

The Effectiveness of STEAM-Based Learning on Elementary School Students' Cultural and Civic Literacy Skills in Cultural Diversity Content

By

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Article History Submitted: July 20, 2026 Revised: August 24, 2026 Accepted: September 1, 2026 Keywords: STEAM; Cultural and Civic Literacy; Social Studies	Abstract <i>Mastery of cultural literacy and citizenship is one of the competencies that must be developed starting in elementary school to equip students to understand cultural diversity and fulfill their roles as citizens. Efforts to develop these competencies can be made through the application of the Science, Technology, Engineering, Arts, and Mathematics (STEAM) approach, which integrates various disciplines into the learning process. This study aims to evaluate the effectiveness of STEAM-based learning on students' cultural literacy and citizenship skills in Social Studies (IPS) instruction, particularly regarding the topic of cultural diversity. The study employs a quantitative approach using a pre-experimental method through a One-Group Pretest–Posttest Design. All 20 fourth-grade students at Ploso Rejo Public Elementary School were included as research subjects using a saturation sampling technique. Data collection was conducted through an essay test developed based on indicators of cultural and civic literacy. The validity of the instrument was confirmed through validity and reliability testing, yielding a Cronbach's Alpha coefficient of 0.79. Data analysis was performed using descriptive statistics and the N-Gain test. Analysis of the research results shows an improvement in students' abilities after participating in STEAM-based learning. The average score increased from 41.50 on the pre-test to 79.25 on the post-test. The N-Gain calculation yielded an average score of 0.65, which falls into the moderate category. Most students showed an improvement in their abilities, with 40% falling into the high category, 55% into the moderate category, and 5% into the low category. These results demonstrate that the implementation of STEAM-based learning can strengthen cultural and civic literacy through social studies learning activities that involve active student participation, connect the material to real-world situations, and encourage collaboration during the learning process. These conditions help students gain a deeper understanding of cultural diversity while developing positive civic attitudes.</i> © Copyright by Author(s). This is an open-access article under the CC-BY-SA license. 
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Introduction

Cultural and civic literacy skills are crucial aspects that need to be developed from elementary school onward to prepare students for the challenges of 21st-century learning

(Afriliani et al., 2024). Cultural literacy refers to a person's ability to understand, appreciate, and apply cultural values as part of national identity. Civic literacy, on the other hand, relates to a person's ability to understand their rights and obligations as citizens and then apply them to everyday social life (Kurniawan, 2023). Indonesia's multicultural character, with its rich diversity of ethnicities, languages, customs, religions, and cultures, demands the strengthening of cultural and civic literacy so that society can appreciate the existing diversity. Therefore, educational efforts are needed that can foster an attitude of tolerance, love of the homeland, and an awareness of maintaining unity in diversity (Rahmawati et al., 2024).

At the elementary school level, the development of cultural and civic literacy has a strategic position because students are at the stage of character development and social identity (Safitri & Ramadan, 2022). Introducing local and national culture from an early age can help students understand the diversity that exists in their environment while fostering an appreciation for differences (Putri & Nurhasanah, 2023). In addition to enhancing cultural knowledge, cultural and civic literacy also contributes to the development of student character traits such as tolerance, responsibility, curiosity, discipline, and national spirit (Humaeroh et al., 2024).

Strengthening cultural and civic literacy at the elementary school level can be done through social studies, given that this subject provides learning experiences related to the social environment, cultural diversity, and life as members of society. Through material on Indonesian cultural diversity, students are expected to understand various forms of culture, appreciate differences, and apply the values of harmonious community life (Anggraeni et al., 2023). Apart from focusing on mastering concepts, social studies learning also plays a role to form students who have social awareness, democratic attitudes, and responsibility towards their social environment (Saputri, 2025). However, achieving these goals still faces various obstacles in teaching and learning activities in elementary schools.

Based on findings from observations and initial interviews at Ploso Rejo Public Elementary School, it was discovered that fourth-grade students' understanding of cultural and civic aspects has not yet developed optimally. Students' ability to recognize various forms of cultural diversity in their environment is still inadequate. They also do not fully understand the importance of diversity in social life, which has resulted in the suboptimal application of civic attitudes in daily life. This situation is thought to occur because the learning process is still teacher-centered, the dominant application of lecture methods in the learning process, accompanied by minimal opportunities for students to actively participate in exploring material, especially related to cultural diversity, are also contributing factors. As a result, students have

not yet received learning experiences that can support the optimal development of cultural and civic literacy skills.

These conditions indicate the need for more innovative learning strategies to create learning processes that are relevant to real life, encourage collaboration, and provide space for students to be the center of learning activities. The Science, Technology, Engineering, Arts, and Mathematics (STEAM) approach is a relevant learning alternative because it combines five disciplines in an integrated learning process (Nasrah et al., 2021) . Through STEAM-based learning, students are given space to practice critical thinking skills in solving various learning problems, generating creative ideas, and building effective communication through solving various problems originating from real situations. This process is carried out by integrating various disciplines in one integrated learning activity (Estriyanto, 2020) . Through the integration of elements of art and technology, STEAM learning enables students to learn about cultural diversity in a more engaging, interactive, and meaningful way.

In its application to cultural diversity materials, STEAM-based learning can be realized through project activities that direct students to explore, design, and produce products that represent Indonesia's cultural diversity. The tangible manifestation of STEAM interaction in social studies subjects is in the form of a map of cultural diversity. Students can identify the characteristics of a culture, then develop cultural products by utilizing elements of Arts through the depiction of motifs, shapes, colors, or ornaments typical of certain cultures as well as elements of Technology through the use of digital media and simple technological devices in the process of designing and presenting products. The process also involves designing and developing products systematically through Engineering elements, applying the concept of measurement and calculation through Mathematics, and understanding the characteristics of materials, environments, or phenomena related to products through Science elements. Thus, the STEAM project in social studies learning not only produces a cultural product, but also provides a learning experience that allows students to understand cultural diversity through an integrated process of exploration, design, creation, and reflection.

Theoretically, the relationship between the STEAM approach and cultural literacy and citizenship can be seen from the contribution of each element, namely Science helps students understand environmental characteristics and cultural diversity, Technology supports the ability to search, process, and present cultural information responsibly, Engineering trains the ability to design solutions and work together in solving problems, Arts encourages students to recognize, appreciate, and express values and values. Cultural identity, while Mathematics trains logical thinking skills in understanding information and social problems. The integration of

these five elements not only helps students understand cultural diversity, but also encourages an attitude of respect for differences, responsibility, cooperation, and awareness of maintaining unity in diversity as part of cultural and civic literacy.

Findings from various studies indicate that the STEAM approach can improve student competencies in various aspects. Research by Widyastika et al. (2025) describes the application of the STEAM approach in the elementary school teaching and learning process has a positive effect on the development of students' thinking skills. Research by Dewi & Sutriyani (2024) shows that the application of STEAM contributes to improving students' mathematics learning outcomes. Furthermore, a study by Zulaeha (2025) showed that the application of the STEAM approach integrated with local culture has been shown to have a positive influence on improving cultural literacy and scientific literacy in students. These achievements indicate that the STEAM approach has contributed to building 21st-century competencies through learning activities that are connected to the realities of students' environments and provide a deeper understanding.

However, based on the results of a literature review, research on the implementation of STEAM at the elementary school level, which emphasizes learning outcomes, still dominates, namely critical thinking skills, creativity, scientific literacy, and problem-solving skills (Nugraha, 2023). Various studies have discussed the application of the STEAM approach to various subjects, but discussions regarding its role in improving cultural and civic literacy in social studies learning in elementary schools are still relatively limited. Yet, these skills play a crucial role in shaping students' character and supporting the strengthening of the Pancasila Student Profile.

These conditions indicate that further in-depth studies are still needed regarding the use of the STEAM approach. Therefore, this study focuses on analyzing the effectiveness of STEAM-based learning in improving the cultural literacy and citizenship skills of fourth-grade students at Ploso Rejo Elementary School in the subject of cultural diversity. This research is expected to enrich scientific studies related to the application of STEAM in social studies learning while providing practical benefits for educators in developing innovative, contextual learning strategies that can support the strengthening of cultural literacy and citizenship skills of students. Considering these objectives, this study was compiled with the title "The Effectiveness of STEAM-Based Learning on the Cultural Literacy and Citizenship Skills of Elementary School Students".

Method

The method applied in this study was a pre-experiment with a One Group Pretest–Posttest Design to compare students' abilities before and after participating in STEAM-based learning through pretest and posttest measurements. This research design was used to determine changes in students' cultural and civic literacy abilities after receiving STEAM-based learning. Before the learning activities began, students first completed a *pretest* to obtain data on their initial abilities. The next stage was the implementation of STEAM-based learning as the main treatment in the study. At the end of the learning series, a re-measurement was conducted through a posttest to obtain an overview of students' abilities after being given the treatment. Data obtained from the two tests were then compared and analyzed to determine the effectiveness of STEAM-based learning in improving students' cultural and civic literacy.

The selection of a pre-experimental design without a control group was based on the practical conditions of the study, namely the limited number of grade IV students and the limitations of the classroom setting that allowed the formation of a control group without interfering with the class division that had been established by the school. Therefore, the quasi-experiment design has not been optimally applied in the context of this study. However, the One Group Pretest–Posttest Design still allows researchers to identify changes in students' cultural literacy and citizenship abilities by comparing the results of measurements before and after treatment. The absence of a control group is one of the limitations of the study so that the improvement of students' ability cannot be completely separated from the possible influence of other factors outside of treatment.

The research was conducted in the even semester of the 2025/2026 academic year at Ploso Rejo Public Elementary School, Belitang III District, East Ogan Komering Ulu Regency. The research participants consisted of all fourth-grade students, with a total of 20 students involved as respondents in the research activities. Because the population size was small, a saturated sampling technique was chosen so that every member of the entire population was used as a research sample (Sugiyono, 2022) .

The implementation of treatment uses STEAM-based learning stages that are adapted to cultural diversity materials. In the first stage, the researcher provided reading materials about cultural diversity and explained that diversity arises due to differences in geographical location, customs, and culture as an application of elements of Science. In the second stage, the researcher showed a video about cultural diversity using digital devices, then students observed the video as the application of technology elements. After that, students were given the opportunity to ask

questions about the material that had been observed, then divided into several groups according to the direction of the researcher. In the next stage, students design a predetermined provincial map using map images provided by the researcher as an application of Engineering elements. Furthermore, students draw and color provincial maps and creatively paste cultural images from various regions as an application of Arts elements. In the next stage, students calculate the number of cultures shown on the map and group them by type as an application of the Mathematics element. After the product is finished, each group presents the results of the provincial map that has been made, then all the maps are combined to form a map of Indonesia that depicts the richness of cultural diversity. In the final stage, the researcher provides responses to the results of the students' presentations to strengthen their understanding of cultural diversity and the value of appreciating diversity.

The instrument used in this study was a descriptive test designed with reference to cultural and civic literacy indicators. This instrument was used to identify students' abilities in understanding cultural diversity and civic life, recognizing their own culture, understanding their rights and obligations as citizens, and their concern for culture (Lestari et al., 2022). The instrument was not used immediately but was first evaluated through validity and reliability tests. Of the 15 items developed, the validity test results showed that 8 met the eligibility criteria, thus selecting them as the research instrument.

Data processing involved two stages. The first stage used descriptive statistical analysis to present a general overview of student abilities. The next stage involved calculating *N-Gain* to determine the extent of improvement in abilities after implementing STEAM-based learning by comparing pretest and posttest scores. The results were then grouped into three levels of improvement: low, medium, and high.

Instrument Test Results

Before being used as a research instrument, the cultural and civic literacy test first underwent a testing process. Validity testing was conducted on 15 items involving 20 respondents. The test results showed that only 8 items met the validity criteria because the calculated *r* value exceeded the table *r* value (0.444), while the other 7 items did not meet the requirements and were therefore eliminated and not used in the research data collection.

Table 1.
Question Validity Test Results

No	Question Items	r count	r table	Information
1	Question Number 3	0.775	0.444	Valid
2	Question Number 4	0.691	0.444	Valid
3	Question Number 6	0.497	0.444	Valid
4	Question Number 8	0.636	0.444	Valid
5	Question Number 9	0.656	0.444	Valid
6	Question Number 10	0.676	0.444	Valid
7	Question Number 11	0.445	0.444	Valid
8	Question Number 12	0.509	0.444	Valid

Internal consistency of the instrument analyzed through coefficient Cronbach's Alpha. From the analysis This show number 0.79 so that instrument fulfil criteria reliability Because exceed mark reference 0.60. Based on classification coefficient Cronbach's Alpha , reliability differentiated into five levels , coefficient reliability categorized into five levels , including very low (0.00–0.20), low (0.21–0.40), fair (0.41–0.60), high (0.61–0.80), and very high (0.81–1.00) (Cahyani & Sukoyo, 2025) . Based on the calculation results, the Cronbach's Alpha coefficient of 0.79 places the instrument at a high level of reliability. Because the value exceeds the reference limit of 0.60, the instrument can be declared to have an adequate level of reliability as a data collection tool (Anggraini et al., 2022).

Table 2.
Reliability Test Results

Variables	Crobach's Alpha Value	Criteria	Information
Cultural and Civic Literacy Test Questions	0.79	>0.60	Reliable

Referring to Table 2, the reliability test yielded a Cronbach's Alpha value of 0.79. This value indicates that the instrument's reliability level has met the requirements, as it exceeds the benchmark value of 0.60. Therefore, the cultural and civic literacy test used in this study has adequate internal consistency. This reliability value indicates that the instrument is capable of producing relatively stable measurements, making it suitable for use in research data collection (Cahyani & Sukoyo, 2025).

Results

Description of Pretest and Posttest Results

Cultural and civic literacy skills were evaluated through two measurement stages: before and after students participated in STEAM-based learning. Initial data were obtained from pretest results, while changes in skills were analyzed based on posttest scores. The results showed that the majority of students experienced improved scores after receiving STEAM-based learning.

Table 3.
Recapitulation of Pretest and Posttest Results

Statistics	Pretest	Posttest
Total Score	830	1585
Average	41.50	79.25
Number of Students	20	

Based on Table 3, the average score for students' cultural and civic literacy before the treatment was 41.50. After implementing STEAM-based learning, the average score increased to 79.25. The analysis indicates a 37.75-point increase from the initial to the final learning stage.

This increase in scores indicates a positive contribution of STEAM learning to strengthening students' cultural literacy and civic skills.

N-Gain Analysis

The improvement in student abilities as a result of the implementation of STEAM-based learning was evaluated using N-Gain analysis. The results indicated that the class achieved an N-Gain index of 0.65. Based on the N-Gain classification, this achievement is considered moderate and reflects an increase in student abilities after the treatment was administered.

Table 4.
N-Gain Category Distribution

No	Category	Value Range	Number of Students	Percentage
1	Tall	$g > 0.70$	8	40%
2	Currently	$0.30 \leq g < 0.70$	11	55%
3	Low	$g < 0.30$	1	5%
Total			20	100%
Average N-Gain Class	0.65	Currently		

In the analysis grouping score *N-Gain*, partly big participant educate show improvement ability at the level currently until high. Category currently occupied by 11 students (55%), followed by category tall as many as 8 students (40%), while category low only consists of over 1 student (5%). Distribution results improvement ability student show existence influence positive from implementation learning STEAM based in support development literacy culture And citizenship part big participant educate.

Analysis more carry on to score individual show that highest N-Gain value of 0.87 obtained by two students, while mark lowest of 0.23 was obtained by One students. In Overall, N-Gain is 0.65 indicates effectiveness learning STEAM-based is in the category currently with trend approach category tall.

Effectiveness of Steam-Based Learning

A comparison of the pre- and post-test results showed an increase in students' cultural and civic literacy skills. The average score, which was originally 41.50 on the pretest, increased to 79.25 after the learning process, with an *N-Gain* of 0.65, which is included in the moderate category. The success of the increase in students' abilities after participating in STEAM learning

is evidence that this approach is able to support the development of cultural and civic literacy in fourth-grade students at Ploso Rejo Public Elementary School.

Through the STEAM approach, social studies learning is designed to integrate science, technology, engineering, art, and mathematics into a unified learning process. The push involvement direct student in activity Contextual learning. Activities linked to everyday experiences help students broaden their understanding of cultural diversity while developing awareness and attitudes as citizens.

Figure 1. Cultural Diversity Map Product



Discussion

The effectiveness of STEAM-based learning in this study was reflected in changes in learning outcomes. The average score, which was initially 41.50, increased to 79.25 in the final measurement. The N-Gain score of 0.65 indicated that students' abilities had developed in the moderate category. These changes indicate that STEAM implementation provides broader benefits, not only improving academic aspects but also helping students develop an understanding of culture and an awareness of cultural identity.

Students' cultural literacy and citizenship skills are thought to be influenced by the characteristics of the STEAM approach in the learning process. Through this integration, students have the opportunity to actively engage in relevant learning activities (Fortuna & Kusuma, 2023). During these activities, students are encouraged to explore Indonesia's cultural diversity, seek information using digital media, engage in collaborative discussions, develop projects, and present their work related to regional culture. Involvement in these various activities encourages students to gain a more comprehensive understanding because knowledge

is built through learning experiences, not just from the presentation of material by the teacher (Rilianti et al., 2023) .

The results obtained in this study support the findings of Wijaya & Ramadhani (2026) , who stated that the STEAM approach provides benefits not only in improving students' literacy skills but also in developing competencies needed in the 21st century. During the learning process, students have the opportunity to practice critical thinking, communication, and collaboration skills. Furthermore, the integration of various elements in STEAM allows students to gain a more comprehensive understanding of the learning material. This occurs because the concepts learned are linked to everyday experiences and real-life situations in their environment (Afrijal et al., 2023) .

The increased capabilities obtained in this research also support the research results. Zulaeha (2025) found that the implementation of STEAM learning oriented towards local culture (Kabaroko) has a positive impact. The alignment of these research findings with this study is evident in the application of STEAM-based learning in cultural diversity material. Through this approach, students are encouraged to recognize Indonesian cultural diversity, understand the meaning of culture as a national identity, and foster an attitude of respect for cultural values in social life.

The results of the study revealed that the integration of technology in the STEAM approach has a positive impact on student participation in learning activities. This active involvement is followed by an increase in literacy skills because students get different things in meaningful learning through activities related to everyday life (Zulaeha, 2025) . These results support the study of Minsih et al. (2025) which states that the integration of cultural literacy in the elementary school curriculum is more effective when developed through learning experiences that are relevant to real life, project-based, and supported by interesting and interactive learning media.

In addition to enhancing cultural understanding, STEAM learning also contributes to strengthening students' civic literacy. During the learning process, students work in groups, discuss, respect each other's opinions, and complete assignments collaboratively (Ros et al., 2026) . These activities indirectly train civic characteristics, namely responsibility, tolerance, cooperation, and appreciation for diversity (Yulianti & Dewi, 2021) . This research aligns with research by Putri & Nurhasanah (2023) , which shows that learning that integrates cultural and civic literacy from elementary school can strengthen students' appreciation for cultural diversity while supporting the development of characters who are open to life in a pluralistic global society.

The N-Gain value of 0.65 obtained in this study proves that the learning effectiveness is in the moderate category with a tendency to approach high. These results indicate that although student abilities have increased significantly, there is still room for optimization of STEAM implementation. A factor suspected of contributing to this condition is the limited experience of students with the application of integrated learning models. The change from previously teacher-centered learning to active STEAM-based learning requires some students to adjust to the demands of collaboration, participation, and independent problem solving (Muntazah et al., 2025).

This study yielded findings consistent with those of Tiasna et al. (2023) , who developed STEAM learning by integrating the local culture of batik jumpat at the elementary school level. Study the show that utilization culture local in the learning process contribute to increasing motivation and involvement students. Besides that, the material that is associated with context culture local make it easier student in build draft learn to be more easy to be understood. The similarity of these results strengthens the argument that STEAM has great potential for use in culturally related learning because the *arts element* in STEAM allows students to express cultural understanding creatively (Estriyanto, 2020) .

The findings of this study demonstrate a similar pattern to the research of Rahayu & Adityarini (2025) , who developed STEAM-based digital media to maximize student literacy and numeracy. This study demonstrated that integrating technology with the STEAM approach contributed to increased student engagement and literacy strengthening through more interactive learning experiences. This condition reinforces the study's finding that the technological element in STEAM plays a crucial role in helping students acquire cultural information in a broader and more engaging way.

Furthermore, Salamah & Susapti (2025) emphasized that the Arts element in the STEAM approach plays a crucial role in helping students understand sociocultural phenomena contextually and holistically. Integrating arts through local culture-based projects allows students to develop creativity, cultural sensitivity, empathy, and social awareness, which support the formation of social identity and civic literacy. Therefore, improving cultural and civic literacy skills is the final outcome of implementing STEAM learning, which integrates cognitive, affective, and social dimensions in a balanced manner.

In particular, the elements of Engineering and Mathematics contribute to helping students understand cultural diversity in a more concrete way. The Engineering element is applied when students design provincial maps, determine the placement of cultural information, and combine maps into a single map of Indonesia so as to train the ability to plan, compile, and work together

in producing products. Meanwhile, the Mathematics element is applied through the activity of calculating the number of cultures displayed and grouping them by type, thus practicing numeracy skills, classifying information, and understanding cultural diversity based on data. Thus, the two elements help connect the concept of STEAM with social studies learning through simple contextual design and analysis activities.

Furthermore, findings by Fadhilah et al. (2025) explain that integrating STEAM learning with elements of local wisdom can encourage the development of creativity and innovation in elementary school students. These results support the findings of this study, which show that learning about cultural diversity through a STEAM approach can facilitate students in exploring cultural values more deeply and actualizing their understanding through products or works produced during the learning process.

The success of STEAM-based learning in this study is a learning process that provides meaningful experiences for students. STEAM-based teaching and learning activities combine science, technology, engineering, art, and mathematics, which play a role in supporting the development of student abilities through an active and integrated learning process. Based on the results of the comparison of initial and final scores, as well as the *N-Gain values* obtained, the STEAM approach has been proven to improve the cultural literacy and citizenship skills of fourth-grade students at Ploso Rejo Public Elementary School. Thus, this approach can be an alternative learning approach that supports strengthening cultural understanding while developing civic character in elementary school students (Agry & Kartono, 2021) .

Conclusion

The implementation of STEAM-based learning on cultural diversity material in fourth grade at Ploso Rejo Public Elementary School showed an improvement in students' cultural literacy and citizenship skills. This condition was demonstrated through an increase in student learning outcomes, with an average score increasing from 41.50 in the initial measurement to 79.25 in the final measurement. The results of the N-Gain index calculation reached 0.65, indicating that the increase in students' abilities was at a moderate level. Based on the distribution of this increase, the majority of students showed an improvement in abilities from the moderate to high category after participating in the STEAM-based learning series.

The implementation of STEAM-based learning encourages active student engagement through collaborative exploration activities utilizing technology and completing culturally relevant projects. This fosters students' understanding of cultural diversity, awareness of their civic obligations, and concern for cultural preservation.

Thus, the STEAM-based learning approach in Social Studies learning is a relevant strategy, the STEAM approach is worth considering as an alternative strategy in Social Studies learning because it is able to strengthen students' cultural literacy and citizenship skills through contextual, active, and meaningful learning experiences.

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