 and the significance value (sig) is 0.102. Because the sig value (0.102) is greater than 0.05, it can be concluded that there is no significant difference in the fine motor skills of control group children before and after treatment. This indicates that the treatment provided did not have a significant impact on the fine motor development of children in the control group..

Table 8. Wilcoxon Test Results of Fine Motor Skills for 5-6 Years of Age in the Experiment Group

Test Statistics [a]	
Z	Posttest-Pretest
	-2.840[b]
Asymp.Sig. (2-tailed)	.005

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Based on the test results, the Asymp Sig (2-tailed) value obtained is 0.005, which is smaller than 0.05. Therefore, H_0 is rejected and H_1 is accepted, which means that there is a significant effect of Ecoprint learning mediaon improving children's fine motor skills, this can be seen in table 8. These results indicate that there is a significant difference in the fine motor skills of experimental group children before and after being given

4. Discussion

This statement is supported by the results of descriptive statistical tests and non-parametric statistical tests, which show that the average fine motor skills of children who were not given ecoprint treatment or only did leaf and flower stamping activities did not show significant changes. In contrast, the provision of Ecoprint learning media to the experimental group resulted in a significant increase in fine motor skills compared to the control group. Thus, it can be concluded that Ecoprint learning mediahave an effect on improving the fine motor skills of children aged 5-6 years at Al-Biruni, Rappocini

Improving children's fine motor skills through Ecoprint learning medianot only improves fine motor skills, but also makes children more enthusiastic about learning because they can be creative (Aam Kurnia et al., 2023). This is in accordance with the desired educational innovation, which is active, innovative, creative and fun learning. Ecoprint is an interesting and fun activity that can facilitate various aspects of early childhood development.

This research is in line with previous research conducted Jariah et al, (2023) entitled "The Effectiveness the Application of Ecoprint Techniques to Develop Children's Fine Motor Skills" published in JCAR (1) (2023). The results of the study state that ecoprint batik activities can improve the fine motor skills of groups children. Similar research by Diana Shanty et al, (2022) "Development Of Ecoprint Batik Method To Foster Fine Motor Skills Of Kindergarten Children shows that Ecoprint learning mediacan improve the fine motor skills of early childhood, especially in children aged 5-6 years.

Furthermore, the research by Latifah & Ismet, (2023) entitled "The Effect of Ecoprint on Children's Fine Motor Development at Istiqamah Islamic Kindergarten in Payakumbuh City" shows that ecoprint has a

positive effect on children's fine motor development at Istiqamah Islamic Kindergarten. Other research by Jariah et al. (2023) in "Effectiveness of Ecoprint Technique for Developing Children's Fine Motor Skills" method is proven effective for growing kindergarten children's fine motoric. Ecoprint batik smart books or flipbooks can be used by parents and teachers as effective teaching materials to foster children's fine motor skills as well as introduce the local culture of environmentally friendly batik and develop children's artistic creativity. other than that research Hijrah, Ahmad Razak, et al, (2024) memphasizes that fine motor development must perform movements that involve certain body parts and small muscles, requires coordination of fine motor development. so that through this ecoprint learning media is able to influence children's fine motor development.

However, during the implementation there were some limitations in the study, the relatively small sample size, which limits the ability to generalize the findings to a wider population. A larger and more diverse sample would provide a more accurate picture of the impact of Ecoprint on fine motor development in children across socio-economic backgrounds and locations. In addition, the study design only used one control method (leaf and flower stamp activities), which may not be varied enough to compare the impact of Ecoprint with other methods that could also potentially improve fine motor skills. Research with a more varied control group and a more complex approach could provide a more comprehensive picture of the effectiveness of Ecoprint compared to other techniques. Despite the limitations above, the results of this study provide opportunities for further research by integrating Ecoprint as a learning method in early childhood education, and the provision of a module as a guide to improve fine motor skills while supporting children's creativity.

Based on the overall results of the study, it can be concluded that the Ecoprint learning media has a positive impact on improving fine motor skills in early childhood. This is supported by previous research, which indicates that Ecoprint is an effective method for supporting the motor development of young children.

5. Conclusion

Based on the results and discussions in this study, it can be concluded that the use of Ecoprint learning media has a significant positive impact in improving fine motor skills in early childhood, especially in children aged 5-6 years at Al Biruni Kindergarten, Rappocini District. Children who participated in activities with Ecoprint media showed a clear increase in fine motor skills, such as eye and hand coordination, movement accuracy, and the ability to express themselves. This increase was much better compared to the group that only did leaf and flower stamping activities.

This study also revealed that Ecoprinting, which combines creativity with environmental awareness, is a fun and effective method to support children's fine motor development. This is in line with the principles of active, creative, and fun learning that are very much needed in early childhood education. The significant increase in fine motor skills shows that Ecoprint can be an attractive alternative compared to traditional learning methods, with positive educational and developmental benefits.

For further research, it can be considered to explore the impact of Ecoprinting on other aspects of development, such as cognitive, social, and emotional. In addition, further research can explore various other creative methods and media to refine strategies in supporting children's development more comprehensively using a large sample. This will contribute to a more holistic approach to early childhood education and more innovative learning.

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