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The Implementation of RBL-STEM Learning Materials to Improve Students Historical Literacy in Designing the Indonesian Batik Motifs

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This study aims to identify students' historical literacy in preserving Indonesian batik designs as traditional cultural heritage and sustainable rural economic development. The method used in this research is a mixed method that combines quantitative and qualitative research methods. Quantitative research methods are used to analyze students' historical literacy, while qualitative research methods are used to analyze learning activities and a portrait phase of the students' historical literacy under the RBL-STEM implementation in the learning process. The research respondents consisted of two classes: the control class with 40 students and the experimental class with 41 students. The research instruments used were interviews, questionnaires, observations, and historical literacy tests. The results showed that based on the independent sample t-test analysis on the post-test, there was a significant difference between the control class and the experimental class. It is due to the sig (2-tailed) score is 0.000 (p = <0.05). Thus, it can be concluded that the implementation of RBL-STEM learning materials can improve students' historical literacy in preserving Indonesian batik designs as traditional cultural heritage and sustainable rural economic development. The students' historical literacy in the experiment class dominantly lies on well-developed and very well-developed category. Furthermore, the student learning activities under the implementation of the RBL-STEM approach on three stages (initial, main and last stages) lies on active and very active category.

Keywords: RBL-STEM, historical literacy, batik design, traditional cloth heritage

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INTRODUCTION

Historical literacy is a minimal skill that must be possessed by the community related to understanding history, the use of history, techniques to explore historical truths, and the embodiment of history in everyday life. Society needs historical literacy to enable us to tell others, instill history in others, and more importantly, be able to internalize it in ourselves, what can be taken from the history of a nation, wrote Lee (2019). The improvement of historical knowledge has a contribution to development of critical thinking by a student to construct the new knowledge and creates skills to the society (Nippi, 2022)

One of the historical literacy, which students should have, is the history of the traditional cloth cultural heritage of Indonesian, namely Indonesian Batik (Steelyana. 2012) see Figure 1. According to the report of the Indonesian Ministry of Finance on the economic outlook of 2021, Indonesian Batik is included in the top ten competitive export commodities (Steelyana, E. 2012). Thus, preserving the Indonesian Batik as a traditional cultural heritage and sustainable rural economic development is very important (Steelyana & Patriana, 2010). To preserve the historical heritage products, we need to improve the social-historical literacy, (Musman & Arini, 2011) especially starting in the academic society, at the school level, or the higher education level (Sari et al., 2019). Otherwise, the work of the nation's cultural heritage will be hijacked by other nations as experienced by the Indonesian nation lately. There are at least eight Indonesian's cultural heritage have been claimed by other nation such as batik, wayang kulit, reog ponorogo, rasa sayange song, angklung music instruments (Nippi, 2022). It has been going on for a long time since not many Indonesians understand that it is the cultural heritage of the Indonesian nation. Therefore, improving the the historical literacy is significantly important.

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a. Solo Batik, Indonesia b. Madura Batik, Indonesia

c. Kalimantan Batik, Indonesia d. Papua Batik, Indonesia

Figure 1
The batik motifs of Indonesian traditional cultural heritage

What is historical literacy? Historical literacy also can be defined in the traditional sense of a person being able to read and write history (Juson, 2009). In this respect, the goal of historical literacy is to enable students to read history texts critically, to write thoughtfully, and to engage in meaningful discussions about the past, see Downey and Long (2016). The indicators of historical literacy, according to Taylor (2003) can be presented in Table 1.

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Table 1
The main indicators and sub-indicators of historical literacy

Main Indicators	Sub Indicators
Recognizing the events of the past	• Recognizing the importance of historical events • Understanding historical events for the provision for future life • Understanding historical heritage
Understanding the narratives of the past	• Understand the story form of continuity over time, • Understand the narrative and use it wisely for future life
Showing the research skills	• Collect, analyze, use evidence (artifacts, documents, pictures), historical events, and narratives • Able to develop exploration skills to enrich historical findings • Find strategies to preserve historical events, relics, and narratives
Implementing the language of history	• Understand the language of history • Use historical terminology in understanding historical language
Analyzing the historical concept	• Understand historical concepts such as to cause and motivation. • Understand the concept of history, historical heritage, and historical narrative
Utilizing of the ICT to explore the documents of history	• Using ICT in conducting historical searches • Using, understanding, and evaluating historical sources using the Internet of Things

Elaboration of the historical literacy, especially regarded to Indonesian batik motifs, in learning is very important, since the efforts to preserve Indonesian Batik as a traditional cultural heritage and sustainable rural economic development must be instilled as early as possible (Alkadrie et al., 2015).

Literature Review
RBL (Research Based Learning) Model of Teaching

Research-Based Learning (RBL) is a model of teaching with six important syntaxes. In this study we apply the RBL syntax in History class. Each step of syntax will motivate the students to actively in theract in the learning process. The students are actively involved in both online and offline learning processes to collect a variety of cultural heritage batik and then elaborate with STEM education to design Indonesian batik motifs so that they can develop some business activities after they are graduated and they plunge into real society later (Gray, 2010). The elaboration of designing the Indonesian batik motifs in the learning process will be quite complex if students are taught to design Batik conventionally (Anggo, 2011). The use of a software application is needed to introduce the Indonesian batik motifs in the classroom. Thus, in this study, we carry out the research entitled *'The Implementation of RBL-STEM Learning Materials to Improve Students Historical Literacy in Designing the Indonesian Batik Motifs as Traditional Cultural Heritage.* The software application will be integrated in the STEM approach, namely in the element of Technology. The syntax of the RBL model can be seen in Figure 2 (Suntusia et.al, 2019).

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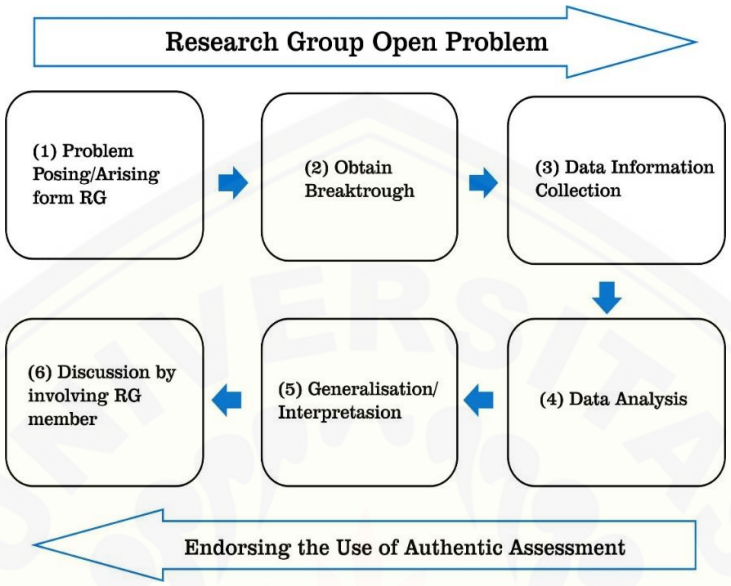

Figure 2
Syntax of research-based learning

With RBL, it will create a specific learning atmosphere. The students will gain more knowledge by doing research. Dafik et al., 2019 stated that research-based learning is effective in changing the way students learn and applying the learning by doing technique. RBL is a learning model that uses contextual learning, authentic learning, problem-solving learning, cooperative learning, direct learning, and inquiry discovery approaches that are implemented by applying the philosophy of constructivism (Dafik, 2019). The students can increase their freedom of learning, critical thinking, creativity, and communication skills (Anderson et al., 2001).

STEM Approach

The challenge of education in this era is to prepare students thinking skills needed to face the industrial revolution 4.0 (Anderson et.al, 2001). In this era, disruptive technologies speed up the advancement of life. People will survive in this era if they possess 4C skills, namely creative-innovative, critical thinking skills, communication skills, and collaboration skills (Sholihah, 2016). STEM education arises in line with these demands. Thus STEM approach is urgently needed to implement in the learning process. STEM has four components: science, technology, engineering, and mathematics (Scanlon, 2010). Together with the RBL model and STEM approach, the combination will be effectively implemented in the classroom to improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (Iskandar & Kustiyah, 2017). The STEM problems related to STEM aspect in designing Batik Motifs can be presented in Figure 3 (Sumardi et al., 2022)

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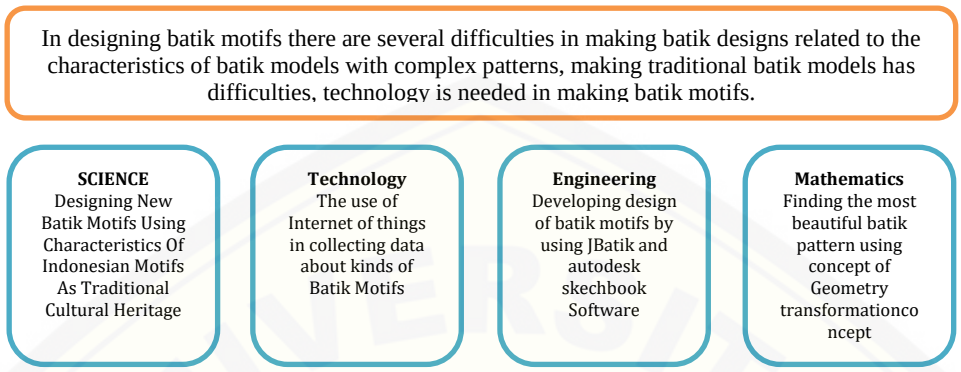

Figure 3
The STEM problem in developing the design of Batik as a Traditional Heritage

The integration between RBL Model of teaching with STEM approach making a perfect combination to help the student learning Batik Motifs as Cultural Heritage. The integration between RBL and STEM explained in Figure 4.

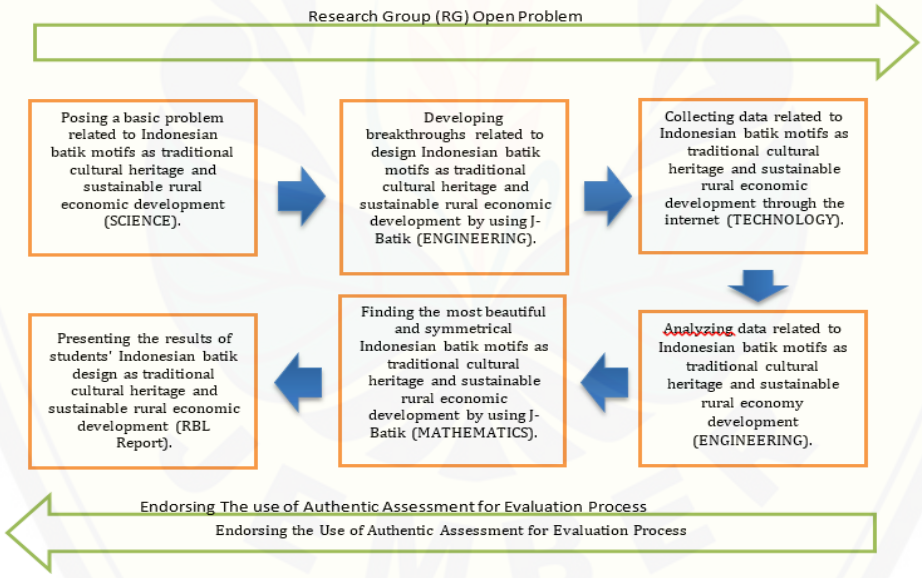

Figure 4
The framework of RBL-STEM in developing the batik design (Sumardi et al., 2022)

Designing Batik Motifs using JBatik Software

The JBatik software developed by the Pixel Group project to design batik motif using fractal geometry concept (Hariadi et al., 2013). The advantaged of using JBatik Softwrae

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in designing of Batik Motifs is about precision of batik pattern and easy for the craftman to draw the batik motif (Nurjanah et al., 2019). The main objective of this study are as follows: (1) analyzing the variety of Indonesian batik motifs with the help of android-based batik software, (2) designing the Indonesian batik motifs with the help of *J*Batik application software, (3) developing the RBL-STEM learning materials to improve students historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (4) testing whether RBL-STEM learning materials can improve the student's historical literacy in designing the Indonesian batik motifs (5) analyzing the portrait of the student's historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development.

METHOD

The type of this research is a mixed-method which is a combination of quantitative research and qualitative research approaches. Creswell (2014) states that combined or mixed research methods will be very useful if the quantitative and qualitative methods separately or individually are not accurate enough to be used in understanding research problems. By using quantitative and qualitative methods in combination, a better understanding can be obtained (Ridlo et al., 2020).

The Type of Research, Approach, and Brief Research Procedure

This study uses a Pretest – Posttest Nonequivalent group design, which is done by using two groups/classes that are given different treatments; the two classes are the experimental class and the control class (Wangguway et al, 2019). The Design of pretest – posttest Nonequivalent group design consist of two group which were experimental group and control group with different treatment (Juraga et al., 2022). The experimental class is a class that is given treatment, i.e the implementation of RBL-STEM learning materials (Yuliani, 2018). While the control class is a class treated by RBL-STEM but it did not use the learning materials developed in this research. Then, after the post-test is given, the students' historical literacy will be compared between the experimental class and the control class by Sugiono (2017), for detail Table 2.

Table 2
The quasi-experiment design of non-equivalent control group

Class	Pre-test	Treatment	Post-test
Experiment Class	O_1	RBL-STEM with Learning Materials	O_2
Control Class	O_3	RBL-STEM with No Learning Materials	O_4

Notes:
O_1: Pre-test score of experimental class before treatment
O_2: Pre-test score of experimental class after treatment
O_3: Pre-test score of control class before treatment
O_4: Pre-test score of control class after treatment

The STEM approach is integration between Science, Technology, Engineering and Mathematics. The STEM approach train students learn to find, plan and solve the

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problems (Sudarsono et al, 2022). The typology of STEM learning, classified in four section namely content integration, pedagogical integration, and learner integration (Cheng & So, 2020).

Research subject/Participant

The subjects as research respondents in this study were the students of the History education study program, FKIP Jember University, Indonesia of accademic year 2021/2022. The research sample consisted of two classes, namely the control class with 40 students and the experimental class with 41 students. The background of participant is student on 5th semester who learning about Batik as Indonesian National Heritage.

Data Collection and Instrument

The research instrument used was a test of student learning outcomes related to historical literacy consisting of pre-test and post-test questions with a scale of 1-100, and a questionnaire sheet related to historical literacy, observation instrument of historical literacy using likert scale from 1-4, including the results of student interviews (Wahyuni, 2020).

Data Analysis Method

The data analysis method used statistic inferential analysis with SPSS software to determine whether there is an effect of the application of RBL-STEM learning materials on students' historical literacy uses the Independent Sample t-test. This t-test aims to determine the difference in historical literacy between the experimental class under RBL-STEM implementation with learning materials and the control class under RBL-STEM implementation with no learning materials. The independent sample *t*-test was analyzed by considering the Independent Sample *t*-test score, namely if the score has a sig value (2-tailed) less than 0.05 (p =<0.05), then there is a significant difference in the student's historical literacy between the experimental class and the control class (Rohim et.al, 2019). On the other hand, if the score of Sig (2-tailed) is greater than 0.05 (p = > 0.05), then there is no significant difference. Before the Independent Sample t-test was conducted, the normality test and the homogeneity of the data were first tested. A normality test is used to determine the condition of the data is normally distributed or not (Haydn et al., 2003). Normality test uses Kolmogorov-Smirnov test. Data is categorized as normal if it has a significance score of more than 0.05 (> 0.05). While the homogeneity test is used to determine whether the two classes have homogeneous data or not. The homogeneity test criterion is if the significance value is more than 0.05 (> 0.05), then the variance of two groups data is the same (homogeneous), but if the significance value is less than 0.05, then the variance of two groups data is not the same (non-homogeneous). Furthermore, the research was continued by conducting in-depth interviews to triangulate the data analysis results (Gita et al., 2021). The basis for selecting students to be interviewed was to see the results of their historical literacy of post-test. One student was from the low level group, one was from the medium level group and one was from the high-level group. The results of the interviews were in the form of a portrait phase. This phase portrait was used to carry out an in-depth meta-

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analysis of the student's historical literacy. The procedure of drawing the portrait phase start from selecting students from three levels of historical literacy, namely low historical literacy, medium historical literacy and high historical literacy. The subjects' chosen are asked by using the questioner sheet on how to design the Batik motifs. The subjects' responses are noted and compared with the interview cards. These cards are derived from the sub-indicators of historical literacy by putting a specific code behind the cards. Once, the interviewer has known the logical response, the interviewer develop the connection between sub-indicators represented by nodes and edges such that it illustrates the phase portrait of the students historical literacy.

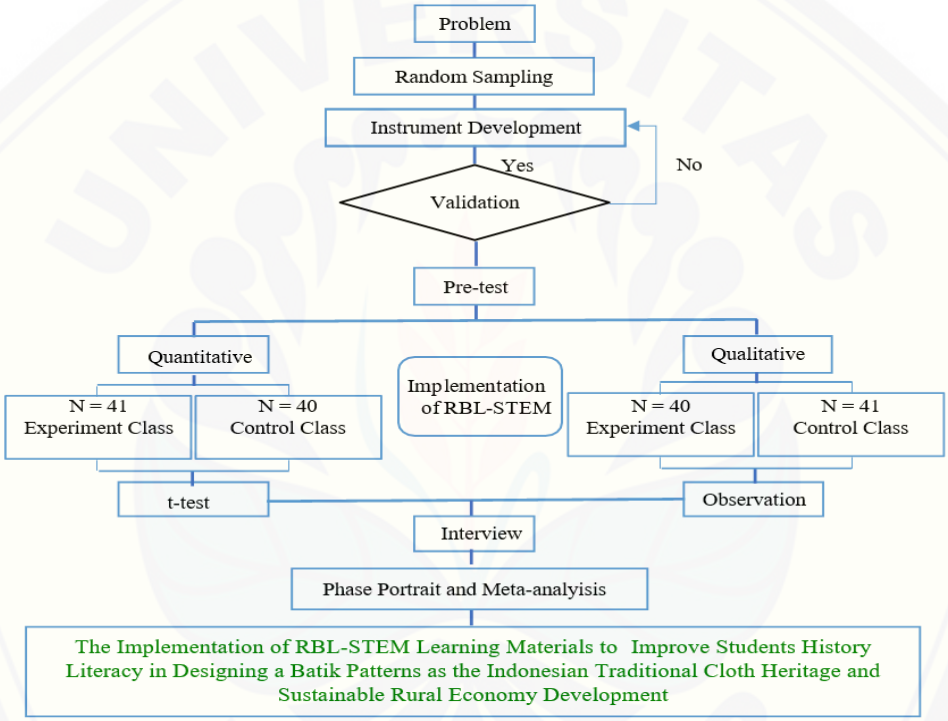

Figure 5
The model of triangulation method

The Validity and Reliability Test

The validity and reliability tests were analized by using inferential statistic, namely Person Correlation. The criteria of validity test from each question item is determined as follows: If each question score of Sig. (2-tailed) is less than 0.05 then the question is valid, we should check for all question items. Furthermore, we consider the Alpha Cronbach test related to reliability test. The criteria of reliability is determined as follows: If the score of alfa Cronbach is bigger than 0.6 then the instrument is reliable.

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FINDINGS

In the following, we will present a framework for integrating the RBL learning model in the STEM approach is to improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (Kussudiardja, 1993). The framework is developed based on the RBL syntax depicted in Figure 2 (Blackmore & Fraser, 2017). What does it look like? We develop the integration of RBL-STEM education in the following stages:

- Problem posing - posing a basic problem related to Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (SCIENCE).
- Obtain Breakthrough - developing breakthroughs related to design Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development by using J-Batik (ENGINEERING).
- Data information collection - collecting data related to Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development through the internet (TECHNOLOGY).
- Data analysis - analyzing data related to Indonesian batik motifs as traditional cultural heritage and sustainable rural economy development (ENGINEERING).
- Generalization - finding the most beautiful and symmetrical Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development by using J-Batik (MATHEMATICS).
- Discussion - Presenting the results of students' Indonesian batik design as traditional cultural heritage and sustainable rural economic development (RBL Report).

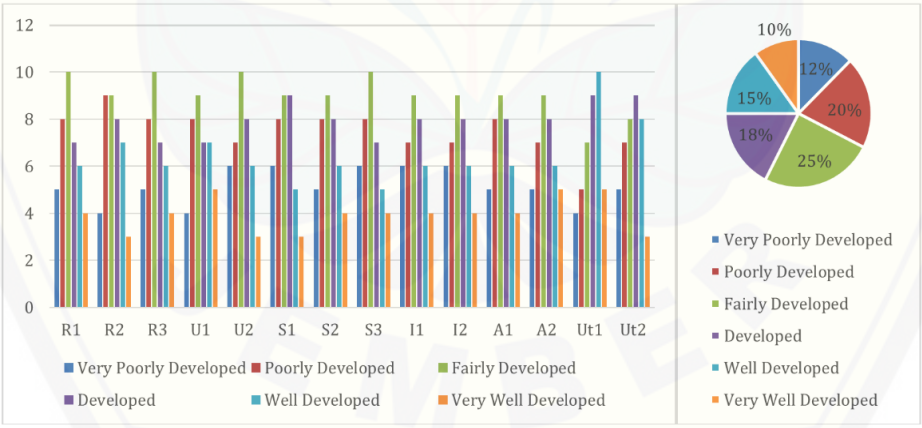

Figure 6
The pre-test result on the students' historical literacy for the control class

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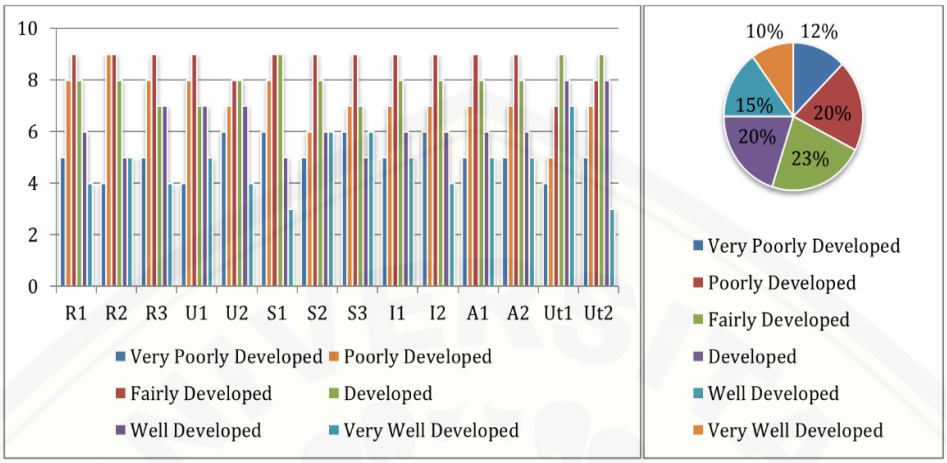

Figure 7
The pre-test result on the students' historical literacy for experiment class

Based on the above syntax, we developed the RBL-STEM learning materials. The learning materials consist of five components, namely Syllabus, Lesson Plans, Students Worksheet, Test instruments (pre and post-tests), and library for J-Batik software application. All the learning materials have been undergone the test process, namely content validity, format validity, language validity, practicality test as well the effectiveness of all instruments. We do not report the score of all the above tests since it has been written in a diferent paper by Firdausya et. Al. (2019). Thus, in this section, we focus on the analysis of the student's results on their pre-test and post-test of both classes, i.e., the validity, reliability, homogeneity, normality, and the last is independent sample *t-test*. The pre-test result on the students' historical literacy for control and experiment classes can be described in Figure 6 and Figure 7. The Figure 6 describes the pre-test result on the students' historical literacy for the control class. The Figure 6 describes the pre-test result on the students' historical literacy for the control class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly developed till fairly developed, Most of student is lack in the historical literacy, It is shown from the pie diagram with very poorly developed is 12%, poorly developed is 20%, fairly developed is 25% so the total of minimum skills in historical literacy is 57%. The medium until high historical literacy is the following: developed is 18%, well developed is 15%, very well developed is 10%. The percentage of medium until high historical literacy is 43%. Similarly, Figure 7 describes the pre-test result on the students' historical literacy for the control class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly develop to fairly develop. Most of student have the historical literacy shortage, It is show from the pie diagram with very poorly developed is 12%, poorly developed is 20%, fairly developed is 23% so the total of minimum skills in historical literacy is

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55%. The medium until high historical literacy as follows: Developed is 20%, well developed is 15%, very well developed is 10%. The percentage of medium until high historical literacy is 45%. Based on these results, it shows that the students' historical literacy for both classes lies in the poorly and fairly developed category.

The implementation of RBL-STEM learning materials in the classroom is initiated by developing the learning materials. The one, which is very important to deal with, is to do validity and reliability tests on the pre-test instruments of the students' historical literacy. The test instrument is derived from the main and sub-indicators of historical literacy, and it consists of 10 questions each. By using inferential statistic Person Correlation, the result of the validity test is given that the score of Sig. (2-tailed) of all question items starting from question 1 to question 10 are less than 0.05. It can be concluded that the question instruments for all questions are valid. Furthermore, the Alpha Cronbach score showing the reliability test gives 0.787, which is greater than 0.60. It can be concluded that the question instrument is reliable, see Table 3.

Table 3
The reliability test of the pre-test instrument

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.799	0.787	10

Furthermore, the results of the homogeneity test of the two quasi-experimental classes obtained from the pre-test are as follows:

Table 4
Test of homogeneity of variances

Value			
Levene Statistic	df1	df2	Sig.
.095	1	48	0.691

Based on the output Table 4 of the test of homogeneity of variances, it is known that the significance value (Sig.) of the student's collaborative thinking skill pre-test is 0.691. Since the value of Sig. 0.691 > 0.05, it can be concluded that the variance of the historical literacy post-test of the control and experimental classes is homogeneous.

The last step is to test the difference of the two means between the control and experimental classes. It aims to determine the effect of the RBL-STEM learning materials. From the research design in Table 2, it was found that the experimental class was given the RBL-STEM learning materials while the control class was given the RBL-STEM approach with no learning materials,. After being given the treatment then, a normality test was carried out on the data from the post-test collaborative thinking skills. The results of the normality test can be presented in Table 5.

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Table 5
Tests of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Value	.148	51	.122	.867	51	.475

a. Lilliefors Significance Correction

The significance value *(p)* in the Kolmogorov-Smirnov test is 0.112 (p > 0.05), so based on the Kolmogorov-Smirnov normality test, the data is normally distributed. The significance value *(p)* in the Shapiro-Wilk test is 0.475 (*p* > 0.05), so based on the Shapiro-Wilk normality test, the data is also normally distributed.

Finally, we end up dealing with statistical analysis by using an Independent Sample *t*-test to test whether there is a significant difference between the experiment class and control class under the implementation of the learning materials of the RBL-STEM approach. Table 6 shows the result on the level of confidence 5% the value of Sig. (2-tailed) = 0,001<0.05. It means $t_{count} > t_{table,}$ which concludes H_1 is accepted and H_0 is rejected. It implies the difference between the two classes is significant. It concludes that the RBL-STEM learning materials improve student's historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (Moersid, 2013).

Table 6
Independent samples test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	.092	.772	-2.806	49	.001	-2.233	.764	-3.831	-.643
	Equal variances not assumed			-2.819	46.598	.001	-2.233	.765	-3.832	-.632

Furthermore, based on the post-test result on the students' historical literacy for control and experiment classes, it can be described in Figure 8 and Figure 9.

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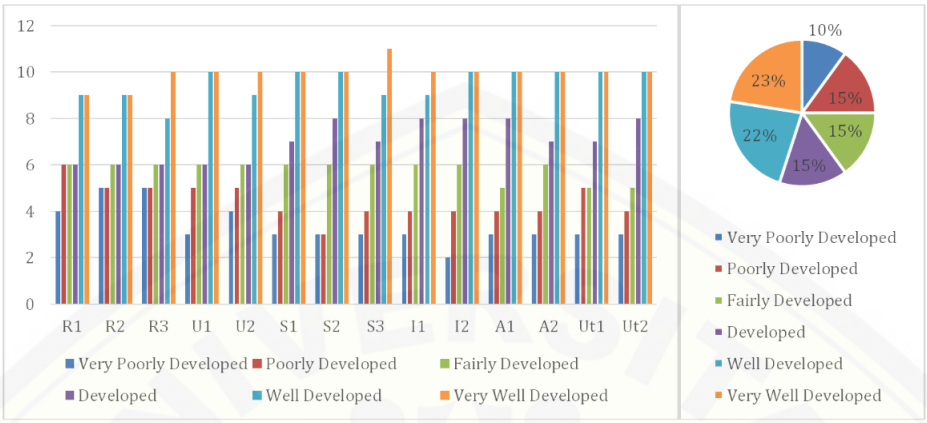

Figure 8
The post-test result on the students' historical literacy for control class

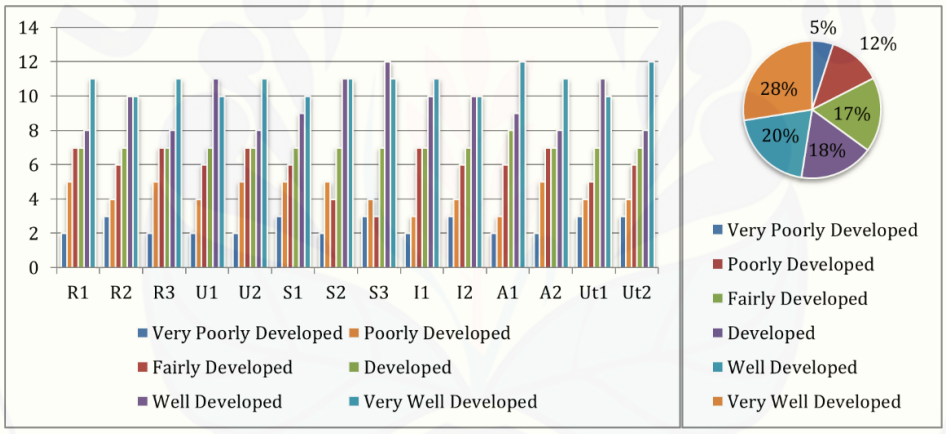

Figure 9
The post-test result on the students' historical literacy for experiment class

Figure 8 describes the post-test result on the students' historical literacy for the control class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly developed till fairly developed. Most of students have the historical literacy shortage. It is shown from the pie diagram with very poorly developed is 10%, poorly developed 15%, fairly developed is 15% so the total of minimum skills in historical literacy is 40%. The medium until high historical literacy is as follows: Developed is 15%, well developed is 22%, very well developed is 23%. The percentage of medium until high historical literacy is 60%. The pos-test result from control class compared with pre-test score shows a significant improvement of student historical literacy from 43% to 60% in medium to high category. Figure 9 describe the

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post-test result on the students' historical literacy for the experiment class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly developed to fairly developed. Most of student is lack in the historical literacy. It is shown from the pie diagram with very poorly developed is 5%, poorly developed 12%, fairly develop 17% so the total of minimum skills in historical literacy is 34%. The medium until high historical literacy is as follows: Developed is 18%, well developed is 20%, Very well developed is 28%. The percentage of medium until high historical literacy is 66%. The post-test result from experiment class compared to the pre-test score shows a significant improvement of student historical literacy, namely from 45% to 66% in medium to high category. Based on these results, it shows that the students' historical literacy for control classes lies on the developed and well-developed category.

Table 7
The descriptive data of the student's historical literacy trough their tests

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test of Experiment Class	41	68	73	70.00	1.118
Post-test of Experiment Class	41	73	89	83.50	1.253
Pre-test of Control Class	40	56	70	61.50	.815
Post-test of Control Class	40	62	79	72.00	.942

Based on the above Table 7, we can conclude that the implementation of RBL-STEM learning materials can improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development. (Nurainun, et.al. 2008). The achievement of the students' historical literacy in the experimental class is higher than the scores of the students' students' historical literacy in the control class.

To convince our research achievement, the following we describe the student's portrait phase. Figure 10 shows a portrait phase of student 001 with the category of low historical literacy. The figure shows that the students start doing the task from stage R_1 to stage R_2 continue to R_3 and immediately jump to stage U_1 and continue to stage U_2. He goes to S_1 and jumps to S_2 and S_3, after passing S_3, and goes to stage I_2, jump into A_1, Ut_1 and finally reaches Ut_2.

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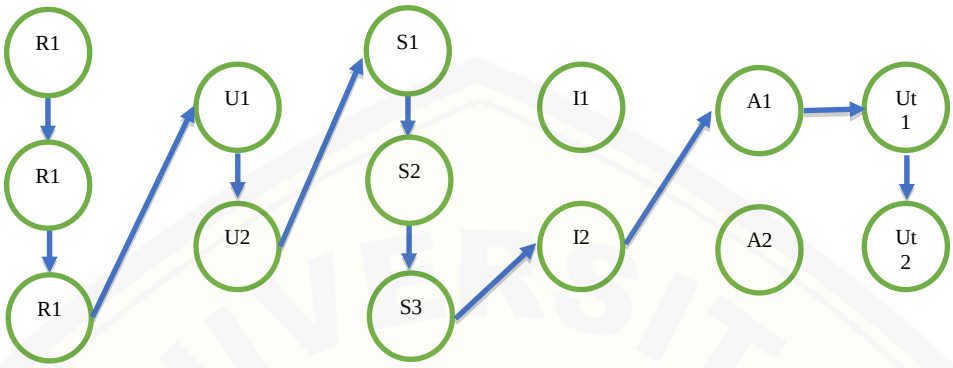

Figure 10
Student low historical literacy

Figure 11 shows a portrait phase of student 002 with the category of medium historical literacy. The figure shows that the students start doing the task from stage R_1,R_2 to stage R_2 and immediately jump to stage U_1 and continue to stage U_2. He goes to S_1 , S_2 , back to U_2 and jumps to S_3, after passing U_2, and goes to stage I_2 then I_1 jumps into A_2 then Ut_1 and finally reaches Ut_2.

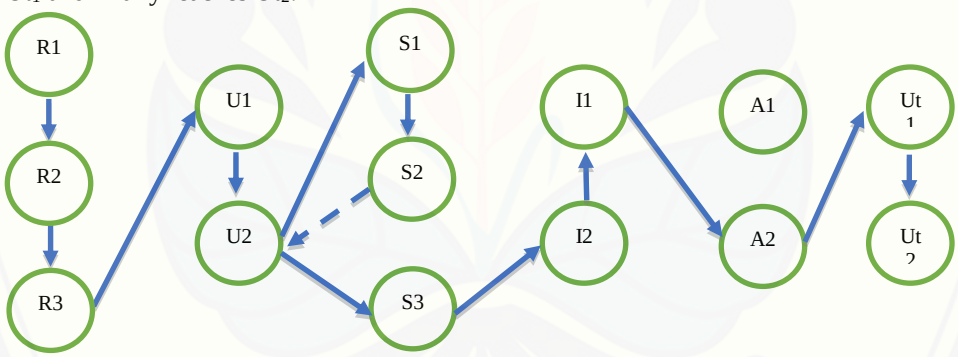

Figure 11
Student medium historical literacy

Figure 12 shows a portrait phase of student 003 with the category of high historical literacy. The figure shows that the students start doing the task from stage R_1 R_2 and continue to stage R_3 and immediately jump to stage U_2 and continue to stage U_1. He goes to S_1 and back toU1 continue to S_2 jump to S_3 goes to I_2 back to S_2 and jump to I_2, after passing I_2, and goes to stage I_1, $A1$, $A2$, jump to Ut_1, back to A_2 and and finally reaches Ut_2.

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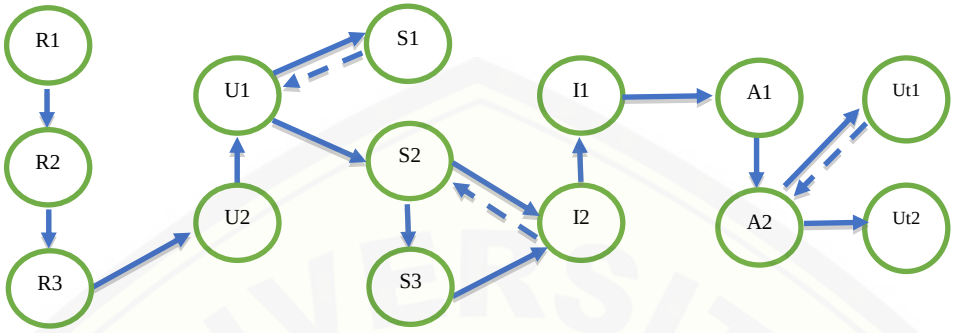

Figure 12
Student high historical literacy

DISCUSSION

The information generated from this research is very meaningful since we have known that students' historical literacy can be improved through the implementation of RBL-STEM. Lecturers and students, especially for the history class, can elaborate this leraning model together with the STEM approach to improve to the students' historical literacy especially related to the preservation of traditional cultural heritage on the Indonesian Batik Motifs. As we know that almost ethnic of Indonesia have a specific Batik Motifs, such as Javanese Batik Motif, Kalimantan Batik Motifs, Papuan Batik Motifs, Maduranic Batik Motifs, and other Batik Motifs. The implementation of RBL-STEM will provide space for students to explore the problems presented by lecturers, and then students can explore some breakthroughs and collect some relevant data of Batik Motifs, and analyze them according to the stages of RBL. The use of the Internet of Things technology also significantly affects to the innovation of designing Batik Motifs (Shabrina & Kuswanto, 2018). It will imply to the students creative thinking skills on designing the Batik Motifs. The use of the Internet of Things will help students to track the history of batik motifs from several others places in Indonesia. This learning activity will be more realistic because it is combined with the STEM approach, wherein its implementation, science problems become the foundation, the use of information technology becomes a mainstay, and then technical breakthroughs become major strategy and finally mathematical analysis will be able to provide in-depth analysis such as determining the number of combinations and permutations of the batik motifs and also students can make interpolations and predictions related to the preservation of the nation's cultural heritage in larger number of batik motifs from a thousand ethnics of Indonesia (Lusianti, 2012).

Mathematical analysis can also give students a space to conduct analyzes related to the potential of the batik industry as a cultural heritage for the development of economic development programs for rural communities. The mathematical concepts of profit and loss in the Social Arithmetic subject can be applied in order to calculate business

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prospects in the field of Batik production as an Indonesian cultural heritage. Suppose we define the purchase price is the price of an item from the factory. The selling price is the price set by the merchant to resell to the buyer the profit is a condition where the selling price is greater than the purchase price, while loss is a condition where the selling price is smaller than the purchase price (Atthariq M. F, 2020). By using this mathematical concept, students can be trained in their analytical thinking skills to analyze the business potential of Batik production as a cultural heritage for the development of the creative economy industry of rural communities easily. Another important of mathematics concept in designing Batik is geometry concept, namely shape, diagrams, transformation geometry such as translation, dilatation, rotation, and reflection. The use of "*Jbatik"* software in designing Batik motifs will help much on the students' skill in designing batik motif (Sudarsono et al, 2022).

Moreover, the integration of RBL-STEM has provided a basic understanding for students to explore many batik motifs such that the student's historical literacy has been significantly increased. Students have been able to recognize the events of the past, understand the narratives of the past, show the research skills, implement the language of history, analyze the historical concept and utilize the ICT to explore the documents of history. All of these are the main indicators of historical literacy for students which have been well developed during the implementation of RBL-STEM. It is also shown by student activities during the implementation of RBL-STEM learning, see Figure 11. This figure shows the student's activity under the implementation of RBL-STEM on three stages, namely the initial stage (fairly active, active and very active), main stage (fairly active, active and very active), and final stage (fairly active, active and very active).

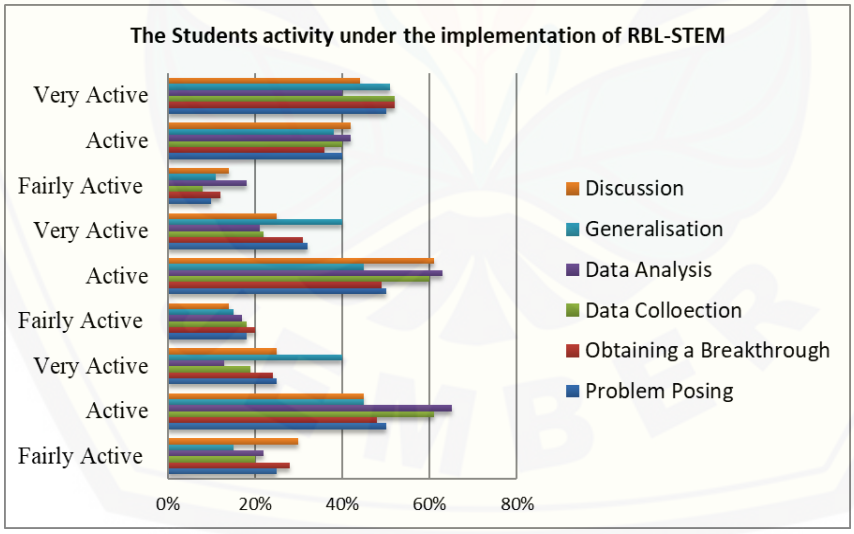

Figure 11
The student's activity under the implementation of RBL-STEM on three stages

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By Figure 11, it confirms that the implementation of RBL-STEM learning materials can improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage. his results supported with the data from pre-test and post-test in control class and experimental class shows a significant improvement of the students historical literacy after the implementation of the RBL model of teaching with STEM approach.

CONCLUSIONS

The research shows that the implementation of RBL-STEM learning materials can improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage. Students' historical literacy in the experimental class is higher compared with the control class. It is due to that the integration of research-based learning and science, technology, engineering, and mathematics approach can foster the ability of the students to recognize the events of the past, to understand the narratives of the past, to show the research skills, to implement the language of history, to analyze the historical concept and the last to utilize the ICT to explore the documents of history. Therefore the use of RBL-STEM is recommended in the classroom. The benefits of this study will contribute to the motifs development of Indonesian batik as well as to enrich understanding for the young generation that the Batik is a National Heritage. However, for the last indicator of students' historical literacy, it needs to do further research, namely exploring the student's creative thinking skills in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development. Therefore, as the suggestion for further researcher is how develop the Batik Motif related to traditional ceremonies such as “Ancak Agung” festival and “Petik Laut” festival. The result of this further study will help student to enrich their historical literacy on other culture and heritage of Indonesia.

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The Implementation of RBL-STEM Learning Materials to Improve Students Historical Literacy in Designing the Indonesian Batik Motifs

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Abstract: This study aims to identify students' historical literacy in preserving Indonesian batik designs as traditional cultural heritage and sustainable rural economic development. The method used in this research is a mixed method that combines quantitative and qualitative research methods. Quantitative research methods are used to analyze students' historical literacy, while qualitative research methods are used to analyze learning activities and a portrait phase of the students' historical literacy under the RBL-STEM implementation in the learning process. The research respondents consisted of two classes: the control class with 40 students and the experimental class with 41 students. The research instruments used were interviews, questionnaires, observations, and historical literacy tests. The results showed that based on the independent sample *t*-test analysis on the post-test, there was a significant difference between the control class and the experimental class. It is due to the sig (2-tailed) score is 0.000 ($p = <0.05$). Thus, it can be concluded that the implementation of RBL-STEM learning materials can improve students' historical literacy in preserving Indonesian batik designs as traditional cultural heritage and sustainable rural economic development. The students' historical literacy in the experiment class dominantly lies on well-developed and very well-developed category. Furthermore, the student learning activities under the implementation of the RBL-STEM approach on three stages (initial, main and last stages) lies on active and very active category.

Keywords : *RBL-STEM, Historical literacy, Batik Design, Traditional Cloth Heritage*

INTRODUCTION

Historical literacy is a minimal skill that must be possessed by the community related to understanding history, the use of history, techniques to explore historical truths, and the embodiment of history in everyday life. Society needs historical literacy to enable us to tell others, instill history in others, and more importantly, be able to internalize it in ourselves, what can be taken from the history of a nation, wrote Lee (2019). The improvement of historical knowledge has a contribution to development of critical thinking by a student to construct the new knowledge and creates skills to the society (Nippi, 2022)

One of the historical literacy, which students should have, is the history of the traditional cloth cultural heritage of Indonesian, namely Indonesian Batik (Steelyana. 2012) see Figure 1. According to the report of the Indonesian Ministry of Finance on the economic outlook of 2021, Indonesian Batik is included in the top ten competitive export commodities (Steelyana, E. 2012). Thus, preserving the Indonesian Batik as a

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traditional cultural heritage and sustainable rural economic development is very important (Steelyana & Patriana, 2010). To preserve the historical heritage products, we need to improve the social-historical literacy, (Musman & Arini, 2011) especially starting in the academic society, at the school level, or the higher education level (Sari et al., 2019). Otherwise, the work of the nation's cultural heritage will be hijacked by other nations as experienced by the Indonesian nation lately. There are at least eight Indonesian's cultural heritage have been claimed by other nation such as batik, wayang kulit, reog ponorogo, rasa sayange song, angklung music instruments (Nippi, 2022). It has been going on for a long time since not many Indonesians understand that it is the cultural heritage of the Indonesian nation. Therefore, improving the the historical literacy is significantly important.

a. Solo Batik, Indonesia b. Madura Batik, Indonesia

c. Kalimantan Batik, Indonesia d. Papua Batik, Indonesia

Figure 1
The batik motifs of Indonesian traditional cultural heritage

What is historical literacy? Historical literacy also can be defined in the traditional sense of a person being able to read and write history (Juson, 2009). In this respect, the goal of historical literacy is to enable students to read history texts critically, to write thoughtfully, and to engage in meaningful discussions about the past, see Downey and Long (2016). The indicators of historical literacy, according to Taylor (2003) can be presented in Table 1.

Table 1
The main indicators and sub-indicators of historical literacy

Main Indicators	Sub Indicators
Recognizing the events of the past	• Recognizing the importance of historical events • Understanding historical events for the provision for future life • Understanding historical heritage

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Understanding the narratives of the past	• Understand the story form of continuity over time, • Understand the narrative and use it wisely for future life
Showing the research skills	• Collect, analyze, use evidence (artifacts, documents, pictures), historical events, and narratives • Able to develop exploration skills to enrich historical findings • Find strategies to preserve historical events, relics, and narratives
Implementing the language of history	• Understand the language of history • Use historical terminology in understanding historical language
Analyzing the historical concept	• Understand historical concepts such as to cause and motivation. • Understand the concept of history, historical heritage, and historical narrative
Utilizing of the ICT to explore thedocuments of history	• Using ICT in conducting historical searches • Using, understanding, and evaluating historical sources using the Internet of Things

Elaboration of the historical literacy, especially regarded to Indonesian batik motifs, in learning is very important, since the efforts to preserve Indonesian Batik as a traditional cultural heritage and sustainable rural economic development must be instilled as early as possible (Alkadrie et al., 2015).

Literature Review

RBL (Research Based Learning) Model of Teaching

Research-Based Learning (RBL) is a model of teaching with six important syntaxes. In this study we apply the RBL syntax in History class. Each step of syntax will motivate the students to actively in theract in the learning process. The students are actively involved in both online and offline learning processes to collect a variety of cultural heritage batik and then elaborate with STEM education to design Indonesian batik motifs so that they can develop some business activities after they are graduated and they plunge into real society later (Gray, 2010). The elaboration of designing the Indonesian batik motifs in the learning process will be quite complex if students are taught to design Batik conventionally (Anggo, 2011). The use of a software application is needed to introduce the Indonesian batik motifs in the classroom. Thus, in this study, we carry out the research entitled *'The Implementation of RBL-STEM Learning Materials to Improve Students Historical Literacy in Designing the Indonesian Batik Motifs as Traditional Cultural Heritage*. The software application will be integrated in the STEM approach, namely in the element of Technology. The syntax of the RBL model can be seen in Figure 2 (Suntusia et.al, 2019).

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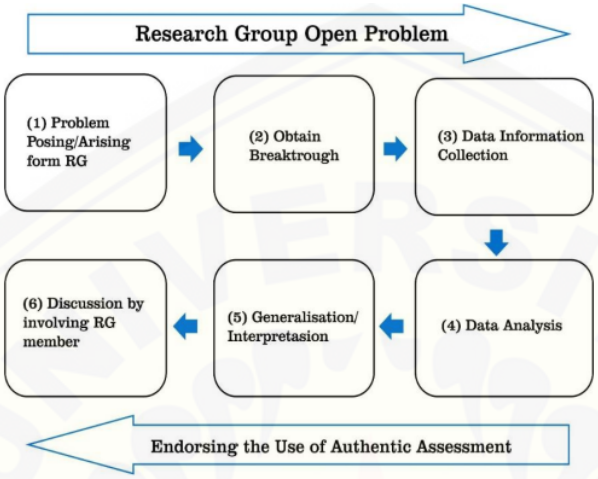

Figure 2
Syntax of Research-Based Learning

With RBL, it will create a specific learning atmosphere. The students will gain more knowledge by doing research. Dafik et al., 2019 stated that research-based learning is effective in changing the way students learn and applying the learning by doing technique. RBL is a learning model that uses contextual learning, authentic learning, problem-solving learning, cooperative learning, direct learning, and inquiry discovery approaches that are implemented by applying the philosophy of constructivism (Dafik, 2019). The students can increase their freedom of learning, critical thinking, creativity, and communication skills (Anderson et al., 2001).

STEM Approach

The challenge of education in this era is to prepare students thinking skills needed to face the industrial revolution 4.0 (Anderson et.al, 2001). In this era, disruptive technologies speed up the advancement of life. People will survive in this era if they possess 4C skills, namely creative-innovative, critical thinking skills, communication skills, and collaboration skills (Sholihah, 2016). STEM education arises in line with these demands. Thus STEM approach is urgently needed to implement in the learning process. STEM has four components: science, technology, engineering, and mathematics (Scanlon, 2010). Together with the RBL model and STEM approach, the combination will be effectively implemented in the classroom to improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (Iskandar & Kustiyah, 2017). The STEM problems related to STEM aspect in designing Batik Motifs can be presented in Figure 3 (Sumardi et al., 2022)

In designing batik motifs there are several difficulties in making batik designs related to the characteristics of batik models with complex patterns, making traditional batik models has difficulties, technology is needed in making batik motifs.

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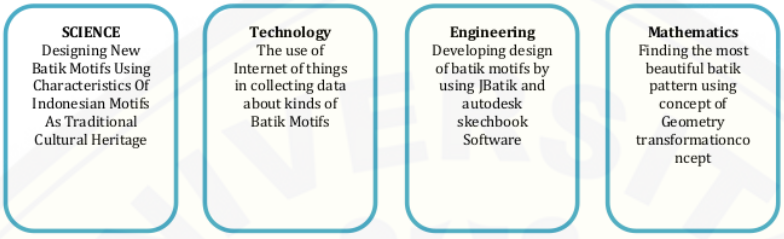

Figure 3
The STEM problem in developing the design of Batik as a Traditional Heritage

The integration between RBL Model of teaching with STEM approach making a perfect combination to help the student learning Batik Motifs as Cultural Heritage. The integration between RBL and STEM explained in Figure 4.

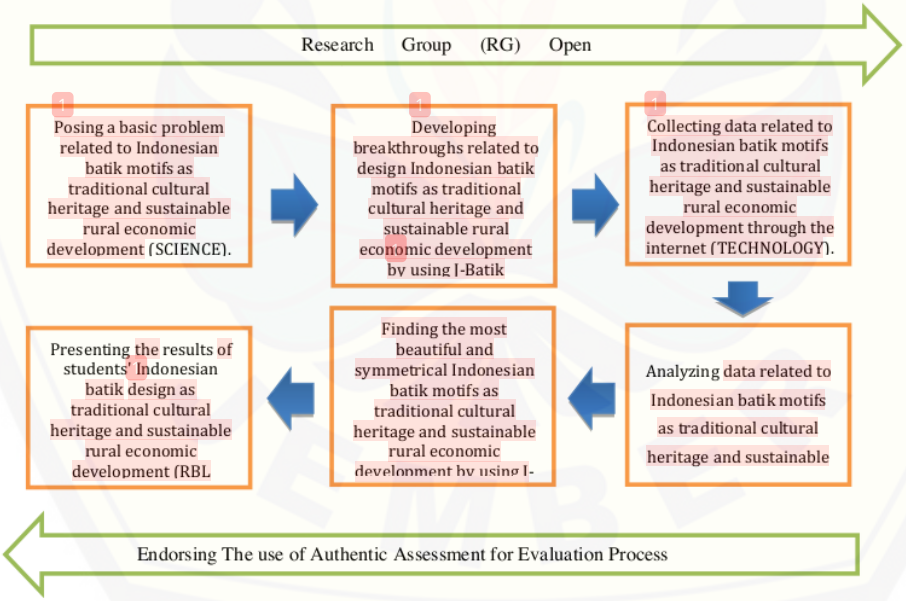

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Figure 4
The framework of RBL-STEM in developing the batik Design (Sumardi et al., 2022)

Designing Batik Motifs using JBatik Software

The JBatik software developed by the Pixel Group project to design batik motif using fractal geometry concept (Hariadi et al., 2013). The advantaged of using JBatik Softwrae in designing of Batik Motifs is about precision of batik pattern and easy for the craftman to draw the batik motif (Nurjanah et al., 2019). The main objective of this study are as follows: (1) analyzing the variety of Indonesian batik motifs with the help of android-based batik software, (2) designing the Indonesian batik motifs with the help of JBatik application software, (3) developing the RBL-STEM learning materials to improve students historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (4) testing whether RBL-STEM learning materials can improve the student's historical literacy in designing the Indonesian batik motifs (5) analyzing the portrait of the student's historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development.

METHOD

The type of this research is a mixed-method which is a combination of quantitative research and qualitative research approaches. Creswell (2014) states that combined or mixed research methods will be very useful if the quantitative and qualitative methods separately or individually are not accurate enough to be used in understanding research problems. By using quantitative and qualitative methods in combination, a better understanding can be obtained (Ridlo et al., 2020).

The Type of Research, Approach, and Brief Research Procedure

This study uses a Pretest – Posttest Nonequivalent group design, which is done by using two groups/classes that are given different treatments; the two classes are the experimental class and the control class (Wangguway et al, 2019). The Design of pretest – posttest Nonequivalent group design consist of two group which were experimental group and control group with different treatment (Juraga et al., 2022). The experimental class is a class that is given treatment, i.e the implementation of RBL-STEM learning materials (Yuliani, 2018). While the control class is a class treated by RBL-STEM but it did not use the learning materials developed in this research. Then, after the post-test is given, the students' historical literacy will be compared between the experimental class and the control class by Sugiono (2017), for detail Table 2.

Table 2
The quasi-experiment design of *non-equivalent control group*

Class	Pre-test	Treatment	Post-test
Experiment Class	O_1	RBL-STEM with Learning Materials	O_2
Control Class	O_3	RBL-STEM with No Learning Materials	O_4

Notes:

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O_1: Pre-test score of experimental class before treatment
O_2: Pre-test score of experimental class after treatment
O_3: Pre-test score of control class before treatment
O_4: Pre-test score of control class after treatment

The STEM approach is integration between Science, Technology, Engineering and Mathematics. The STEM approach train students learn to find, plan and solve the problems (Sudarsono et al, 2022). The typology of STEM learning, classified in four section namely content integration, pedagogical integration, and learner integration (Cheng & So, 2020).

Research subject/Participant

The subjects as research respondents in this study were the students of the History education study program, FKIP Jember University, Indonesia of accademic year 2021/2022. The research sample consisted of two classes, namely the control class with 40 students and the experimental class with 41 students. The background of participant is student on 5th semester who learning about Batik as Indonesian National Heritage.

Data Collection and Instrument

The research instrument used was a test of student learning outcomes related to historical literacy consisting of pre-test and post-test questions with a scale of 1-100, and a questionnaire sheet related to historical literacy, observation instrument of historical literacy using likert scale from 1-4, including the results of student interviews (Wahyuni, 2020).

Data Analysis Method

The data analysis method used statistic inferential analysis with SPSS software to determine whether there is an effect of the application of RBL-STEM learning materials on students' historical literacy uses the Independent Sample t-test. This t-test aims to determine the difference in historical literacy between the experimental class under RBL-STEM implementation with learning materials and the control class under RBL-STEM implementation with no learning materials. The independent sample *t*-test was analyzed by considering the Independent Sample *t*-test score, namely if the score has a sig value (2-tailed) less than 0.05 ($p =<0.05$), then there is a significant difference in the student's historical literacy between the experimental class and the control class (Rohim et.al, 2019). On the other hand, if the score of Sig (2-tailed) is greater than 0.05 ($p = > 0.05$), then there is no significant difference. Before the Independent Sample t-test was conducted, the normality test and the homogeneity of the data were first tested. A normality test is used to determine the condition of the data is normally distributed or not (Haydn et al., 2003). Normality test uses Kolmogorov-Smirnov test. Data is categorized as normal if it has a significance score of more than 0.05 (> 0.05). While the homogeneity test is used to determine whether the two classes have homogeneous data or not. The homogeneity test criterion is if the significance value is more than 0.05 (> 0.05), then the variance of two groups data is the same (homogeneous), but if the significance value is less than 0.05, then the variance of two groups data is not the same (non-homogeneous). Furthermore, the research was continued by conducting in-depth interviews to triangulate the data analysis results (Gita et al., 2021). The basis for selecting students to be interviewed was to see the results of their historical literacy of

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post-test. One student was from the low level group, one was from the medium level group and one was from the high-level group. The results of the interviews were in the form of a portrait phase. This phase portrait was used to carry out an in-depth meta-analysis of the student's historical literacy. The procedure of drawing the portrait phase start from selecting students from three levels of historical literacy, namely low historical literacy, medium historical literacy and high historical literacy. The subjects' chosen are asked by using the questioner sheet on how to design the Batik motifs. The subjects' responses are noted and compared with the interview cards. These cards are derived from the sub-indicators of historical literacy by putting a specific code behind the cards. Once, the interviewer has known the logical response, the interviewer develop the connection between sub-indicators represented by nodes and edges such that it illustrates the phase portrait of the students historical literacy.

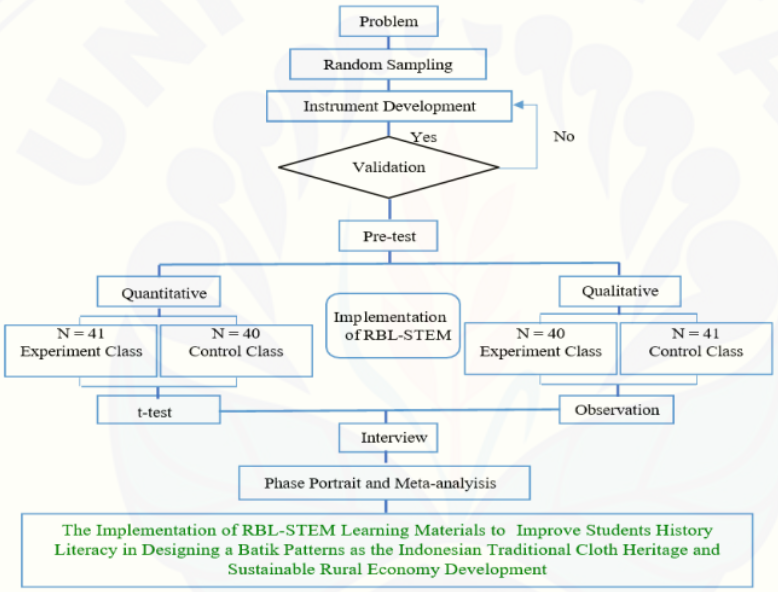

Figure 5
The model of triangulation method

The Validity and Reliability Test

The validity and reliability tests were analized by using inferential statistic, namely Person Correlation. The criteria of validity test from each question item is determined as follows: If each question score of Sig. (2-tailed) is less than 0.05 then the question is valid, we should check for all question items. Furthermore, we consider the Alpha Cronbach test related to reliability test. The criteria of reliability is determined as follows: If the score of alfa Cronbach is bigger than 0.6 then the instrument is reliable.

RESULT

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In the following, we will present a framework for integrating the RBL learning model in the STEM approach is to improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (Kussudiardja, 1993). The framework is developed based on the RBL syntax depicted in Figure 2 (Blackmore & Fraser, 2017). What does it look like? We develop the integration of RBL-STEM education in the following stages:

- Problem posing - posing a basic problem related to Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (SCIENCE).
- Obtain Breakthrough - developing breakthroughs related to design Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development by using J-Batik (ENGINEERING).
- Data information collection - collecting data related to Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development through the internet (TECHNOLOGY).
- Data analysis - analyzing data related to Indonesian batik motifs as traditional cultural heritage and sustainable rural economy development (ENGINEERING).
- Generalization - finding the most beautiful and symmetrical Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development by using J-Batik (MATHEMATICS).
- Discussion - Presenting the results of students' Indonesian batik design as traditional cultural heritage and sustainable rural economic development (RBL Report).

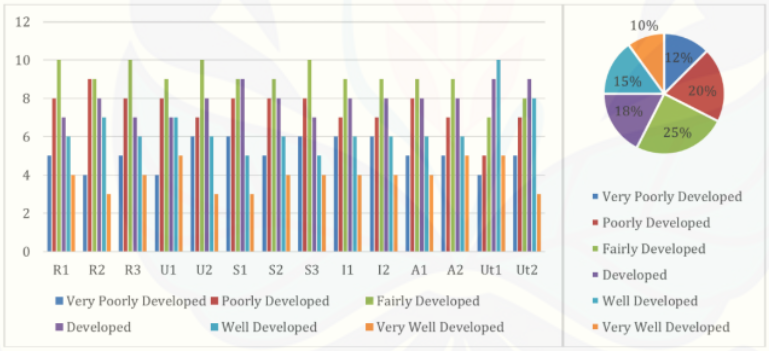

Figure 6
The pre-test result on the students' historical literacy for the control class

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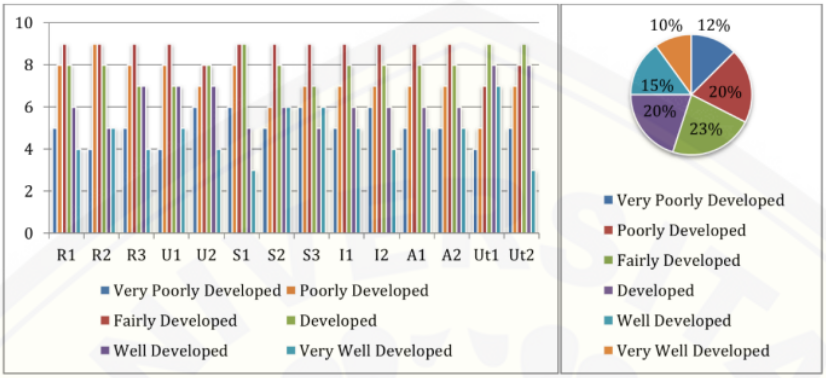

Figure 7
The pre-test result on the students' historical literacy for experiment class

Based on the above syntax, we developed the RBL-STEM learning materials. The learning materials consist of five components, namely Syllabus, Lesson Plans, Students Worksheet, Test instruments (pre and post-tests), and library for J-Batik software application. All the learning materials have been undergone the test process, namely content validity, format validity, language validity, practicality test as well the effectiveness of all instruments. We do not report the score of all the above tests since it has been written in a diferent paper by Firdausya et. Al. (2019). Thus, in this section, we focus on the analysis of the student's results on their pre-test and post-test of both classes, i.e., the validity, reliability, homogeneity, normality, and the last is independent sample *t-test*. The pre-test result on the students' historical literacy for control and experiment classes can be described in Figure 6 and Figure 7. The Figure 6 describes the pre-test result on the students' historical literacy for the control class. The Figure 6 describes the pre-test result on the students' historical literacy for the control class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly developed till fairly developed, Most of student is lack in the historical literacy, It is shown from the pie diagram with very poorly developed is 12%, poorly developed is 20%, fairly developed is 25% so the total of minimum skills in historical literacy is 57%. The medium until high historical literacy is the following: developed is 18%, well developed is 15%, very well developed is 10%. The percentage of medium until high historical literacy is 43%. Similarly, Figure 7 describes the pre-test result on the students' historical literacy for the control class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly develop to fairly develop. Most of student have the historical literacy shortage, It is show from the pie diagram with very poorly developed is 12%, poorly developed is 20%, fairly developed is 23% so the total of minimum skills in historical

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literacy is 55%. The medium until high historical literacy as follows: Developed is 20%, well developed is 15%, very well developed is 10%. The percentage of medium until high historical literacy is 45%. Based on these results, it shows that the students' historical literacy for both classes lies in the poorly and fairly developed category.

The implementation of RBL-STEM learning materials in the classroom is initiated by developing the learning materials. The one, which is very important to deal with, is to do validity and reliability tests on the pre-test instruments of the students' historical literacy. The test instrument is derived from the main and sub-indicators of historical literacy, and it consists of 10 questions each. By using inferential statistic Person Correlation, the result of the validity test is given that the score of Sig. (2-tailed) of all question items starting from question 1 to question 10 are less than 0.05. It can be concluded that the question instruments for all questions are valid. Furthermore, the Alpha Cronbach score showing the reliability test gives 0.787, which is greater than 0.60. It can be concluded that the question instrument is reliable, see Table 3.

Table 3
The reliability test of the pre-test instrument

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.799	0.787	10

Furthermore, the results of the homogeneity test of the two quasi-experimental classes obtained from the pre-test are as follows:

Table 4
Test of Homogeneity of Variances

Value			
Levene Statistic	df1	df2	Sig.
.095	1	48	0.691

Based on the output Table 4 of the test of homogeneity of variances, it is known that the significance value (Sig.) of the student's collaborative thinking skill pre-test is 0.691. Since the value of Sig. 0.691 > 0.05, it can be concluded that the variance of the historical literacy post-test of the control and experimental classes is homogeneous.

The last step is to test the difference of the two means between the control and experimental classes. It aims to determine the effect of the RBL-STEM learning materials. From the research design in Table 2, it was found that the experimental class was given the RBL-STEM learning materials while the control class was given the RBL-STEM approach with no learning materials,. After being given the treatment then, a normality test was carried out on the data from the post-test collaborative thinking skills. The results of the normality test can be presented in Table 5.

Table 5
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Value	.148	51	.122	.867	51	.475

a. Lilliefors Significance Correction

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The significance value *(p)* in the Kolmogorov-Smirnov test is 0.112 (p > 0.05), so based on the Kolmogorov-Smirnov normality test, the data is normally distributed. The significance value *(p)* in the Shapiro-Wilk test is 0.475 (p > 0.05), so based on the Shapiro-Wilk normality test, the data is also normally distributed.

Finally, we end up dealing with statistical analysis by using an Independent Sample *t*-test to test whether there is a significant difference between the experiment class and control class under the implementation of the learning materials of the RBL-STEM approach. Table 6 shows the result on the level of confidence 5% the value of Sig. (2-tailed) = 0,001<0.05. It means $t_{count} > t_{table,}$ which concludes H_1 is accepted and H_0 is rejected. It implies the difference between the two classes is significant. It concludes that the RBL-STEM learning materials improve student's historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development (Moersid, 2013).

Table 6
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	.092	.772	-2.806	49	.001	-2.233	.764	-3.831	-.643
	Equal variances not assumed			-2.819	46.598	.001	-2.233	.765	-3.832	-.632

Furthermore, based on the post-test result on the students' historical literacy for control and experiment classes, it can be described in Figure 8 and Figure 9.

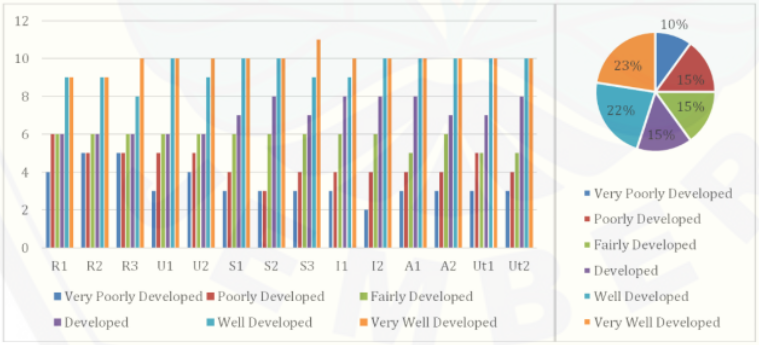

Figure 8
The post-test result on the students' historical literacy for control class

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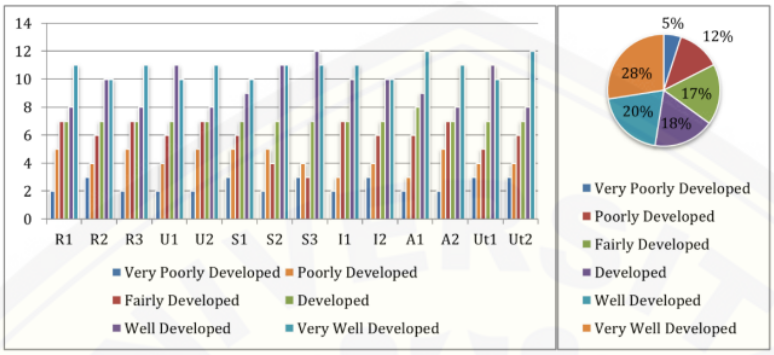

Figure 9
The post-test result on the students' historical literacy for experiment class

Figure 8 describes the post-test result on the students' historical literacy for the control class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly developed till fairly developed. Most of students have the historical literacy shortage. It is shown from the pie diagram with very poorly developed is 10%, poorly developed 15%, fairly developed is 15% so the total of minimum skills in historical literacy is 40%. The medium until high historical literacy is as follows: Developed is 15%, well developed is 22%, very well developed is 23%. The percentage of medium until high historical literacy is 60%. The pos-test result from control class compared with pre-test score shows a significant improvement of student historical literacy from 43% to 60% in medium to high category. Figure 9 describe the post-test result on the students' historical literacy for the experiment class. The data category from Figure 6 divided into two parts, minimum to medium historical literacy and medium until high historical literacy. The minimum to medium historical literacy start from very poorly developed to fairly developed. Most of student is lack in the historical literacy. It is shown from the pie diagram with very poorly developed is 5%, poorly developed 12%, fairly develop 17% so the total of minimum skills in historical literacy is 34%. The medium until high historical literacy is as follows: Developed is 18%, well developed is 20%, Very well developed is 28%. The percentage of medium until high historical literacy is 66%. The post-test result from experiment class compared to the pre-test score shows a significant improvement of student historical literacy, namely from 45% to 66% in medium to high category. Based on these results, it shows that the students' historical literacy for control classes lies on the developed and well-developed category.

Table 7
The descriptive data of the student's historical literacy trough their tests

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	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test of Experiment Class	41	68	73	70.00	1.118
Post-test of Experiment Class	41	73	89	83.50	1.253
Pre-test of Control Class	40	56	70	61.50	.815
Post-test of Control Class	40	62	79	72.00	.942

Based on the above Table 7, we can conclude that the implementation of RBL-STEM learning materials can improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development. (Nurainun, et.al. 2008). The achievement of the students' historical literacy in the experimental class is higher than the scores of the students' students' historical literacy in the control class.

To convince our research achievement, the following we describe the student's portrait phase. Figure 10 shows a portrait phase of student 001 with the category of low historical literacy. The figure shows that the students start doing the task from stage R_1 to stage R_2 continue to R_3 and immediately jump to stage U_1 and continue to stage U_2. He goes to S_1 and jumps to S_2 and S_3, after passing S_3, and goes to stage I_2, jump into A_1, Ut_1 and finally reaches Ut_2.

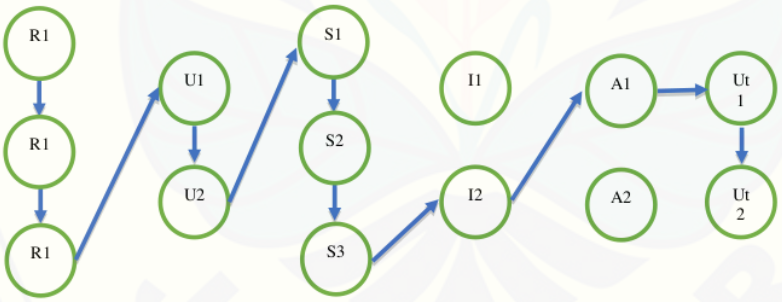

Figure 10
Student low Historical Literacy

Figure 11 shows a portrait phase of student 002 with the category of medium historical literacy. The figure shows that the students start doing the task from stage R_1,R_2 to stage R_2 and immediately jump to stage U_1 and continue to stage U_2. He goes to S_1 , S_2 , back to U_2 and jumps to S_3, after passing U_2, and goes to stage I_2 then I_1 jumps into A_2 then Ut_1 and finally reaches Ut_2.

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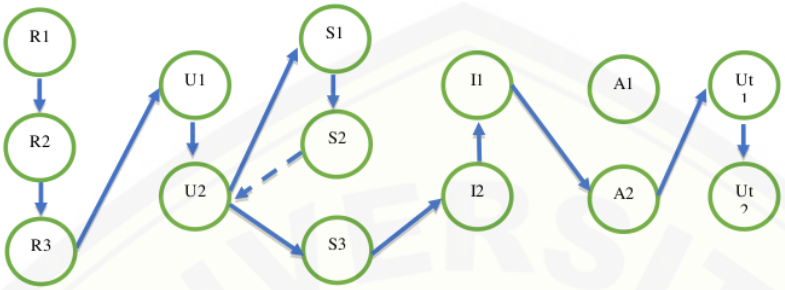

Figure 11
Student Medium Historical Literacy

Figure 12 shows a portrait phase of student 003 with the category of high historical literacy. The figure shows that the students start doing the task from stage R_1 R_2 and continue to stage R_3 and immediately jump to stage U_2 and continue to stage U_1. He goes to S_1 and back toU1 continue to S_2 jump to S_3 goes to I_2 back to S_2 and jump to I_2, after passing I_2, and goes to stage I_1, $A1$, $A2$, jump to Ut_1, back to A_2 and and finally reaches Ut_2.

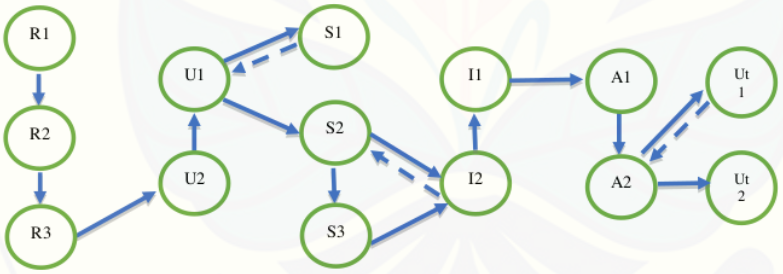

Figure 12
Student High Historical Literacy

DISCUSSION

The information generated from this research is very meaningful since we have known that students' historical literacy can be improved through the implementation of RBL-STEM. Lecturers and students, especially for the history class, can elaborate this leraning model together with the STEM approach to improve to the students' historical literacy especially related to the preservation of traditional cultural heritage on the Indonesian Batik Motifs. As we know that almost ethnic of Indonesia have a specific

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Batik Motifs, such as Javanese Batik Motif, Kalimantan Batik Motifs, Papuan Batik Motifs, Maduranic Batik Motifs, and other Batik Motifs. The implementation of RBL-STEM will provide space for students to explore the problems presented by lecturers, and then students can explore some breakthroughs and collect some relevant data of Batik Motifs, and analyze them according to the stages of RBL. The use of the Internet of Things technology also significantly affects to the innovation of designing Batik Motifs (Shabrina & Kuswanto, 2018). It will imply to the students creative thinking skills on designing the Batik Motifs. The use of the Internet of Things will help students to track the history of batik motifs from several others places in Indonesia. This learning activity will be more realistic because it is combined with the STEM approach, wherein its implementation, science problems become the foundation, the use of information technology becomes a mainstay, and then technical breakthroughs become major strategy and finally mathematical analysis will be able to provide in-depth analysis such as determining the number of combinations and permutations of the batik motifs and also students can make interpolations and predictions related to the preservation of the nation's cultural heritage in larger number of batik motifs from a thousand ethnics of Indonesia (Lusianti, 2012).

Mathematical analysis can also give students a space to conduct analyzes related to the potential of the batik industry as a cultural heritage for the development of economic development programs for rural communities. The mathematical concepts of profit and loss in the Social Arithmetic subject can be applied in order to calculate business prospects in the field of Batik production as an Indonesian cultural heritage. Suppose we define the purchase price is the price of an item from the factory. The selling price is the price set by the merchant to resell to the buyer the profit is a condition where the selling price is greater than the purchase price, while loss is a condition where the selling price is smaller than the purchase price (Atthariq M. F, 2020). By using this mathematical concept, students can be trained in their analytical thinking skills to analyze the business potential of Batik production as a cultural heritage for the development of the creative economy industry of rural communities easily. Another important of mathematics concept in designing Batik is geometry concept, namely shape, diagrams, transformation geometry such as translation, dilatation, rotation, and reflection. The use of "*Jbatik"* software in designing Batik motifs will help much on the students' skill in designing batik motif (Sudarsono et al, 2022).

Moreover, the integration of RBL-STEM has provided a basic understanding for students to explore many batik motifs such that the student's historical literacy has been significantly increased. Students have been able to recognize the events of the past, understand the narratives of the past, show the research skills, implement the language of history, analyze the historical concept and utilize the ICT to explore the documents of history. All of these are the main indicators of historical literacy for students which have been well developed during the implementation of RBL-STEM. It is also shown by student activities during the implementation of RBL-STEM learning, see Figure 11. This figure shows the student's activity under the implementation of RBL-STEM on three stages, namely the initial stage (fairly active, active and very active), main stage (fairly active, active and very active), and final stage (fairly active, active and very active).

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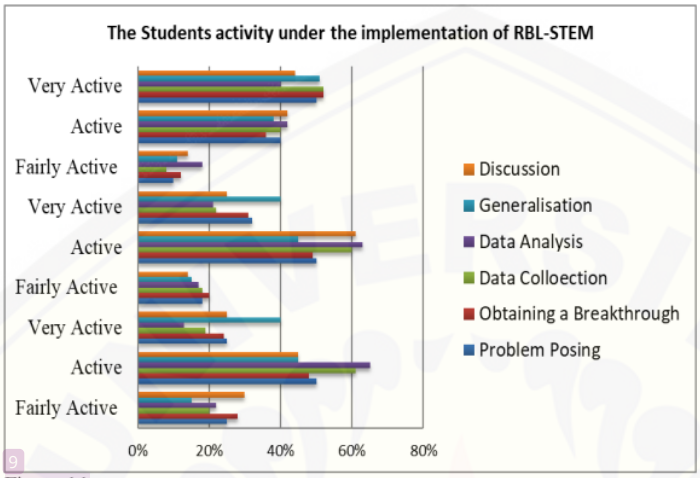

Figure 11
The student's activity under the implementation of RBL-STEM on three stages

By Figure 11, it confirms that the implementation of RBL-STEM learning materials can improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage. his results supported with the data from pre-test and post-test in control class and experimental class shows a significant improvement of the students historical literacy after the implementation of the RBL model of teaching with STEM approach.

CONCLUSIONS

The research shows that the implementation of RBL-STEM learning materials can improve students' historical literacy in designing the Indonesian batik motifs as traditional cultural heritage. Students' historical literacy in the experimental class is higher compared with the control class. It is due to that the integration of research-based learning and science, technology, engineering, and mathematics approach can foster the ability of the students to recognize the events of the past, to understand the narratives of the past, to show the research skills, to implement the language of history, to analyze the historical concept and the last to utilize the ICT to explore the documents of history. Therefore the use of RBL-STEM is recommended in the classroom. The benefits of this study will contribute to the motifs development of Indonesian batik as well as to enrich understanding for the young generation that the Batik is a National Heritage. However, for the last indicator of students' historical literacy, it needs to do further research, namely exploring the student's creative thinking skills in designing the Indonesian batik motifs as traditional cultural heritage and sustainable rural economic development. Therefore, as the suggestion for further researcher is how develop the Batik Motif related to traditional ceremonies such as “Ancak Agung” festival and “Petik Laut” festival. The result of this further study will help student to enrich their historical literacy on other culture and heritage of Indonesia.

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