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The effectiveness of Ibis Paint X through project-based learning on learning outcomes in exploring primary and secondary colors

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Abstract: The less-than-optimal learning outcomes of students in the Gatot Subroto Cluster serve as the background for this research. The purpose of this study is to analyse the effectiveness of digital media using Ibis Paint X within the Project-Based Learning (PjBL) model. The research employed a quantitative experimental design with a true experimental approach, using cluster random sampling. Research instruments included observations, questionnaires, and tests. Data analysis was performed using inferential statistics to test the research hypotheses. The results indicated a significant difference in learning outcomes between the group utilizing Ibis Paint X based on the PjBL model and the group using conventional media. The average N-gain scores for the experimental and control classes were 59.8% (moderately effective) and 32.1% (ineffective), respectively. In conclusion, Ibis Paint X media integrated with the PjBL model significantly affects student learning outcomes. This approach can be applied by teachers as a viable strategy to improve academic results.
Keywords: ecoliteracy, elementary school, lower elementary school grade

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Introduction

Education plays an important role in efforts to improve the standard of living. (Utama et al., 2025). In accordance with Law Number 20 of 2003 of the Republic of Indonesia, education serves to develop students who are knowledgeable, capable, creative, and independent (Gemilang & Anggoro, 2022). Art education is one of the learning processes that not only helps understand the material's concepts theoretically, but also through creativity (Halverson & Sawyer, 2022). Through art education, students are given the opportunity to experiment (Lestari et al., 2024) actively.

Colour exploration is a part of the visual arts that teaches basic colour theory concepts while also providing hands-on experience (Wijayanto et al., 2025). This color exploration material will be more productive if supported by innovative media (Kusumawati et al., 2023). In this technological development, teachers are required to design creative and innovative digital-based learning (Karmila et al., 2023). Utilising technology is one way to implement innovative media in the digital era (Usoh et al., 2024). The use of technology can make learning interactive, thereby creating a conducive classroom environment (Boateng et al., 2024). One media tool for exploring colours is IbisPaint X. The digital application offers a variety of drawing features that students can use to explore colours and create creative paintings (Sari et al., 2024).

On the other hand, the use of digital media does not guarantee significant learning outcomes unless it is integrated with appropriate learning models (Mikamahuly et al., 2023). Digital media serves only to facilitate learning, so a learning model is needed to organise the flow, objectives, and processes of learning (Rhosyida et al., 2022). The learning model should allow students to try, observe, and reflect (Nurhamidah & Nurachadijat, 2023). A learning model that encourages active participation and observation is project-based learning. The project-based learning model consists of six stages that include activities of trying, producing works, and communicating (Safitri & Nurharini, 2024). The use

of appropriate media and learning models will make learning productive and innovative (Gusmiarni & Jufri, 2024).

However, the results of interviews and observations at Gatot Subroto elementary school revealed a gap: teachers generally have not yet implemented digital media and still rely on conventional or concrete media. In using concrete media, teachers have applied the project-based learning model, which emphasises project activities. However, teachers have not fully implemented the PjBL syntax during the stage of communicating project results, as they present the work in front of the class. There are also teachers who have used digital media such as PowerPoint and Canva, but they do not involve students in the independent planning, implementation, and evaluation of the project. This issue is not only found in this study but also occurred in previous research.

In previous research, the first one by Mutiara & Herry (2023), the results from Pulutan 02 Elementary School in art education show that teachers only provide theoretical lessons without any exploration activities to create a project. The researcher used the PjBL model to address students' low learning outcomes and creativity. Based on PjBL learning with the PTK research method, the results showed that the influence of using the PjBL model had an average score from cycle I to cycle II of 77%, which falls into the good category. Additionally, the research by Devia Ulfa & Muhammadi (2024) at Patamuan Padang Pariaman 01 Elementary School found that, in creating learning devices, teachers had not systematically prepared them according to the teacher's guidebook. Teachers tend to implement one-way learning, resulting in low student achievement in the art subject. The researcher introduced PjBL (Project-Based Learning) to study its effectiveness in addressing the problem. The research results using the Classroom Action Research (CAR) method showed that the PjBL model influenced the art subject at Patamuan Padang Pariaman 01 Elementary School. In the first cycle, the average score was 71.3, categorised as sufficient, and increased to 82.3 in the second cycle, categorised as good.

Third, research by Nisa & Kurnia (2025) found that field conditions at elementary schools show that the use of innovative media is limited, and that learning is generally conventional. Learning in elementary schools is dominated by lecture-based instruction, which limits students' opportunities to express themselves. Based on this phenomenon, the researcher examined the PjBL model using a systematic literature review and found that it stimulates creativity through project activities. Fourth, a study by Ngurah et al. (2023) found that teachers at Sukasada 1 Vocational High School use IbisPaint X as a medium for teaching painting. In fact, besides IbisPaint X, various applications can be used for teaching painting, such as Procreate, MediBang Paint, and Clip Studio. The research findings indicate that the choice of IbisPaint X is based on its free features. Some features are locked and paid, but they can be unlocked by watching ads. Although it takes time to unlock all the features, this is comparable to the features that can be used to produce works with aesthetic value.

The fifth study by (2025) found that art education in first grade at UPT Kembangbilo Tuban Elementary School is less interactive, thereby failing to attract students' interest in learning. To address this gap, the researcher used digital media (Canva, PowerPoint, and Quizziz) for art lessons in elementary school. The average N-Gain score of 0.898 indicates that the use of digital media significantly improves students' interest. The sixth study by (2025) examines the pedagogical potential of digital media, which has attracted the attention of the academic community, but its application in the field of visual arts is underexplored. This research uses a literature review to discuss how digital media can improve learning outcomes in the future. Feedback from this study indicates that the limited number of empirical studies presents a challenge to comprehensive understanding.

The conditions on the field in previous research are similar to those in schools in the Gatot Subroto cluster in Blora Regency, where conventional learning is still predominantly applied. To address these issues, many researchers use the PjBL model to implement in learning. Some researchers use the IbisPaint X application to address the problems, but the samples they collected involve vocational high school students and have not been integrated into the learning model. Based on previous research results, there is an indication of increased learning outcomes with the PjBL model. On the other hand, the IbisPaint X media offers easy access to its features. The influence of PjBL on improving learning outcomes and the ease of access to the IbisPaint X application, which can be used flexibly without the need for physical tools or materials for painting, are the focus of this study's selection of IbisPaint X media based on the PjBL model.

Previous research has used digital learning media, including IbisPaint X. Various studies have also examined the influence of the PjBL model on students' learning outcomes. However, a research gap

was found between this study and previous research. The research gap identified in previous studies focused on motivation, activity, and media development. Most researchers have not specifically combined IbisPaint X with the PjBL model, so this study will fill the gap by integrating IbisPaint X with the learning model. Based on these conditions, this study will add novelty by using IbisPaint X based on PjBL to assess students' learning outcomes as empirical evidence. Besides integrating media and learning models as a new aspect of the research, another novelty lies in the research subjects, namely third-grade students, sampled from the Gatot Subroto cluster in Blora Regency.

The purpose of the research is to describe students' understanding, analyze the influence, and obtain information on the effectiveness or ineffectiveness of IbisPaint X media based on PjBL for the subject of visual arts exploration of primary and secondary colors in third grade. To determine whether PjBL can be applied to colour exploration materials, indicators are needed to assess the achievement of learning objectives. Indicators are important for evaluating the achievement of learning goals, including learning outcomes. (Novitasari, 2023). Learning outcomes are the competencies students have achieved, determined during the learning process. These outcomes will serve as indicators of whether the application of colour exploration using the PjBL model was successful (Abduloh et al., 2022).

This research emphasizes the importance of enhancing students' cognitive intelligence, fostering their ability to collaborate with peers, and utilizing existing digital media. This research contributes to education in Indonesia by supporting the use of media integrated with technology, thereby expanding understanding of media use that can or cannot be applied in learning, especially for exploring primary and secondary colours. This study supports the Merdeka curriculum by integrating digital media with the PjBL learning model, aligning with 21st-century skills.

Methods

The purpose of the research is to describe students' understanding, analyze the influence, and obtain information on the effectiveness or ineffectiveness of IbisPaint X media based on PjBL for the subject of visual arts exploration of primary and secondary colors in third grade. This quantitative research aims to determine students' learning outcomes when using IbisPaint X, a digital media tool, with the PjBL model compared with conventional media for exploring primary and secondary colours. The design used is a true experimental design with a pretest-posttest control group, as presented in Table 1 (Sugiyono, 2016). This research uses only a portion of the population, representative of the population, through the cluster random sampling technique.

Table 1. Research Design

Group	Technique	*Pretest*	Treatment	*Posttest*
Experimental Group	R	O_1	X	O_2
Control Group	R	O_3		O_4

Noted:
O_1 dan O_3: The experimental and control groups were given the same pretest to determine the students' initial abilities.
X: Treatment in the form of learning using the IbisPaint X application based on the Project-Based Learning model in the experimental group.
O_2: Posttest in the experimental group that was given treatment using the IbisPaint X application based on the Project-Based Learning model.
O_4: Posttest in the control group that was not given the IbisPaint X application based on the Project-Based Learning model.

The research subjects are third-grade students studying the colour exploration material outlined in the art book. The population of this study is Daping I Gugus Gatot Subroto, Blora Regency, as listed in Table 2. The sample was randomly selected using folded papers with school names written on them, then drawn at random. The results identified Gabusan 4 Elementary School as the experimental class using IbisPaint X based on project-based learning. Gabusan 2 Elementary School served as the control class using conventional learning media.

Table 2. Elementary School Name in Daping 1 Gatot Subroto Group

No	Elementary School Name
1.	Bangklean 1 Elementary School
2.	Bangklean 2 Elementary School
3.	Bangklean 3 Elementary School
4.	Bangklean 4 Elementary School
5.	Bangklean 5 Elementary School
6.	Gabusan 1 Elementary School
7.	Gabusan 2 Elementary School
8.	Gabusan 3 Elementary School
9.	Gabusan 4 Elementary School
10.	Singget 1 Elementary School
11.	Singget 2 Elementary School

Media IbisPaint X is integrated with the PjBL model, which consists of 6 steps: (1) determining the fundamental question; (2) designing the project plan; (3) creating the schedule; (4) monitoring project progress; (5) testing the learning process and outcomes; and (6) evaluating the experience. The research procedure begins with (1) identifying teachers and principals through interviews and observations; (2) preparing facilities and infrastructure for the digital media application IbisPaint X; (3) pretest; (4) treatment; (5) posttest; and (6) data analysis. Hypotheses of this study:

1) Ho = There is no effect of using the IbisPaint X application media based on the project-based learning (PjBL) model on students' learning outcomes in the exploration of primary and secondary colors in grade III at Gatot Subroto Cluster, Blora Regency.
2) Ha = There is an effect of using the IbisPaint X application media based on the project-based learning (PjBL) model on students' learning outcomes in the exploration of primary and secondary colors in grade III at Gatot Subroto Cluster, Blora Regency.

The research instruments used were observations, questionnaires and tests. Before the test questions are used, they will be tested for validity and reliability to ensure they are valid. Validity and reliability tests for the questions were conducted at Gabusan 3 Elementary School with a sample size of 13 students. Questionnaires were given to the experimental and control classes before the pretest and after the posttest. The questionnaires are used to measure interest in learning. Pretests and posttests are used to measure students' learning outcomes. The tests were given to the experimental class at Gabusan 4 Elementary School, consisting of 15 students, and the control class at Gabusan 2 Elementary School, also with 15 students. Data analysis methods used IBM SPSS Statistics 27. Data processing was performed to reduce the risk of manual calculation errors and facilitate statistical analysis. The data analysis included normality and homogeneity tests, independent t-tests, and N-Gain tests to assess students' learning outcomes.

Results and Discussion

Results

In the experimental class activity, students are required to mix all primary colours before creating their artwork. After students discover various colour-mixing results, each group can continue colouring the image on the canvas. Students are required to use at least one secondary color. Colour mixing activities by the experimental group are shown in Figure 1.

Figure 1. Color Mixing Activity

Students used the eyedropper tool to view the colour-mixing results. The eyedropper tool in IbisPaint X samples colours from the canvas. The bucket tool is used by students to color the illustration (Ruhidawat et al., 2025). The bucket feature makes it easy to apply colour without stepping outside the illustration's lines. The coloring results by the experimental group are divided into three, as shown in Figures 2, 3, and 4.

Figure 2. Results of the Work of Experimental Class Group 1

The works of Group 1 in the experimental class, as shown in Figure 2, consist of, first, a moon given primary yellow color. Second, a rainbow blending the colors blue, yellow, and pink. Third, a purple star is obtained by mixing red and blue. Lastly, there is a unicorn painted in yellow, pink, blue, and green, created by mixing yellow and blue. Overall, Group 1 uses the primary colours yellow and blue, while the secondary colours are green and purple.

Figure 3. Results of the Work of Experimental Class Group 2

In Group 2, the colouring results using a unicorn are shown in Figure 3. Group 2 has used the primary colours blue and yellow, while the secondary colours are purple and green. The work in Group 3 features assets such as bushes, a unicorn, the moon, and several stars. Group 3 has used yellow and blue as primary colours in their work, while secondary colours include purple and orange as shown in Figure 4 below.

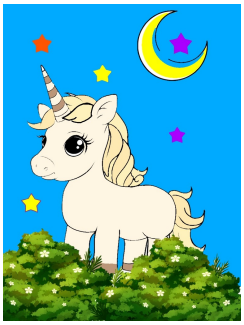

Figure 4. Results of the Work of Experimental Class Group 3

The goal is to describe third-grade students' understanding of primary and secondary colour exploration material, as analysed through the statistical descriptions presented in Table 3. The results of the research, through a series of data collection, began with a pretest, which involved giving treatment

using IbisPaint X based on PjBL, showing differences in the average scores obtained. The average pretest scores for the experimental and control groups were 54.67 and 44, respectively. The average scores were calculated from a total of 15 samples per class. The minimum pretest scores for the experimental and control classes were 30 and 15, respectively, while the maximum scores were 70 and 65, respectively. The posttest scores for the experimental and control groups averaged 79.67 and 60.33, respectively. The minimum posttest scores for the experimental and control classes were 50 and 35, respectively, while the maximum scores were 100 and 85, respectively. The experimental group experienced an average increase of 25 points, while the control group increased by 16.33 points. The improvement in scores was observed across the range of pretest to posttest scores. The scores for the experimental and control classes are presented in the following table.

Table 3. Descriptive Statistics

Class	N	Minimum	Maximum	Mean
Pretest Experiment	15	30	70	54.67
Posttest Experiment	15	50	100	79.67
Pretest Control	15	15	65	44.00
Posttest Control	15	35	85	60.33
Valid N (listwise)	15			

Before testing the hypothesis in a parametric analysis, two prerequisite tests are conducted: the normality test and the homogeneity test. The normality test is performed to determine whether the students' learning outcome data are normally distributed. In this study, the normality test uses the Shapiro-Wilk test with SPSS version 27. Based on the decision rule for the normality test, a p-value> 0.05 indicates that the data are normally distributed. The significance values for the normality test on the pretest and posttest of the experimental class are 0.175 and 0.445, respectively. Meanwhile, the results of the normality test for the pretest and posttest of the control class are 0.188 and 0.081, respectively. The significance values for the normality test in both the experimental and control classes are > 0.05. Based on the normality test results, the learning outcome data for students in the experimental and control classes are normally distributed. The results of the normality test are presented in Table 4.

Table 4. Normality Results

Value	Class	Shapiro-Wilk		
		Statistic	df	Sig.
Student Learning Outcomes	Pretest Experiment	.917	15	.175
	Posttest Experiment	.945	15	.445
	Pretest Control	.919	15	.188
	Posttest Control	.896	15	.081

The second prerequisite test, if the data is normally distributed, is the homogeneity test. The homogeneity test is conducted to determine whether the variances among groups are similar. Both prerequisite tests (normality and homogeneity tests) are important for determining whether there are deviations from assumptions that could result in biased or invalid conclusions. The basis for decision-making in the homogeneity test is that if the significance value is> 0.05, then the data distribution is considered homogeneous. The significance value of the homogeneity test in this study was 0.181, which is greater than 0.05, indicating that the data distribution is homogeneous. The results of the homogeneity test can be seen in Table 5. Since the data are normally distributed and homogeneous, the next analysis can proceed with an independent-samples t-test.

Table 5. Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Learning Outcomes	Based on Mean	1.878	1	28	.181
	Based on Median	1.223	1	28	.278
	Based on Median and with adjusted df	1.223	1	27.102	.278
	Based on the trimmed mean	1.915	1	28	.177

The independent sample T-test is used to obtain information from the hypothesis test results. The independent-samples T-test was used to analyse the effect of using IbisPaint X on PjBL. The basis for decision-making in the independent-samples T-test is whether the Sig. (2-tailed) If the value is less than 0.05, there is a significant difference in learning outcomes between the experimental and control classes. The data for the independent-samples T-test are shown in Table 6. The independent-samples T-test shows Sig. (2-tailed) value of 0.00 < 0.05, so the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. The conclusion is that the digital media IbisPaint X, based on the PjBL model, affects students' learning outcomes in the exploration of primary and secondary colours in the third-grade art subject.

Table 6. Independent Samples Test

		F	Sig.	t	df	Sig. (2-tailed)
Learning Outcomes	Equal variances assumed	1.878	.181	3.247	28	.003

The next analysis, using the N-gain test, was conducted to assess the effectiveness of using IbisPaint X based on the PjBL model. Based on the N-gain test in SPSS version 27, the average N-gain score for the experimental group was 59.8194 (59.8%), which falls into the fairly effective category. Meanwhile, the average N-gain score for the control group was 32.1072 (32.1%), which is categorised as not effective. The conclusion of this study is that the use of IbisPaint X media, based on the PjBL model, is highly effective in improving students' learning outcomes when exploring primary and secondary colours in art subjects in third grade at Gabusan 4 Elementary School during the 2025 academic year. In contrast, conventional media were ineffective in improving students' learning outcomes in exploring primary and secondary colours in art subjects in third grade at Gabusan 2 Elementary School during the 2025 academic year. The average N-gain scores are shown in Table 7.

Table 7. The Average N-gain Scores

Group	N-gain score (%)	Criteria
Experiment	59.8194	Quite Effective
Control	32.1072	Not Effective

Discussion

The analysis of the description shows that the average scores for the experimental and control classes in the pretest are 54.67 and 44, respectively, indicating that students' understanding is still lacking, as the average scores are below the KKM (Minimum Completeness Criteria) of 70. The learning outcomes indicate an influence of using IbisPaint X media, based on the PjBL model, in the exploration of primary and secondary colours in the Grade III Art subject in the Gatot Subroto cluster, Blora Regency. The effects of using the media and the learning model can be seen in the results of the independent-samples T-test and N-gain test in this study. Before testing the hypothesis, prerequisite tests for normality and homogeneity must be conducted in line with the research. Sari et al. (2024) stated that students' learning outcomes must be normally distributed and have homogeneous variances to ensure valid comparisons between the experimental and control classes. The independent sample T-test results show a Sig. (2-tailed) value of 0.00 < 0.05. Therefore, the alternative hypothesis (Ha) is accepted, and the null hypothesis (Ho) is rejected. This finding addresses the research objective of analysing the influence of IbisPaint X on students' learning outcomes using the PjBL model, which is significant for improving students' learning outcomes. These findings align with Maharani and Nurharini (2024), who state that selecting appropriate media and learning models can significantly impact learning outcomes.

This finding indicates a relationship between students' learning methods and their learning outcomes, which is relevant to Vygotsky's theory of the zone of proximal development (ZPD). As Vygotsky (1998) explains, children's cognitive development grows through social interaction and teacher guidance (Rahman, 2024). Through the Project-Based Learning model, students are guided by teachers and work together to complete the project (Lin et al., 2025). In PjBL learning, there are also discussions, idea exchanges, and reflections on the work results, which improve critical thinking skills (Suryanti et al., 2024).

Theoretically, this research aligns with Piaget's constructivist theory, which holds that knowledge is acquired through direct experience with the learning environment (Do et al., 2023). Learning with IbisPaint X not only provides information about colours but also builds knowledge through activities of experimenting with and mixing colours to create digital artwork (Nabila et al., 2024). Digital technology in painting facilitates users to interact with various mixing and coloring features virtually (Qiu & Zhang, 2023). In line with this, the digital media IbisPaint X facilitates users' active exploration of colour (Saputra et al., 2024). In the experimental class, students coloured a digital illustration using the pencil brush feature with a watercolour pencil. Using the watercolour pencil feature, users can mix colours to create new ones.

The effectiveness of using IbisPaint X based on PjBL is supported by N-gain test results, which show an average score of 59.8% in the experimental group, indicating it is quite effective. The N-gain test results address the research objective of analysing the effectiveness of IbisPaint X based on PjBL. These results are in line with the findings Dewi et al. (2024) stated that the use of Ibis Paint X media provides a broader, more flexible, efficient, and engaging space for color exploration, thereby motivating students to actively participate in learning. This finding is further supported by the research results of Satria et al. (2025), which state that the PjBL model directs activities that proceed systematically, contained within six syntax steps, starting with project planning, implementation, and evaluation of the work results. This aligns with the opinion Dewi and Tyas (2025) stated that the use of learning media can improve the quality of learning when integrated with an appropriate learning model. On the other hand, the average N-gain score for the control group was 32.1%, categorized as ineffective. This finding is in line with research by Woods and Copur-Gencturk (2024), which states that conventional media tend to be teacher-centred and passive because communication is one-way.

Based on the results of this research discussion, it aligns with previous studies that argue that the use of digital media can improve learning outcomes. This research has addressed the limitations of previous studies, which generally used only digital media, specifically IbisPaint X, without integrating it with the PjBL learning model. This study contributes to the field by introducing the use of IbisPaint X media, based on the PjBL model, in a structured manner that aligns with the cognitive development of elementary school students, as outlined by Piaget and Vygotsky. Therefore, IbisPaint X, a digital media platform based on the PjBL model, can be used as an innovative alternative learning method in the third-grade art subject in elementary schools.

Conclusion

Analysis of the research results shows that the use of IbisPaint X media, based on the Project-Based Learning (PjBL) model, has a significant effect on third-grade students' learning outcomes in exploring primary and secondary colours in visual arts in the Gatot Subroto cluster, Blora Regency. This is evidenced by a hypothesis test using the independent samples T-test, which shows Sig. (2-tailed) value of $0.00 < 0.05$, so the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. The use of IbisPaint X media is deemed quite effective in improving students' learning outcomes. This result is influenced by students actively engaging in creating works. Educators are key to achieving learning objectives. Integrating engaging learning media suited to the digital era and adopting a systematic learning model make the classroom more participative and meaningful. However, this study has limitations in scope: it focuses only on primary and secondary colours, involves only one cluster, and does not comprehensively measure learning outcomes, including affective and creative aspects. Therefore, future research can expand the material coverage, involve more diverse subjects, and systematically and comprehensively examine affective and creative aspects in the use of digital media in art education.

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