

## Connecting Science to Society : STEAM Deep Learning in Elementary School

Adelyn Salurapa<sup>a\*</sup>, Fadlan Muchlas Abrori<sup>b</sup>

<sup>a\*</sup>Universitas Terbuka, North Borneo, Indonesia, [adn.salurapa@gmail.com](mailto:adn.salurapa@gmail.com)

<sup>b</sup>Universitas Borneo Tarakan, North Borneo, Indonesia

\*Correspondence: [adn.salurapa@gmail.com](mailto:adn.salurapa@gmail.com)

### Abstract

This research is motivated by the results of observations on students in class VB of Indotionghoa Elementary School, which show that the current learning process is only superficial and not in-depth. The impact is that students' critical thinking abilities are not maximized. The purpose of this research is to determine the effect of the STEAM Deep Learning approach on students' critical thinking skills. The type of research used is *Pre-Experimental* with a *One Group Pretest-Posttest* design. The data analysis technique uses statistical-based quantitative analysis using the SPSS 25 application, which consists of prerequisite tests and hypothesis tests. The prerequisite tests consist of normality and homogeneity tests. After the prerequisite tests are conducted, the t-test is performed. Based on the results of the normality test, the Sig value is  $> 0.05$ , so it is concluded that the data is normally distributed. The homogeneity test shows a Sig value  $> 0.05$ , indicating that the data is homogeneously distributed. Furthermore, the t-test results show that the Sig.(2-tailed) value is 0.027, which is less than 0.05, meaning that there is an effect of using the STEAM deep learning approach on student learning outcomes.

### Keywords:

Connecting Science,  
STEAM, Deep Learning

## 1. Introduction

Science education in elementary school plays a very important role. Critical, creative, and problem-solving thinking skills are needed in students so they can address various issues in society. This is in line with the demands of an increasingly complex era, so the various policies formulated by the government, such as curriculum changes and adapting approaches or strategies in the learning process, are intended to address current challenges.

Currently, the Ministry of Education, Culture, Research, and Technology is promoting the implementation of the deep learning approach in classrooms. This is not without reason, but is due to the learning process in the classroom being considered superficial and not fully in-depth. In fact, deep learning processes are very much needed in this 21st-century era where humans are competing with technological advancements. Deep learning is not just an approach, but a concept that emphasizes the integration of higher-order thinking skills with the real world (Fatimah et al., 2025).

Beside deep learning, there is also the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach, which combines science, technology, and art in its application. When these two approaches are combined, it is hoped that harmony can be created. The STEAM approach not only sharpens cognitive abilities but also develops students' creativity skills supported by technological advancements (Mu'minah et al., 2020).

Based on the observation results in class V at Indotionghoa Elementary School in Tarakan, it shows that the learning process in the classroom is still not optimal. Teachers are still impressed with teaching conventionally. This is evident when teachers simply teach and students receive learning information without incorporating technology and art. The material taught is also very superficial without involving learning activities that support students' critical thinking skills. Meanwhile, according

to (Wijayanti et al., 2026), the use of technology plays a very important role in optimizing in-depth learning because of its attractive appearance, which can increase curiosity and impact critical thinking skills. Meanwhile, the Merdeka Curriculum clearly provides flexibility for teachers to develop learning materials and allows for innovation in teaching strategies (Maya et al., 2025). But in reality, this did not materialize in the classroom. As a result, students' learning outcomes and critical thinking skills are very poor. Therefore, thru this research, it is hoped that the application of STEAM deep learning can improve students' critical thinking and creativity in the science learning process in elementary schools.

## 2. Method

The type of research used is Pre-Experimental with a One Group Pretest – Posttest research design, meaning a single group, which is the experimental group receiving treatment in the form of STEAM Deep Learning. The basis for selecting this design is to obtain an initial overview of the STEAM Deep Learning treatment in the classroom, making it highly feasible for further research. The research design generally does not use a control group. Data collection was done by administering pretests and posttests. The research instrument consists of 10 multiple-choice questions. The test questions are based on the material taught and align with critical thinking ability indicators.

Before the treatment was administered, students were given a pretest at the beginning of the learning process, and a posttest at the end of the learning process to determine their final abilities after receiving the treatment, which was a STEAM-based Deep Learning approach. The population in this study consisted of 27 fifth-grade students. The learning material used in this study is "Ecosystem". The data analysis technique used in this study is statistical-based quantitative analysis using the SPSS 25 application, which consists of prerequisite tests and hypothesis tests. The prerequisite tests include normality and homogeneity tests; after these tests are conducted, the t-test is performed as a reference for testing the hypothesis..

**Table 1.** *One Group Pretest-Posttest Design*

Pretest	Treatment	Posttest
$O_1$	$X$	$O_2$

## 3. Results and Discussion

### 3.1 Results

Based on the results of statistical tests using the SPSS 25 application, it shows that there is an increase in learning outcomes before and after the implementation of STEAM deep learning approach, by giving pretest and posttest questions. Quantitative pre-test data was tested at the beginning of learning, while the post-test results were at the end of learning or after the treatment in the form of the STEAM deep learning approach. The following table shows the results of pre-tests and post-tests of critical thinking skills.

**Tabel 2.** *Pre-test dan Post-test Result*

Parameter	Pre-test	Post-test
Minimum	20	20
Maximum	100	100
Average	50,90	61,81
Std. deviation	21,36	17,08

There is a difference in student learning outcomes before and after being given the treatment, which is a STEAM-based deep learning approach. Although the minimum and maximum values appear the same, the average posttest results increased from 50.90 to 61.81. Next, to complete the hypothesis testing, several analyzes were conducted, namely the normality test using the Shapiro-Wilk test, which yielded a Sig value of  $0.320 > 0.05$ , thus concluding that the data is normally distributed. Meanwhile, the homogeneity test results showed a Sig value of  $0.068 > 0.05$ , indicating that the data is homogeneous. After the prerequisite test was conducted, a t-test was then performed to see how much influence learning with the STEAM deep learning approach had. Here is the table of t-test results.

**Tabel 3.** *Paired Sample T-Test Result*

<i>Pair</i>	<i>T</i>	<i>Df</i>	<i>Sig.(2-tailed)</i>
Pretest-posttest	-2.371	22	0.027

Based on the t-test results above, it is known that the sig.(2-tailed) value is 0.027, which is less than 0.05. This means that there is an effect of using the STEAM deep learning approach on student learning outcomes.

### 3.2 Discussion

The STEAM approach is a concept that integrates five disciplines: science, technology, engineering, art, and mathematics. Its aim is to enhance students' critical thinking and creativity in problem-solving (Atiaturrahmaniah et al. 2022). On the other hand, the deep learning approach emphasizes in-depth, contextual, and meaningful learning, thereby fostering critical thinking, creativity, and problem-solving skills (Suyanto et al. 2025). When these five elements are integrated, it creates meaningful learning (Zaid et al., 2022).

Based on the results of the t-test in this study, the significance value is 0.027, which is less than 0.05. This indicates a significant difference between before and after the STEAM deep learning approach was applied to science learning in the classroom. This difference is certainly greatly influenced by the use of a learning approach that previously relied solely on information from teacher to student without using technology or involving students in learning that requires critical thinking skills. Previous research conducted by (Hidayat et al., 2025) also showed an increase in critical thinking skills thru the STEAM approach in deep learning.

Deep learning will be simplified with the use of digital technology to increase student engagement in the learning process. This is certainly in line with meeting the criteria for STEAM learning, which includes the element of technology utilization. Beside utilizing technology, the STEAM approach also integrates the learning process with art, enabling students to become accustomed to solving problems creatively (Nur et al., 2023).

The material "Ecosystem" contains various images of food chains and food webs, accompanied by pictures of animal and plant objects. This aligns with the inclusion of art elements in the learning process, such as creating food chains or food webs according to the creativity of the students. This was evident when the students were very enthusiastic about drawing animals or plants according to their individual abilities. Students' ability to deeply understand the relationships between components in an ecosystem can foster their awareness of the importance of preserving the sustainability of components within the ecosystem. This is the awareness that modern society needs today, and it is also the answer to environmental problems or issues.

### 4. Conclusion

The research results show that STEAM deep learning can improve the quality of science learning. This is evident from the increase in student learning outcomes from pretest to posttest, indicating improvement. Based on the results of the t-test, it is known that the sig.(2-tailed) value is 0.027, which is less than 0.05. This means that there is an effect of using the STEAM deep learning approach on student learning outcomes. This research was conducted with a limited number of students and could be expanded to include more students using a true research method. Recommendation: The curriculum field should allocate time for teachers to participate in special training on creating structured STEAM project designs.

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