Research Article

# Effect of Digitalization of Web-Based Science Learning Media with the STEAM Approach to Student's Creative Thinking Abilities

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**Abstract.**
Learning innovation in the present digital transformation era emphasizes employing technology and methods in learning. The utilization aims to enhance 21st-century foundational skills, including students' abilities in creative thinking. This research was conducted with the purpose of investigating how the application of web-based science learning media with the Science, Technology, Engineering, Mathematics, and Arts (STEAM) approach improves student's creative thinking abilities. This research process uses a quasi-experimental research design using a one-group pretest-posttest design. The sample of this research consisted of 7th-grade students at SMP Negeri 65 Central Maluku. The results showed that website for science learning media with the STEAM approach had a significant impact on student's creative thinking abilities with very creative indicators of 18.75%, creative 75%, and creative enough of 6.25% with an N-Gain Test score of 0.61 in the medium category and by results of data analysis of the t-test with a significance value (2-tailed) $0.000 < 0.05$. based on research results, using web-based science learning media with the STEAM approach can potentially increase student's ability to think creatively by integrating the media flow of science, technology, engineering, art, and mathematics. With this media, teachers can train students to produce innovative solutions and creative thinking skills and support digital transformation.

**Keywords:** STEAM, media, creative thinking, web-based learning

## 1. Introduction

A person's ability to think creatively is one of the basic abilities of the 21st Century that is highly useful for dealing with the actual world, which is still evolving and requires everyone to have creative and original thoughts connected to their field of knowledge [1]. This innovation cannot be separated from the creative thinking process, where The ability to think creatively is one of the abilities to come up with new ideas to solve problems by creating innovative solutions to predict possibilities that will occur in the future [2,3]. With this ability, students can adapt and keep up with the dynamic developments of the times [4,5]. A person is said to have high creative thinking abilities

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if he can provide various possible answers to a problem that are appropriate, precise, and varied [6]. The creative thinking indicators include fluency, flexibility, original, and elaboration [7].

Natural Sciences is a subject that emphasizes the discovery of empirical concepts and facts to develop student's competence to understand the natural environment through the process of finding out and applying it to obtain a deep understanding [8]. Creative thinking Students require abilities to study and understand natural objects or phenomena. However, the facts in the field are based on research results reported by Leasa & Batlolona [9]. It was found that the creative thinking abilities of students in the Maluku Islands were still relatively low. Therefore, it is necessary to improve learning continuously and comprehensively to improve student's creative thinking abilities. This is in line with the results of a preliminary study conducted by Mulder & Siswanto [10] because teachers still use conventional learning, and media does not improve student's high-level thinking abilities. Even if you look at the research results of Talaku & Elly [11], learning media in the form of mobile learning greatly influences student's creative thinking abilities. This indicates that media can be a solution to improve student's creative thinking abilities. However, it must be seen again that most students on the island of Maluku come from weak economic backgrounds, so not all students have smartphone devices. For this problem, digital learning media are needed to improve student's creative thinking abilities and facilitate student diversity. The media must also be relevant to the principles of science learning.

The learning media must realize the transformation of learning to the regions following the principles of an independent curriculum [12]. According to Mufida, et al. [13], learning media combined with STEAM influences student's skills and provides a better learning ecosystem. For this reason, this research aims to analyze the influence of web-based digital learning media with a STEAM approach on improving student's creative thinking abilities in island areas.

## 2. Method

This research process uses a quasi-experimental one-group pretest-posttest design because there was only one class at each level at SMP Negeri 65 Central Maluku. The data collection method uses creative thinking ability test instruments and has previously undergone a validation process by experts. Research data analysis used a paired difference test (paired sample t-test) to see how to use web-based digital

learning resources with the STEAM approach and the N-Gain Normality test to see the effect on student's creative abilities.

# 3. Result and Discussion

## 3.1. Results

The research results presented in this study describe the average creative thinking ability score based on research results obtained and from the analysis results using the N-gain test and t-test to see the effectiveness.

TABLE 1: Analysis of Student's Capability to Think Creatively.

| Sample | Average Score | | Average N-Gain Score | Category |
|---|---|---|---|---|
| | Pre-Test | Post-test | | |
| 16 | 38.43 | 76.41 | 0.61 | Currently |

TABLE 2: Analysis of Achievement Indicators for Student's Creative Thinking Ability.

| Indicator | Number of Questions | Pre-Test | Post-test | N-Gain Score | Category |
|---|---|---|---|---|---|
| Fluency | 3 | 52 | 83.33 | 0.65 | Currently |
| Flexibility | 2 | 31.25 | 73.43 | 0.61 | Currently |
| Originality | 2 | 28.9 | 77.34 | 0.68 | Currently |
| Elaboration | 3 | 35.93 | 72.39 | 0.59 | Currently |

Based on Table 1, the analysis of normalized gain calculations generally shows an increase in student's capability to think creatively, which is at an average interval of 0.61 and is included in the medium category. Then, further analysis was carried out regarding improving student's creative thinking abilities based on the level of each indication of creative thinking ability achievement, with results as in Table 2.

The research results based on Table 2, presented in this study, are in the form of an average score of creative thinking abilities based on the types of creative thinking indicators using the Gain test. Based on the analysis of the level of achievement of each creative thinking criterion, students are, on average, in the medium category, with the highest level of achievement being the Originality thinking indicator with an N-Gain of 0.68 and the lowest being the elaboration indicator. Then, results were analyzed again based on categories, as in Table 3.

Based on Table 3, a noticeable improvement in student's creative thinking skills between the pre-test and post-test had a significant effect on student's creative thinking

TABLE 3: Categories of Student's Creative Thinking Ability.

| Score Intervals | Category | Pre-Test | | Post-test | |
|---|---|---|---|---|---|
| | | Frequency | Percentage (%) | Frequency | Percentage (%) |
| 81-100 | Very creative | 0 | 0 | 3 | 18.75 |
| 61-80 | Creative | 1 | 6.25 | 12 | 75 |
| 41-60 | Creative Enough | 2 | 12.5 | 1 | 6.25 |
| 21-40 | Less Creative | 13 | 81.25 | 0 | 0 |
| 0-20 | Not Creative | 0 | 0 | 0 | 0 |
| | Total | 16 | 100 | 16 | 100 |

abilities with creative indicators of 18.75%, Creative 75%, and Creative Enough of 6.25%. To determine the significance value of the impact of the average creative thinking ability score, a t-test was carried out, as presented in Table 4.

TABLE 4: t-Test Results.

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | PRE TEST – POST TEST | -37.969 | 11.039 | 2.760 | -43.851 | -32.087 | -13.759 | 15 | .000 |

Based on Table 4, a significance value (2-tailed) of 0.000 < 0.05 was obtained, indicating a significant influence between before and after using web-based digital learning media with the STEAM approach.

## 3.2. Discussion

The research results show that analysis of the influence of web-based digital learning media using the STEAM approach showed that the results of increasing creative thinking abilities were generally in the medium category. Although it is in the "medium" category, it can be considered a good starting point for further development. With additional practice and experience, students can improve their creative thinking abilities. One of the reasons is that students are using digital-based learning for the first time after receiving Chromebook assistance from the government. It can also be seen that based on the achievements of the four indicators of creative thinking ability, the results of the elaboration thinking indicator are one of the lowest indicators, which is caused

by student's ability to deepen a concept so that they can detail and find various approaches to solving a problem. This aligns with research conducted by Rofiqoh, et al. [14]. Elaboration is in a low category compared to other indicators. students experience little difficulty explaining an idea or describing it in detail in an experiment.

Research results show that the above t-test shows a significant impact on student's average creative thinking score after using web-based digital learning media with STEAM method with a a significant value (2-tailed) of 0.000 < 0.05. This proves that creative thinking abilities can be improved by providing a directed and structured learning ecosystem by connecting the digital learning ecosystem in the form of digital learning media, which contains learning visualizations and using the STEAM learning flow integrated into it, which encourages independent thinking [15] which has an impact on success a lesson. The web-based learning that is carried out contributes to changes in the learning paradigm in areas that have only used mobile learning, experiencing changes by using web-based learning. With a combination of a web-based learning ecosystem, it can support a face-to-face learning environment in the classroom or remotely and increase the efficiency of learning time and student learning outcomes [16]. Apart from that, the web-based learning ecosystem provides extraordinary changes compared to conventional learning ecosystems in terms of appearance, provides abundant information assets and learning resources, and provides opportunities for students to become leaders in their learning [17].

The influence is also based on the web-based learning transformation pattern developed by presenting scaffolding. Where scaffolding impacts the diversity of students based on their learning styles on the achievement and improvement of the learning process in the concept of learning autonomy or learning carried out by students themselves without direct teacher assistance [18]. Apart from that, the thing that has the most influence in this research is using STEAM as a learning approach flow. The flow of the STEAM ecosystem influences student participation and learning motivation based on the involvement of technology, gamification, and learning scenarios that encourage positive changes in learning [19]. With the STEAM approach in the learning flow, it has been proven that it can improve student's creative thinking abilities [20], increasing creative thinking, which impacts creativity and the ability to solve problems based on direct experience with the environment [21]. This indicates that the digitization of web-based learning with the STEAM approach significantly influences student's creative thinking abilities.

# 4. Conclusion

According to research results, the utilization of web-based digital learning media with the STEAM approach influences increasing student's creative thinking abilities. This is reinforced by the t-test results with a significance value (2-tailed) of 0.000 < 0.05.

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