



## The framework of RBL-STEAM learning activities: Designing batik motifs as cultural heritage and sustainable rural economic development to improve students' historical literacy

Sumardi <sup>1\*</sup>, AA UU Kamila <sup>2</sup>, AM Marvianto <sup>3</sup>, ZR Ridlo <sup>4</sup>, Dafik <sup>5</sup>

<sup>1</sup> Department of History Education, University of Jember, Indonesia

<sup>2,5</sup> Department of Post Graduate of Mathematics Education, University of Jember, Indonesia

<sup>3</sup> Department of Science Education, University of Jember, Indonesia

<sup>4,5</sup> PUI-PT Combinatorics and Graph, CGANT, University of Jember, Indonesia

\* Corresponding Author: **Sumardi**

---

### Article Info

**ISSN (online):** 2582-7138

**Volume:** 04

**Issue:** 04

**July-August** 2023

**Received:** 01-07-2023

**Accepted:** 22-07-2023

**Page No:** 923-932

### Abstract

This paper aimed to build the RBL model of teaching activities framework combined with the STEAM approach, specifically by developing batik motifs as cultural heritage and sustainable rural economic development to increase students' historical literacy. This type of research employs a qualitative methodology. The first step in the research process is collecting literature and published papers on creating a framework for research-based learning activities integrated with the STEAM approach. The findings were presented in a table containing six stages, stage 1-6. Each stage is explaining how students learned to design Batik motifs using CorelDraw and Geogebra software while implementing the Research Based Learning Model of teaching with a STEAM approach. The primary finding of these studies relates to the STEAM integrated to the RBL model are to determine STEAM activity in designing batik motifs using Geogebra and CorelDraw software to increase students' historical literacy in described in stage 1-6. This study also included the construction of a test instrument framework for students' historical literacy. The implication is that the learning activities frame are ready to be continued to the development process of RBL-STEM learning materials in improving students' historical literacy in designing batik motifs as cultural heritage and sustainable rural economic development.

**DOI:** <https://doi.org/10.54660/IJMRGE.2023.4.4.923-932>

**Keywords:** Batik Design, Historical Literacy, RBL-STEAM

---

### Introduction

Cultural heritage shapes the identity of local communities as palpable proof of a past reality that has only been experienced temporally and bears witness to the passage of time, historical occurrences, and deeds of individuals or communities (Król, 2021) <sup>[8]</sup>. It encompasses aspects of various cultures, such as values, traditions, beliefs, languages, art, architecture, music, dance, folklore, traditional dress, specialty foods, and anything that describes a way of life and the identity of a human group. It is crucial to safeguard and preserve cultural heritage as this helps maintain a society's cultural identity, promotes cross-cultural understanding, and gives meaning and depth to people's lives. International organizations such as UNESCO play an essential role in preserving the world's cultural heritage through recognition, protection, and promotion (Meskell, 2018) <sup>[11]</sup>.

Cultural heritage can be viewed differently by different groups (generations, communities), and for some, it may only be an "episode" with no lasting value or significance (Jaafar *et al.*, 2015) <sup>[5]</sup>. For others, it should even be forgotten and erased. Today's generation's problem is the need for more appreciation for their culture (Malihah, 2015) <sup>[9]</sup>. One example is the appreciation of batik. Many people only understand batik as an Indonesian cultural heritage that must be preserved, but they need to gain

knowledge of the types and how they are made. Therefore, there is a need for an introduction to the batik culture itself in today's younger generation. The introduction can be done by utilizing software technology to create the design. In addition, to support the preservation of batik in the younger generation, it can also be inserted with knowledge so that they look practical and beautiful. Additionally, creating batik helps sustain economies in rural, urban, and even national areas (Sumardi *et al.*, 2022) <sup>[17]</sup>.

The designs and types of batik motifs are very diverse, and each classic batik motif has a philosophy and meaning that is not the same (Rini *et al.*, 2019) <sup>[13]</sup>. A typical regional motif is a batik motif with unique elements and characteristics that characterize a particular region. The motif is created by exploring the region's unique and prominent natural and cultural potential (Yoga and Eksak in Salma, 2019) <sup>[14]</sup>. Designs that support regional product attributes can display different characters when presented or compared to other products (Kotler and Armstrong in Wahyuni & Kurniawan, 2019) <sup>[20]</sup>. Mainly Situbondo batik has existed since the 1970s or even before that, as evidenced by the relics of batik cloth in Peleyan Village, Kapongan sub-district (Firdausya *et al.*, 2019) <sup>[3]</sup>. This batik generally uses shells and marine life as the central motif because Situbondo is coastal (Achmad *et al.*, 2020) <sup>[1]</sup>. The clam motif used as the central motif of Situbondo batik is the shape of the clamshell, not the clam inside. The term shell is used because, in general, the shape of the motif is better known by the term shell or the name of the shell instead of the clamshell batik (Sasongko, 2014) <sup>[15]</sup>. Batik itself can help revive the economy in rural areas. A concept known as "rural economic development" aims to improve the welfare of rural communities by enabling them

to use natural resources to produce goods and services (G. Bosworth in Setiyartiti & Rachmawatie, 2021) <sup>[16]</sup>. The diversity and culture of rural communities, which help them fulfill their daily needs, often impact the rural economy. Rural communities often use natural resources as a source of income, which affects rural economic growth. Integrating production provides economic benefits and helps preserve and promote local cultural identity. It can be a way to transmit cultural values from generation to generation, strengthen people's pride in their heritage, and maintain the sustainability of traditional culture. A group of people who uphold communal values, cooperation, and solidarity is called a village. If there is community involvement, this becomes the foundation for the village economy to thrive. UNESCO has recognized Indonesian batik as a cultural heritage of humanity since 2009 (UNESCO, 2009). Batik motifs often reflect cultural values, myths, folklore, and historical events. Understanding the history and development of batik over time can better understand how Indonesian culture has evolved. Historical literacy can help us realize the importance of this recognition and appreciate the efforts to preserve cultural and historical traditions in the ever-changing modern world. Sumardi (2022) <sup>[17]</sup> asserts that historical literacy in batik is crucial, mainly when using Indonesian batik motifs in educational activities. To help practical learning activities on historical literacy in batik and adjust to the development of education in the 21st century, learning about batik can utilize the Internet of things, such as software or design applications, to attract students. Six leading indicators (Sumardi *et al.*, 2022) <sup>[17]</sup> of historical literacy are explained in Table 1.

**Table 1:** The Indicator and Sub-Indicator of Historical Literacy

Indicator	Sub-Indicator
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, and use evidence, 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 cause and motivation. Understand the concept of history, historical heritage, and historical narrative.
Utilizing ICT to explore the documents	Using ICT in conducting historical searches Using, understanding, and evaluating historical sources using the Internet of Things

The use of various technologies that involve art can be classified as STEAM. STEAM combines science, technology, engineering, art, and mathematics. Students can become more engaged in their education by using the STEAM approach, which encourages them to develop ideas based on technology and science that allow them to investigate how to solve problems from the viewpoints of five different disciplines (Bin Amiruddin *et al.*, 2022) <sup>[2]</sup>. Through STEAM education, teachers can demonstrate to students how concepts, principles, and methodologies from STEM fields are used to develop the goods, services, and systems they use daily (Tresnawati *et al.*, 2020) <sup>[18]</sup>.

RBL is one such educational model that calls for real-world, contextual problems. In other words, research-based learning is a constructivism-based learning model that embraces student-centered learning associated with various activities in

the learning process to build students' knowledge. The stages in RBL consist of the exposure, experience, and capstone stages (Mapata *et al.*, 2021) <sup>[10]</sup>. These three stages can be developed into six steps, according to Nawawi *et al.* (2020) <sup>[12]</sup>, namely background problems, problem formulation, hypotheses, data collection, discussion, and conclusions.

The main objectives of this research are as follows : (1) To outline the structure of the STEAM-based RBL model learning activities in designing the Situbondo Batik Motifs as Cultural Heritage to improve students' historical literacy, (2) To outline the framework for the creation of instructional materials based on the RBL model and the STEAM approach in designing the Situbondo Batik Motifs as Cultural Heritage, and (3) to explain how the use of Corel Draw and Geogebra Software and learning materials from the RBL model of teaching with a STEAM approach can enhance historical

literacy in designing Batik motifs as Cultural Heritage.

**Method**

A qualitative method is used in this kind of research. The research process begins by gathering some reviews and literature. From the literature review findings, we create frameworks for the four research mentioned above goals. The foundational courses in basic design are subjected to the ADDIE model, and the effectiveness of the course design is assessed based on how well the students learned during the course's implementation process. The ADDIE model of research and development, which stands for Analyze, Design, Development, Implementation, and Evaluation (Iswati, 2019)<sup>[4]</sup>, served as the framework for creating RBL-STEAM learning activities.

**Research Finding**

**A. The Framework of RBL-STEAM Syntax**

The following sections outline a framework for incorporating the RBL learning model into the STEAM approach to increase historical literacy as cultural heritage and sustainable rural economic development. The syntax suggested by Nawawi *et al.* (2020)<sup>[12]</sup> is the foundation upon which the framework is developed. In this study, we consider the accuracy of the design motif batik for a specific color and shape and the uniqueness of the design pattern itself. The first stage that students must do is to understand the problem given and then determine how to solve the problem, followed by finding data and information through related literature. The framework for this RBL-STEAM integration is detailed in Fig. 2.

The coloring pattern of the batik motif design must be designed symmetrically, regularly, and pay attention to color. Based on this, it is necessary to be accurate in determining the type of color choice used in batik motif design so that it looks practical and aesthetic.

Science	Technology	Engineering	Art	Mathematics
Analysis of batik motif design based on coloring, layout, and symmetry by adjusting the characteristics of batik motifs from Situbondo.	The use of the Internet of Things in obtaining data on batik characteristics and Geogebra & Corel Draw in designing batik motifs	Application coloring concept of rainbow vertex antimagic coloring by representing graphs on batik motif design using Corel Draw	Arrangement and addition of design elements to batik motifs according to the characteristics of the region	The use of mathematical calculations in determining the minimum color set permutation in batik motif design and using geometry transformation for its artistic form.

Fig 1: The STEAM Problem in Developing the Design of Batik

**B. Students' Learning Outcome and Objective**

Students' learning outcomes keep using application design, where students can create a batik design that reflects the local culture, particularly in the Situbondo region. Students can check to see if the batik in Situbondo design motif is prevalent throughout the rest of the area. Meanwhile, for the learning objective, Students will be able to gain knowledge and skills in Science, Technology, Engineering, Art, and Mathematics through RBL-STEAM learning.

- **Science- Students are expected to**
  - We present the fundamental issue of traditional cultural heritage and sustainable rural economic development to Situbondo batik motifs.
  - Discover the short history of the Batik motifs.
  - Analyze the decoration business strategy to increase profits and aid in the growth of the rural economy.
- **Technology - Students are expected to**
  - We use the Internet to gather information about Situbondo batik patterns as a traditional cultural heritage and viable rural economic development.
  - Use any website for the most recent research on creating Batik motif designs.
  - Use any digital resource to find a tutorial for creating a batik design using software or an application, such as the Youtube channel.

- **Engineering-Students are expected to**
  - We are making advances in the design of traditional cultural Situbondo batik motifs.
  - We use Coral Draw Software to promote rural heritage and sustainable economic development.
  - Create various types of basic batik designs using the Geogebra software.
  - Utilize the Coral Draw to create various Batik designs from the basic design.
- **Art - Students are expected to**
  - Using Coral Draw to identify the most stunning and symmetrical Situbondo batik motifs as a means of conserving rural communities' cultural traditions and fostering sustainable economic growth
  - Decide on the best arrangement and coloring scheme for the batik motif.
  - Adding components to batik motifs as accessories by the regional batik style
- **Mathematic - Students are expected to**
  - It used the Internet to look up any graph containing rainbow vertex antimagic.
  - The primary color required for the main batik motif can be determined by adjusting the number of colors in the rainbow vertex antimagic coloring.

- To determine artistic forms with geometric transformations to obtain various models from basic batik motifs to show their aesthetic side.

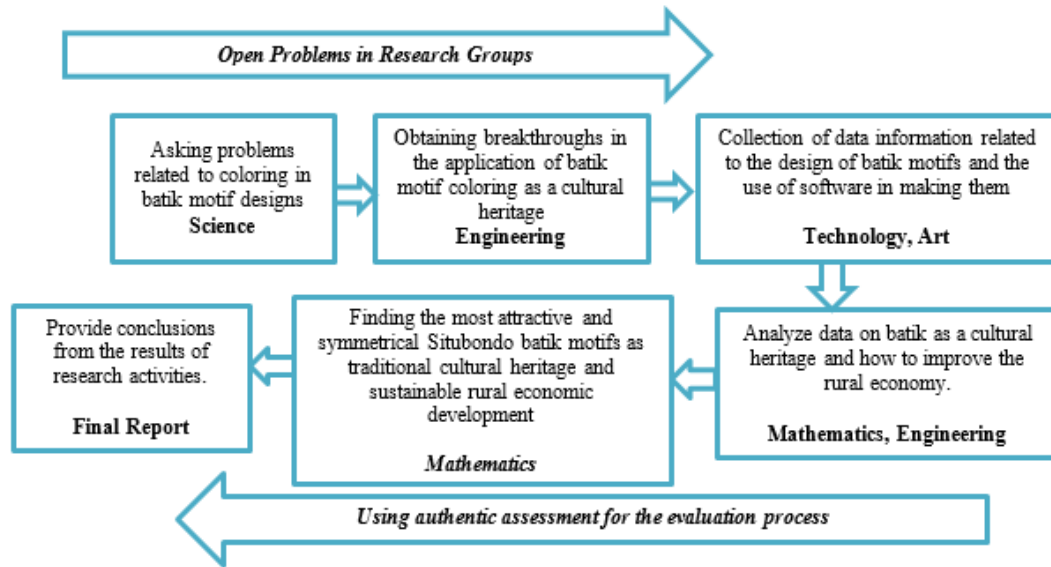


Fig 2: The Framework of RBL-STEAM in Developing Batik Design

### C. Steam problems

This research uses a research-based learning model with a STEAM approach that allows students to learn and develop knowledge and skills in Science, Technology, Engineering, Art, and Mathematics. The problem of each element can be seen below.

#### ▪ The element of science problem

Marine biota refers to the various forms of life that exist in the marine ecosystem, including animals, plants, and microorganisms. The diversity of marine biota is essential to maintain the balance of the ecosystem and the various benefits humans obtain, including in the industrial and cultural fields such as batik.

However, there has been an alarming decline in marine biota diversity in recent decades. Various factors have contributed to this problem, including human activities that damage marine habitats, climate change, pollution, and overfishing. This decline in the diversity of marine life has also impacted the batik industry, Indonesia's cultural heritage.

One significant impact is the decline of natural resources used in batik production. Some of the natural materials used to make natural dyes in batik come from marine biota, such as sea snails (*Murex* spp.) and crustaceans. The decreasing number of these marine biota results in the scarcity of raw materials, increasing production costs and limiting the availability of natural dyes used in batik.

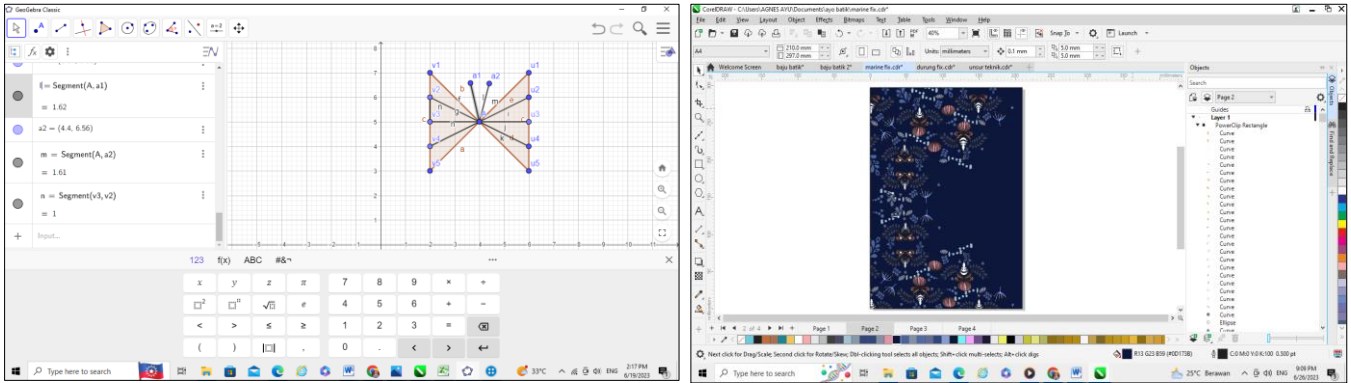
In addition, the decline in marine life diversity also impacts

the sustainability of the batik tradition. Batik motifs and designs are often inspired by the beauty and diversity of marine life, such as images of fish, coral reefs, and marine plants. With the decline in the number and variety of marine life, batik artists and crafters need help creating new and unique motifs related to marine life. This can hinder innovation in the world of batik and reduce the attractiveness and authenticity of batik products.

Steps can be taken to utilize textile-type and natural colorings such as mangosteen skin, mango, and turmeric. To get beautiful coloring, it is necessary to match the colors in the batik motif itself. Coloring can be done by utilizing the concept of rainbow vertex antimagic coloring. Utilizing science in determining the colors in batik motifs will help the batik tradition rise again.

#### ▪ The element of the technology problem

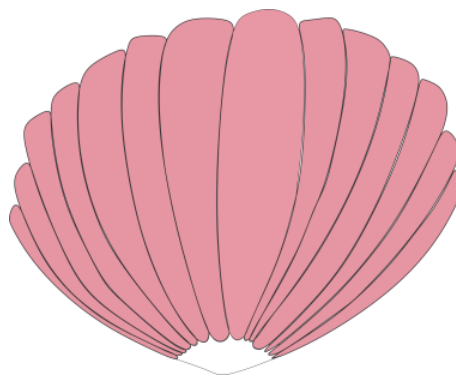
The use of technology has become an integral part of many industries, including the batik industry. In designing batik motifs, technological elements significantly contribute to simplifying and improving the process of creativity and production. Technological elements can be used with various types of software and online platforms. In this research, the software used is GeogGebra Classic and Corel Draw to draw graph illustrations on local wisdom batik motif designs. With this software, it will create complex patterns and will create motifs with precise details. The following is an overview of the work in some of the software used.



**Fig 3:** Use of technology in designing batik (a) Geogebra (b) Corel Draw

▪ **The element of engineering problem**  
 In the technical element, the technique used to solve problems regarding the design of batik motifs using the rainbow vertex antimagic coloring concept is represented by

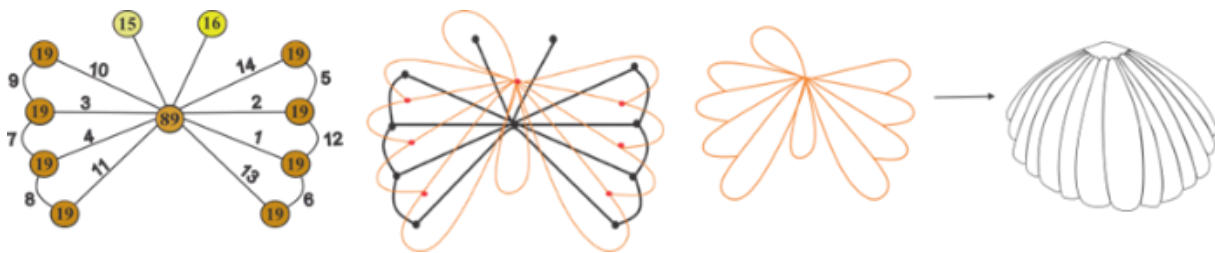
the basic motifs obtained into graph form. Figure 4. Illustrates the basic batik motif that will be sought for its graph representation.



**Fig 4:** Basic Design Motif Batik

The application of rainbow vertex antimagic coloring in a graph in batik motif design is (1) performing antimagic labeling on all edges of the graph representation, (2) calculating the vertex weight by summing the labels of the connected edges, (3) analyzing the rainbow path in the graph with every two points having at least one rainbow path, (4) if

in one rainbow path there is the same color or weight, then it must repeat it. Based on the primary motif in Figure 5, it can be seen that the rainbow vertex antimagic connection number is three because it has three different types of colors. The following are the stages of determining the basic motif based on the graph.



**Fig 5:** Graph Representation Process on Batik Basic Motifs (a) Representation Result Graph (b) Representation Process (c) Basic Motifs

For graph representation, the concept of the dual graph is used where the graph formed from changing the region of the forming graph, as in Figure 5 (b), becomes the vertices of the dual graph, and an edge will connect the vertices formed if an edge directly separates the region represented by the vertices from the forming graph. After forming the dual graph of the original graph, it can be formed into the desired graph shape as the fundamental motif, as shown in Figure 5 (c).

obtained into the basic batik motif. The motif will be shaped in such a way using the Corel Draw application, which will be adjusted to the desired local style of the batik area. For batik in this research, it is based on the local culture of Situbondo, which leads to marine life as the primary motif. The basic batik motif's color scheme is modified to match the butterfly shell graph's rainbow vertex antimagic, where the outcomes are three different color categories that can be applied to coloring graphs. As shown in Figure 6., this. The RGB values listed below show three different colors.

▪ **The element of art problem**  
 The art element highlights the coloring pattern previously

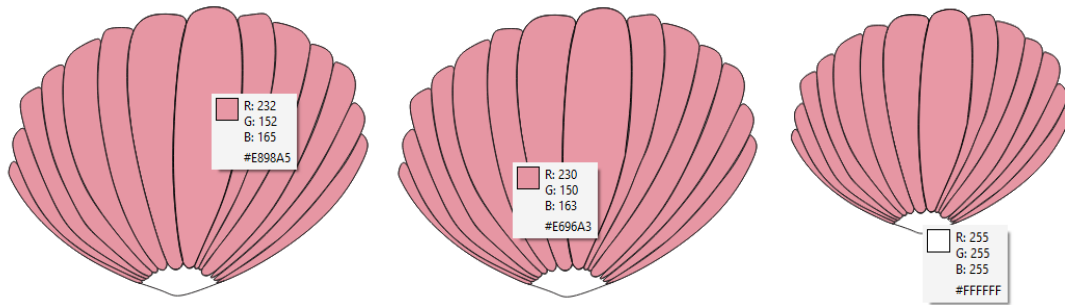


Fig 6: Differences in coloring according to the RVAC concept



Fig 7: Elemental Accessories on Batik

To complement the main design of batik motifs, some elements are added as accessories in the form of leaves and coral reefs, as in Figure 7. These additional motifs can enrich the aesthetics of batik and provide variations in the batik

design. The following illustrates the batik motif design after being given various elements and appropriate coloring patterns.



Fig 8: Application of Batik Motif Design on Clothes

▪ **The element of mathematics problem**

The mathematical element used in problem-solving is the calculation of point weights on the graph when applying rainbow vertex antimagic coloring to determine the coloring

pattern for batik motif design, as explained in Kamila *et al.* (2023) [6]. The labeling of the point is denoted by  $v, u,$  and  $A$ . As shown in Figure 9.

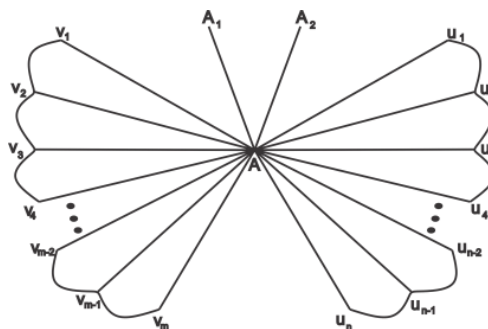


Fig 9: Shell-Butterfly Graph Labeling

Based on Figure 9, the set of vertex and edges is known, and the cardinality has been found for the vertex cardinality is  $2m + 3$ , and the edge cardinality is  $4m$ . To determine  $rvac(BF_{(m,n)})$ , one must first determine its lower bound. Since point A has a large degree compared to the others, it will have a different point weight than the other points. Therefore, point A will have many differences in the weights with  $u_n$  and  $v_m$ . Therefore, the lower bound of  $BF_{(m,n)}$ , is 4.

The next step is determining the upper bound using vertex weights and edge functions. Where for the graph  $BF_{(m,n)}$  has 3 cases. The first and second cases are when  $m = 3, 4$ , and the 5th is when  $m \geq 5$ . When  $m = 3, 4$ , the value of  $m$  will not run, so the function and point weight determination can be directly observed in Figures 10 (a) and 10(b). Meanwhile,  $m \geq 5$  can be seen in Figure 10 (c).

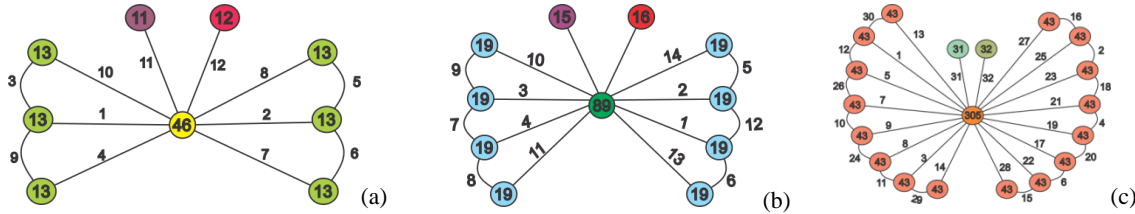


Fig 10: Illustration of RVAC  $BF_{(m,n)}$  with  $m = n, m = 3, m = 4$  and  $m > 5$

From the rainbow vertex antimagic coloring results, coloring is done on the primary motif. After that, the art is formed using geometry transformation. Determination of the artistic form in batik is produced through transforming points, lines, or flat fields through translation (shift), reflection (mirroring), rotation, and transformation. Where the reflection of the

primary motif will be developed according to the aesthetics of the batik design motif itself. Rotation on the shell motif that has been mirrored is then put together and then rotated by 180 degrees. Meanwhile, the transformation is combined through the mirroring process according to the line showing its aesthetic side.

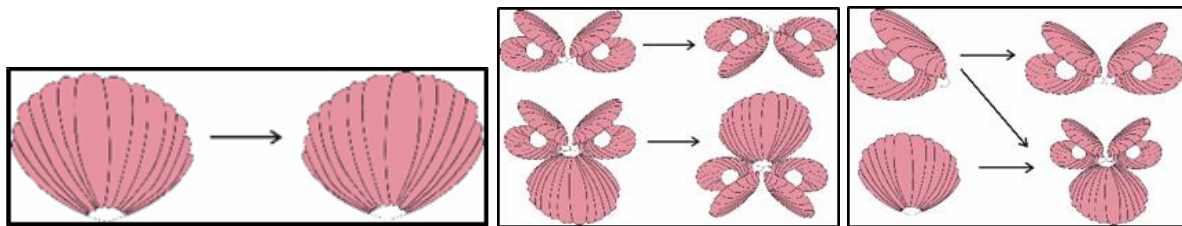


Fig 11: Artistic Forms from Geometric Transformations

**D. RBL-STEAM Learning Activities on Design Motif Batik**

The six stages of the RBL-STEAM activities model of teaching will be covered in this section. The six stages outline students' research and design work to create Batik Motifs integrated into educational activities. The first phase of the process focuses on posing a fundamental issue regarding Situbondo batik patterns as a traditional cultural heritage and sustainable rural economic development. In order to preserve Situbondo batik motifs as a traditional cultural heritage, we will ask the student to consider how to create and develop them. The table below provides more information.

The RBL-STEAM approach's first stage (Science) learning activities raise an essential question about Situbondo batik designs. The lecturer and students talk about the brief history of batik and how it relates to developing a sustainable rural economy. At this stage, the discussion will center on how to create batik motifs that reflect the distinctive features of the Situbondo region. The purpose of producing batik is to raise a region's economic standing.

The RBL-STEAM approach's second stage (Engineering) learning activities focus on creating innovations. Students gain knowledge of numerous batik motifs, current research on batik, and its connection in design for Situbondo batik motifs as traditional cultural heritage and long-term rural economic. At this point, the student tries to create a batik motif using software or any other application design.

The RBL-STEAM approach's third stage (Technology, Art)

learning activities involve gathering information about Situbondo batik motifs as traditional cultural heritage and sustainable rural economic development through the Internet from various sources that demonstrate how to create these motifs using software and other supporting applications in solving local wisdom batik motif design problems and deciding the arrangement and coloring pattern that is appropriate for the batik motif.

The fourth stages of the RBL-STEAM approach's learning activities (Mathematics and Engineering) involve data analysis about the Situbondo batik motif as a traditional cultural heritage and developing a sustainable rural economy. The students use any source to find rainbow vertex antimagic graphs to make it into elemental design batik.

Finding the most attractive and symmetrical Situbondo batik motifs as traditional cultural heritage and sustainable rural economic development is one of the five-stage (Mathematics) learning activities of the RBL-STEAM approach. They use software or any other application such as Corel Draw and Geogebra to calculate the pattern and color required from the rainbow vertex antimagic coloring that is already founded.

The sixth stage involves presenting the findings as an RBL report on using Corel Draw as Software/application to develop a new Batik design related to each region's distinctive features. The student will participate in a focus group conversation about batik, sustainable economic development, and historical literacy.

For more details, see the table below:

**Table 2:** The RBL-STEAM Learning Activities in Science Aspect

Stage One	Learning Activities
Asking problems related to coloring in batik motif designs	a. Lecturers asked students about their knowledge of making batik motif designs. b. Lecturers provide students with an overview of batik motif designs, then ask whether they can develop batik motif design arrangements with local wisdom. c. The lecture explained the relationship between Batik as a traditional cultural Heritage and sustainable rural economic development. d. Students discuss in groups the development of the basic construction of batik motif design and try to analyze the color of each motif design.

**Table 3:** The RBL-STEAM Learning Activities in Engineering Aspect

Stage Two	Learning Activities
Obtaining breakthroughs in the application of batik motif coloring as a cultural heritage	a. Lecturers guide students to discuss breakthroughs in solving problems regarding the design of batik motifs with local wisdom. b. Lecturers explain how to collect data using the Internet of Things to determine batik motifs and coloring. c. Students create innovations of how to design motif batik of each region d. Students gain knowledge of numerous batik motifs, current research on batik, and its connection to the platform

**Table 4:** The RBL-STEAM Learning Activities in Technology and Art Aspect

Stage Three	Learning Activities
Collection of data information related to the design of batik motifs and the use of software in making them	a. Students collect data on batik as a traditional cultural heritage and sustainable rural economic development by browsing scientific journals/articles from various reference sources, such as Science Direct, Google Scholar, and Research Gate. Students can use a PC or smartphone. b. Students discuss the information obtained and record things necessary for making batik motifs. c. Lecturers explain using software or other design applications to make batik motifs. d. The student develops breakthroughs in designing Situbondo batik motifs as traditional cultural heritage and sustainable rural economic development by application design. e. Students decide the arrangement and coloring pattern appropriate for the region's batik motif.

**Table 5:** The RBL-STEAM Learning Activities in Mathematic Engineering Aspect

Stage Four	Learning Activities
Analyze data on batik as a cultural heritage and how to improve the rural economy.	a. Students involve data analysis about the Situbondo batik motif as a traditional cultural heritage and the development of a sustainable rural economy. b. Students use any source to find rainbow vertex antimagic graphs to make it into elemental design batik. c. Students use any software and application design to create patterns according to the region.

**Table 6:** The RBL-STEAM Learning Activities in Mathematic Aspect

Stage Five	Learning Activities
Finding the most attractive and symmetrical Situbondo batik motifs as traditional cultural heritage and sustainable rural economic development	a. Students identify the most lovely and symmetrical Indonesian batik patterns as traditional cultural heritage and sustainable rural economic development by any software and application design. b. Students Create a program using Geogebra using software to calculate the pattern. c. Students use Corel Draw or another program to create the design and adjust the already established rainbow vertex antimagic coloring. d. Students use geometric transformations to create artistic forms from simple batik motifs to express their aesthetic side.

**Table 7:** The RBL-STEAM Learning Activities in RBL-Report Aspect

Stage Six	Learning Activities
Provide conclusions from the results of research activities	a. Students make a research report on using rainbow vertex antimagic coloring to determine the coloring of basic batik motifs. b. Students make presentations in front of the class to conduct focus group discussions. c. Lecturers evaluate and reinforce understanding of the previous activities' results. d. Lecturers make observations of students' historical literacy skills using observation sheets.

**E. The instrument Framework for Assessing Students' Historical Literacy**

The framework for the instruments used to evaluate your

historical literacy skills will be presented next; for a sample, see Table.9.

**Table 8:** Student Historical Literacy assessment instrument framework

Indicator	Sub-Indicator	Test Material
Recognizing the events of the past	Recognizing the importance of historical events	Explaining the significance of the connection between batik and historical events.
	Understanding historical events for the provision for future life	Giving an explanation of the historical event of batik for the benefit of future generations
	Understanding historical Heritage	Defining the batik as a historical artifact
Understanding the narratives of the past	Understand the story form of continuity over time	Providing a summary of the development of Batik as a historical heritage
	Understand the narrative and use it wisely for future life	A narrative and descriptive explanation of the history of batik.
Showing the research skills	Collect, analyze, and use evidence, historical events, and narratives	Assembling a few Batik motifs with characteristics of the local knowledge and historical aspects
	Able to develop exploration skills to enrich historical findings	Investigating and creating the batik motif while relating to the historical aspect
	Find strategies to preserve historical events, relics, and narratives	Creating a batik exhibition using a student project for creating batik motifs.
Implementing the language of history	Understand the language of history	Describing the characteristics of batik as a component of the linguistic heritage of Indonesian culture.
	Use historical terminology in understanding historical language	Providing a brief history of batik as one of the languages in Indonesian culture.
Analyzing the historical concept	Understand historical concepts such as cause and motivation.	Explaining the origins and distinctive features of batik
	Understand the concept of history, historical heritage, and historical narrative.	Defining Batik as a Historical Heritage
Utilizing ICT to explore the documents	Using ICT in conducting historical searches	Researching the history of batik in Indonesia using online resources.
	Using, understanding, and evaluating historical sources using the Internet of Things	Investigating the history, development, and cultural significance of batik in relation to historical literacy in students

#### F. The framework of learning material process development

The ADDIE model served as the foundation for developing the learning materials for this study. Analysis, design, development, implementation, and evaluation are the stages of development.

- The first stage is the analysis stage; In this stage, students will gather information about each region's batik production. Activities here involve looking at the learning materials, the students' personalities, and the lesson plans that will be applied.
- The second stage is design. During this phase, the professor combines the RBL model of instruction with a STEAM approach, selects the techniques to be used, and sets up the lesson plans, student worksheets, pretest and posttest tools, and historical literacy testing equipment.
- The third stage of development involves evaluating the effectiveness and practicality of the instrument and instructional materials. The validation process includes checking the instrument's content, format, language, and level of applicability. The validation process includes checking the instrument's content, format, language, and level of applicability.
- The main task of the fourth stage, implementation, is to evaluate the tool in the classroom and assess how well the RBL model of instruction combined with a STEAM approach has improved student historical literacy when creating batik motif designs using any software and application design.
- The final stage is evaluation. The primary activities during this stage are evaluation and reflection of the implementation of the RBL model of teaching integrated with the STEAM approach, which can enhance students' historical literacy in batik design.

#### Discussion

Creating a framework for RBL-STEAM learning activities that use the Internet of Things is crucial to help students develop their historical thinking abilities. This framework serves as the foundation for the R&D research format. This paper will serve as a manual for researchers to take additional research-related action. At least two additional research projects can be carried out, namely: (1) creating RBL-STEAM teaching materials using the ADDIE development model and (2) analyzing RBL-STEAM teaching materials to enhance students' abilities to use historical literacy when creating a design motif batik. According to the research findings (Kamila *et al.*, 2023) <sup>[6]</sup>, learning activities that combine RBL-STEAM effectively develop students' thinking skills. Incorporating RBL-STEAM into other science and social science problems will train students to solve complex problems effectively. This is crucial for producing an excellent young generation for the future.

#### Conclusion

The main finding of these studies relates to the development of activity framework RBL model of instruction combined with the STEAM approach, specifically the STEAM activity of creating batik motifs using the Corel Draw and Geogebra to improve student historical literacy in the form of stages one until six and their associated learning activities. This research activity also includes the creation of the test instrument framework for student historical literacy. It is crucial to complete this task before engaging in further research activities, such as R&D and experimental research. Due to the difficulty of this initial research, it is necessary to explore collaborative research for other STEAM cases and to propose a breakthrough for resolving STEAM issues.

### Acknowledgment

We would like to express our gratitude from the support of the Postgraduate Project Grant of LP2M-University of Jember of year 2023 for carrying out this research and finishing this paper for publication.

### References

- Achmad A, Amir A, Azzahrah A. Penerapan Manajemen Ekonomi Islam Pada Produksi Batik Labako UD. Bintang Timur Jember. Istidlal: Jurnal Ekonomi Dan Hukum Islam. 2020;4(1):13-23. <https://doi.org/10.35316/istidlal.v4i1.205>.
- Bin Amiruddin MZ, Magfiroh DR, Savitri I, Binti Rahman SMI. Analysis of The Application of The Steam Approach to Learning In Indonesia: Contributions to Physics Education. International Journal of Current Educational Research. 2022;1(1):1-17. <https://doi.org/10.53621/ijocer.v1i1.139>.
- Firdausya AR, Sumardi, Umamah N. Situbondo batik: Natural resources in culture. IOP Conference Series: Earth and Environmental Science. 2019;243(1). <https://doi.org/10.1088/1755-1315/243/1/012163>.
- Iswati L. Developing Addie Model-Based Esp Coursebook. Indonesian EFL Journal. 2019;5(2):103. <https://doi.org/10.25134/ieflij.v5i2.1804>.
- Jaafar M, Noor SM, Rasoolimanesh SM. Perception of young residents toward sustainable conservation programs: A case study of the Lenggong World Cultural Heritage Site. Tourism Management. 2015;48:154-163. <https://doi.org/10.1016/j.tourman.2014.10.018>.
- Kamila AAUU, Dafik, Kristiana AI, Nisviasari R, Kurniawati EY. On Rainbow Vertex Antimagic Coloring of Shell Related Graphs. c2023;2. [https://doi.org/10.2991/978-94-6463-138-8\\_3](https://doi.org/10.2991/978-94-6463-138-8_3).
- Kamila AAUU, Dafik, Tirta IM. The Development of RBL-STEAM Learning Materials to Improve Students' Metaliteracy Thinking Skills in Solving RVAC Problems and Application on Design Motif Batik. International Journal of Current Science Research and Review. 2023;6(7):5319-5328. <https://doi.org/10.47191/ijcsrr/V6-i7-147>.
- Król K. Assessment of the cultural heritage potential in Poland. Sustainability (Switzerland). 2021;13(12):6637. <https://doi.org/10.3390/su13126637>.
- Malihah E. An ideal Indonesian in an increasingly competitive world: Personal character and values required to realize a projected 2045 'Golden Indonesia.' Citizenship, Social and Economics Education. 2015;14(2):148-156. <https://doi.org/10.1177/2047173415597143>.
- Mapata D, Ulinsa Ningrum AAL, Evi T, Syaggaf AW, Hasan M, Pratama C. Pembelajaran Berbasis Riset (Research Based Learning). Bandung: CV. Media Sains Indonesia; c2021.
- Meskill L. A Future in Ruins: UNESCO, World Heritage, and the Dream of Peace. Oxford University Press; c2018.
- Nawawi E, Hartono Suharman A, Mulyani S. Research Based Learning Design: Teacher and Lecturer Perception Analysis. Advances in Social Science, Education, and Humanities Research. c2020;513.
- Rini DR, Hidayat I, Samodra J, Sillah S. Motif Batik Mapping in East Java as Local Cultural Heritage. International Journal of Social Science Research. 2019;1(1):1-7.
- Salma IR. Review: Pengembangan Batik Motif Khas Daerah Di Balai Besar Kerajinan Dan Batik. Dinamika Kerajinan Dan Batik: Majalah Ilmiah. 2019;36(2):149-162.
- Sasongko ADW. Pengembangan Desain Motif Kerang Pada Batik Di Desa Peleyan Kabupaten Situbondo. Jurnal Pendidikan Seni Rupa. 2021;2(3):1-7.
- Setiyartiti L, Rachmawatie D. Batik industry development based on rural economic development: The case study of Gunungkidul Regency. E3S Web of Conferences. c2021;316. <https://doi.org/10.1051/e3sconf/202131604013>.
- Sumardi, Ridlo ZR, Puji RPN, Dafik. The Research-based Learning-STEM Learning Activity Framework: Using Software J-Batik in Designing the Indonesian Batik Motifs as Traditional Cultural Heritage to Improve Students Historical Literacy. International Academic Education and Literature. 2022;3(4):24-34.
- Tresnawati N, Saleh I, Kurniawan DT, Sudarmin S, Wardani S. Learning Science Through STEAM Approach (Science Technology, Engineering, Arts, and Mathematics) Integrated Ethnoscience in the Context of Batik Culture for Pre-Service Teachers of Primary Education. Advances in Social Science, Education, and Humanities Research. 2020;429:243-246. <https://doi.org/10.2991/assehr.k.200402.056>.
- UNESCO. Intangible Cultural Heritage: Indonesian Batik [Nomination File No. 00170]; c2009.
- Wahyuni PR, Kurniawan DT. Pengaruh Interaksi Harga Dan Desain Atau Motif Batik Terhadap Keputusan Pembelian Batik. Jurnal Pertanian Cemara. 2019;16(1):8-16.