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Research Article

# Optimizing Creative Thinking: STEAM-PjBL in Yogyakarta's Batik Science e-Book with Kawung Motif for Students

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**Abstract.**
Batik tulis is an Indonesian cultural heritage with a rich meaning and philosophical value. Although batik is often taught in the arts, the process of batik can also be integrated into science learning. This research aims to analyze: (1) the feasibility of science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL, (2) the practicality of science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL, and (3) the effectiveness of science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL in improving students' creative thinking skills. The study uses the Thiagarajan 4D development model (Four-D Model), consisting of four stages, namely the define, design, develop, and disseminate. The results showed that: (1) The science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL was feasible to use, judging from the results of the material validator, 79.50 (very good), and the results of the teaching material validator, 33.00 (very good). (2) Student response was 3.28 (very good). (3) Results of the N-Gain and Effect Size analysis of the science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL was quite effective in improving students' creative thinking skills (N-Gain 0.56 [medium], Effect Size 0.9 [high]).

**Keywords:** creative thinking skill, development research, science e-book, STEAM-PjBL

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## 1. INTRODUCTION

Education serves as a system aimed at enhancing the overall quality of human life and, concurrently, as a means to pass down cultural values to humanity [1, 2]. When cultural elements are integrated into the educational process, they become more accessible and better understood, contributing to a deeper appreciation of culture [3]. One approach to incorporate local culture into education involves integrating indigenous wisdom into the learning process [1, 4].

Batik and its making techniques are one of Indonesia's priceless heritages originating from Java [5]. The intricate and thoughtful process of making hand-drawn batik reflects the skillful hands of the artisans, as well as the traditional values that have been passed down from generation to generation [6]. The traditional Javanese expertise in creating high-value fabrics for various purposes, ranging from daily wear, traditional ceremonies, to industrial commodities, reflects the high culture of the Javanese people related to clothing, fashion, and lifestyle [4]. Batik becomes a cultural symbol depicting the identity of the Javanese nation with sentimental and national values, reflecting a rich and civilized culture [7].

Local wisdom-based learning is very suitable to support the progress of the world of education [8, 9]. In addition, local wisdom-based learning can also foster awareness in developing students' attitudes that regional potential, if properly utilized and preserved, can be very beneficial for the community to improve welfare [10, 11]. However, Kurniawati's research shows that there is a decline in students' interest in maximizing their own local wisdom [12].

STEAM learning trains students to be able to think in finding solutions to existing problems by creating ideas into the latest technology [13, 14]. According to data from Badan Pusat Statistik, the unemployment rate in Indonesia has increased by 1.84% compared to the last data released in August 2019 [15]. One of the solutions taken to overcome the lack of experts in the STEAM field is the use of textbooks that contain STEAM components during learning [16].

One of the science learning models that can build 21st century skills in students is project-based learning [17, 18]. Project-based learning system integrates interdisciplinary of different skills, e.g. skills in interpreting math, technology in building concept understanding through integration in other subjects [19].

E-books with local wisdom in science lessons can optimize learning. The development of this flipbook-based learning module can increase student interest in learning because of the attractive appearance of teaching materials [12]. Teaching materials integrated with technology are one of the main learning resources that support the learning process [20]. The educational process in the era of rapidly developing information and communication technology as it is today makes it possible to optimize science learning in the form of developing technology-based learning such as flipbooks [21, 22].

Based on the results of interviews with science teachers at State Junior High School 1 Sleman, information was obtained that students were still lacking in creative thinking. Teachers feel constrained by time and there is a demand to complete the material content. Students are enthusiastic in learning, but to develop creative thinking skills

requires a lot of time. The teacher said that there is an assessment that is fixed on the material that must be completed. As stated by I. M Sari et al., that one indication of the low ability of creative thinking is that it still receives less attention in formal education, so it still needs a lot more attention to generate creative thinking skills [23].

Based on data from the Global Creativity Index, Indonesia ranks 108th in creativity out of 134 countries worldwide [24]. Based on this research, it is concluded that the ability to think creatively is not really cultivated and developed in the implementation of learning in schools. Based on data on the scores of students in the odd semester exam, it was found that out of 30 students, 13 students (43.33%) reached the minimum learning completeness limit. While 17 students (56.67%) obtained an average score below 78. The low number of students who reach the KKM is influenced by the inability of students to think creatively.

One of the learning models suggested for use in implementation is project-based learning or abbreviated as PjBL [25]. PjBL allows students not only to develop their intellectual skills, but also their manual skills [26]. Based on the background of the problem, a study was conducted to develop a science e-book containing batik tulis Yogyakarta kawung motif based on STEAM-PjBL to improve students' creative thinking. Therefore, the results of this study are expected to be a program that initiates the integration of local wisdom into science learning.

## 2. METHOD

This research is a research and development (R&D). The product developed by the researcher is a science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL. The development adapted the 4D model (Four-D Models) developed by Thiagarajan (1974) [27]. This development model consists of four stages, namely define, design, develop, and disseminate.

The implementation of this research was carried out at State Junior High School 1 Sleman on February 1 to May 23, 2023. The subjects in this study were 30 students of class VII B State Junior High School 1 Sleman. The research design conducted was the one group pretest-posttest design. This design is a pretest and posttest design that is carried out in one group only without comparison [28]. The feasibility and practicality of science e-books containing the local wisdom of batik tulis Yogyakarta kawung based on STEAM-PjBL is analyzed by converting the score [29]. The implementation of learning with the contextual approach was analyzed using the Interjudge Agreement (IJA) equation [30]. The effectiveness of science e-books containing local wisdom of

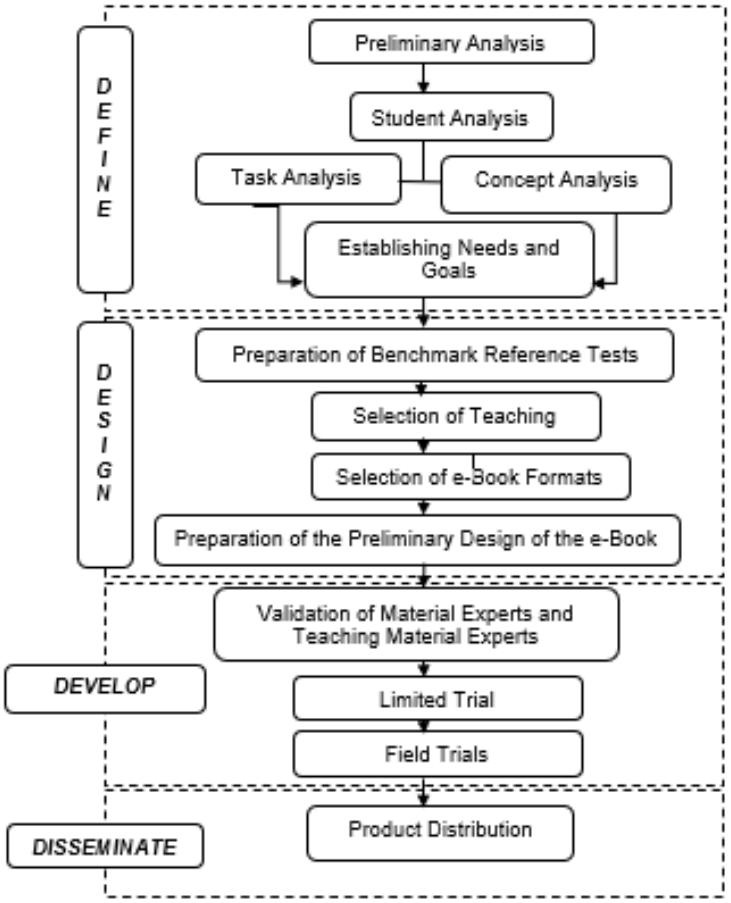


**Figure** 1: Research Steps to Develop a Science e-Book.

batik tulisYogyakarta kawung motif based on STEAM-PjBL to improve students' creative thinking skills, analyzed by gain score [31] and effect size [32].

The data from the content validation results for the creative thinking instrument were analyzed using Aiken's V formula which is based on the results of the assessment of the expert panel of two people on each item of the creative thinking instrument in terms of the extent to which the item represents the construct being measured [33].

## 3. RESULTS AND DISCUSSIONS

### 3.1. Feasibility of the Product

The results of the material expert assessment in the form of a science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL received a total score of 79.50 with a very good category and the assessment received an Aiken's V value of 1.00 with a valid category. The results of the teaching material expert

assessment in the form of a science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL received a total score of 33.00 with a very good category.

The product is said to be valid if it includes several components, namely (1) the content feasibility component includes the suitability of SK with KD, needs, truth of substance, benefits, moral values, and social values [34]. A product is said to be valid if it meets content validation and construct validation [35]. The validity of the science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL development results is measured based on the results of expert validation.

## 3.2. Effectiveness of the Product

The results of the calculation of the effect size of 0.9 with a sample size of 30 students can be said that the science e-book containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL on the creative thinking skill of students in a high category influence. This shows that the science e-book containing the local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL has a high influence (high effect) on the creative thinking skill of students in science learning in class VII B students of State Junior High School 1 Sleman. Table 1 show Interpretation of Creative Thinking Skills

Table 1: Interpretation of Creative Thinking Skills.

| No. | Indicator | Indicator | Percentage | Interpretation |
|---|---|---|---|---|
| 1 | Fluency thinking (fluency) | The ability to respond with a number of answers when asked a question. | 96.67% | Very good |
| 2 | Flexible thinking (flexebility) | The ability to classify things according to different divisions (categories). | 85.00% | Very good |
| 3 | Original thinking (originality) | The ability to have a different way of thinking from others. | 85.83% | Very good |
| 4 | Elaboration | The ability to elaborate an idea to make it clearer. | 85.83% | Very good |
| 5 | Self-concept | Ability to interpret the results of an experiment by giving different concepts or ideas. | 78.33% | Good |
| 6 | Imagination | Ability to create creative and innovative images or visualizations related to a concept or problem. | 95.83% | Very good |

The average creative thinking of students reached an impressive figure of 87.91%. This figure reflects an extraordinary level of interpretation of creative thinking skills after

learners use a science e-book that includes local wisdom content in the form of batik tulis Yogyakarta kawung motif based on STEAM-PjBL. This result can be concluded as evidence that a learning approach that integrates local wisdom in the context of science and technology can have a very good impact on the development of students' creative thinking. The results of the calculation of the gain value obtained an average pretest of 77.90 and an average posttest of 91.30. So that a gain of 0.56 is obtained. This means that students experience an increase in learning outcomes with a moderate category because the N-gain is in the interval $0.7 > g \geq 0.3$.

## 3.3. Product Practicality

Based on the results of the field trial, the results of the assessment of the practicality of the science e-book developed using the student response questionnaire, obtained a score for the display aspect is 2.17, the material presentation aspect is 3.32, the benefit aspect with a score of 3.30, the STEAM component aspect with a score of 3.07, the PjBL learning component aspect with a score of 3.30, the local wisdom aspect with a score of 3.30, the creative thinking aspect with a score of 3.30, and the aspect of loving local culture with a score of 3.48. The total average of the overall response results is 3.28. So based on the final average value obtained, the criteria for science e-books containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL can be categorized in the practical category, because the final average result obtained is 3.28 which is in the interval $X \geq 3.25$ with the assessment criteria which is very good. Thus, the criteria for the practicality of science e-books containing local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL developed are achieved.

The overall score of all aspects is 81.98%. This percentage shows that students are very interested in science e-books with local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL. The percentage of the display aspect is 79.17%, the material presentation aspect is 82.92%, the benefit aspect with a percentage of 82.50%, the STEAM component aspect with a percentage of 76.75%, the PjBL learning component aspect with a percentage of 82.50%, the local wisdom aspect with a percentage of 82.50%, the creative thinking aspect with a percentage of 82.50%, and the aspect of loving local culture with a percentage of 87.00%.

The average implementation of the learning implementation plan at the first to second meetings was 94.74% with a very good category. Thus, based on the assessment of the students' response questionnaire and the implementation of the learning implementation plan, it shows that the science e-book with the local wisdom of batik tulis

Yogyakarta kawung motif based on STEAM-PjBL is said to be practical and students are interested in using it.

## 4. CONCLUSION

The science e-book with the local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL developed in this study is valid and feasible to use in science learning. The science e-book with the local wisdom of batik tulis Yogyakarta kawung motif based on STEAM-PjBL is also effective to improve students' creative thinking skills.

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