STEAM Journal for Elementary School Education
Volume 01, Number 01, April 2025, Page 33-44
Website: https://journal.unesa.ac.id/index.php/sjese/index
ISSN xxxx-xxxx

STEAM in the Frame of Independent Curriculum in Elementary School

Rizki Putri Wardani[1*], Chumi Zahroul Fitriyah[2], Annur Rofiq[3], Wiwin Hartanto[4], Vit Ardhyantama[5]

[1,2,3]Primary Teacher Education, Universitas Jember, Indonesia
[4]Asia-Pacific Regional Studies, National Dong Hwa University
[5]Primary Teacher Education, State University of Surabaya, Indonesia
[*]rizkiputriwardani.fkip@unej.ac.id

DOI: .....

Keywords:
4C Skills; Independent Curriculum; Learning Activities; Learning Outcomes; STEAM

Publisher:
Primary Teacher Education Program, PSDKU, State University of Surabaya (UNESA), Indonesia

Received: 10 April 2025
Revised: 15 April 2025
Accepted: 19 April 2025
Published: 26 April 2025

Abstract

The independent curriculum is a curriculum that was implemented in Indonesia in 2021 until now. Various approaches are implemented in the curriculum, one of which is STEAM. The purpose of writing this article is to identify and analyze the STEAM approach in elementary school learning that is aligned with the principles of the Merdeka Curriculum, and provide recommendations for developing contextual and integrative learning that supports the achievement of the Pancasila learner profile and 4C skills, student activities, and learning outcomes. The research method used is a literature study by reviewing journals as literature recorded in Sinta, Garuda, and indexed nationally and internationally. The results showed that there are many learning models that integrate with the STEAM approach in the independent curriculum which effectively provide results in increasing the achievement of the Pancasila learner profile, 4C skills, student activity, and learning outcomes. This STEAM approach encourages students to be active in various learning activities designed by teachers in the independent curriculum and gain direct experience both theoretically and practically.

INTRODUCTION

The development of character, critical thinking skills, and creativity of students is important in the implementation of the foundations of basic education. Character education is important in facing moral and knowledge degradation in the 4.0 era, so character education needs to be instilled early in basic education (Pahri, 2023; Permatasari, 2023). Basic education is education that provides knowledge, skills, and fosters basic community attitudes and provides the basic provisions needed to live in society. The improvement of skills and development is implemented in a curriculum. Along with the times and technology, the curriculum is constantly changing and continues to innovate in Indonesia or because of a pandemic that requires curriculum changes (Fitriyah dan Wardani, 2022). The current curriculum in Indonesia uses the independent curriculum.

Early in the development of the independent curriculum, there were efforts to restore learning to support educational goals in Indonesia. The independent curriculum currently implemented provides a lot of space for a variety of learning approaches that are more contextual (Ripandi, 2023). The Independent Curriculum is more flexible and gives teachers the freedom to develop learning, in fact there are still many teachers who find it difficult to move on from K-13 and still use themes (Marsela Yulianti et al., 2022). This results in early childhood being uncreative, their imagination is limited and they are unable to develop their critical thinking skills because the learning activities carried out by the teacher are already available and organized, children only need to do as instructed. For this reason, learning methods that encourage children to be creative, critical and communicative are needed.

One approach that supports the vision of Indonesian education is STEAM (Science, Technology, Engineering, Arts, Mathematics). The emergence of the STEAM approach was inspired by America in the 90s and is considered up-to-date with the industrial era 4.0 which supports 4C skills (Critical thinking, Creative thinking, Communication skills, Collaborative skills) and the 21st century (Mu'minah, 2021; Leavy et al., 2023). STEAM implementation in Indonesia has been implemented at the elementary to high school levels. The STEAM approach focuses on collaborative learning to get a pleasant learning environment situation. The STEAM approach is also able to stimulate and strengthen the 4C abilities of students (Adlina, 2022). The STEAM approach is a strategy that integrates various disciplines to encourage students to solve real problems. The involvement of cognitive, psychomotor, and affective aspects is very possible.

The STEAM approach is a learning approach that can encourage students to improve their ability to process information and communicate to think critically, as well as increase student creativity in connecting various facts and phenomena encountered during the learning process. Students in the generation of the industrial era 4.0 towards 5.0 are expected not only to have cognitive abilities, but

also competent thinking skills such as 4C abilities. Several studies in the field have widely used the STEAM approach implemented in learning.

Based on the explanation above, researchers are interested in conducting a literature review on STEAM in the independent curriculum in elementary schools. Several studies related to STEAM have begun to emerge that are applied in the independent curriculum, but these studies are generally still exploratory, limited to certain contexts or levels, and have not examined in depth how STEAM is integrated in the structure and spirit of the Merdeka Curriculum, especially at the primary school level. Although various studies have discussed the STEAM approach in learning, studies that specifically analyze the relationship between STEAM and the Merdeka Curriculum at the primary school level are still limited. Therefore, this study aims to identify and analyze the application of the STEAM approach in the context of the Merdeka Curriculum in primary schools, by reviewing the current scientific literature and highlighting the integration of local values, strengthening 21st century competencies, and contributing to the achievement of the Pancasila learner profile.

The purpose of this study is to identify and analyze the STEAM approach in elementary school learning that is aligned with the principles of the Merdeka Curriculum, and provide recommendations for developing contextual and integrative learning that supports the achievement of the Pancasila learner profile. It is hoped that this research can provide an overview and understanding to readers and teachers to describe the challenges, obstacles, and implementation of STEAM in the independent curriculum in elementary schools.

METHODS

This research design uses a literature study which basically uses scientific journal references related to STEAM and the independent curriculum. Literature study apart from looking for secondary and primary data sources that will support research is also needed to find out to what extent the science related to research has developed, to what extent there are conclusions and generalizations that have been made, so that the necessary situation can be obtained (Nazir, 2003: 92). The criteria for articles used as literature studies include similarity of topics, maximum publication year of 5 years and indexed nationally and internationally. Data sources were searched through google scholar and scopus. Data analysis was carried out by descriptive analysis. The data that has been collected is analyzed and then a conclusion is drawn which is used to answer the questions in the research. Through this research, researchers provide arguments and explore related information to see the relationship of STEAM in the independent curriculum in elementary schools.

The data analysis technique uses steps from Milles and Huberman (Huberman, 2014)) namely (1) data collection, the process of collecting information from

several journals that are in accordance with the research topic, (2) data reduction, simplifying data in order to obtain clear data, data reduction steps include summarizing articles, focusing on main topics, and discarding irrelevant data, (3) data display, namely presenting data or information obtained and written in narrative, and the last step is (4) conclusions and verification are the findings obtained from the research process in literature studies or literature.

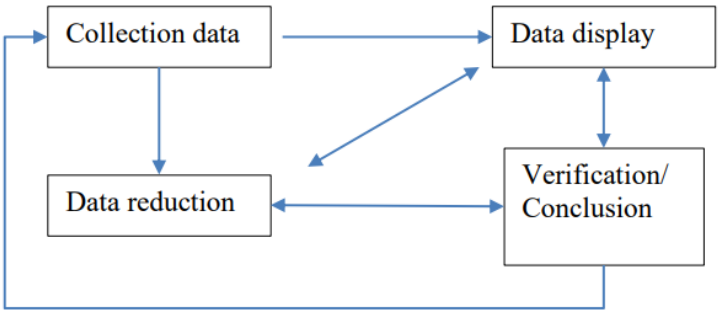

Figure 1. Research Design

RESULTS AND DISCUSSION

The process of searching for journal articles to be analyzed in the literature review requires systematic stages, including determining the keywords of the article, determining the search database in the national and international scope, the process of collecting, filtering and determining. An overview of the results of the analysis of several journals obtained related to the independent curriculum and STEAM is presented in the table 1 below:

Table 1. *Review* Articles

No.	Title	Author	Results
1	Efektivitas Pembelajaran Melalui Steam Pada Kurikulum Merdeka Di SDN Palebon 01 Semarang (Umami, Saputra dan Kiswoyo, 2023)	Muhammad Rizal Umami, Henry Januar Saputra , Kiswoyo	Learning outcome using STEAM learning in independent curriculum science materials have an effective impact on learning outcomes. improve grade IV science learning outcomes in the independent curriculum on material changes in objects.
2	Analisis Kebutuhan Guru terhadap E Module	Nikmatin Mabsutsah, Yushardi	Teachers need the development of STEAM-based e-modules and

No.	Title	Author	Results
	Berbasis STEAM dan Kurikulum Merdeka pada Materi Pemanasan Global (Nikmatin Mabsutsah dan Yushardi, 2022)		independent curriculum that are easy to understand, easy to use, and effective for improving learning outcomes and student science process skills that can be used for teachers and students.
3	Implementing STEAM education in the independent curriculum: Enhancing 21stcenturyskills (Ismiati, 2024)	Nur Ismiati	The implementation of STEAM-based education in the independent curriculum can make a significant contribution to the development of 21st century skills. By fostering critical thinking, creativity and innovative problem-solving abilities, STEAM education aligns with and supports the key objectives of the independent curriculum, making it a valuable educational strategy for modern learning Environments.
4	STEAM Designed and Enacted: Understanding the Process of Design and Implementation of STEAM Curriculum in an Elementary School (Quigley *et al.*, 2020)	Cassie F. Quigley, Dani Herro, Elizabeth King & Holly Plank	This research demonstrates the importance of teachers designing STEAM curriculum using problem- based units in a way that encourages students to question. The data shows this is important to realize

No.	Title	Author	Results
			discipline integration, teacher facilitation and authentic tasks.
5	Pendekatan STEAM Pada Project Based Learning Mewujudkan Merdeka Belajar Untuk Meningkatkan Kreativitas Siswa (Santi, 2022)	Ella Laras Santi	STEAM approach in PjBL can be used in classroom learning for other subject matter and subjects.
6	The Effect of STEAM on Student Learning Activities in Elementary School (Rahayu dan Amanahtillah, 2024)	Nina Rahayu, Febriyantika Wulandari, Dara Amanahtillah	The results of this study also show that the STEAM approach can help overcome low student participation in science learning and improve learning methods that previously tended to be conventional.
7	Effectiveness of STEAM-Integrated Project-Based Learning to Improve Creative and Collaborative Thinking Skills of Elementary School Students (June dan Muzaini, 2024)	M.Choirul Muzaini, Zulfatul Khoiriyah, M.Aliful Khabib, Reno Kuncoro	The application of STEAM makes a positive contribution to increasing student learning activities and can be used as an effective learning model in the future.
8	Development and Challenges of STEAM Learning Implementation in Elementary Schools: A Comprehensive Literature Review	Galih Majesty Erawan1*, Neni Mariana1, Suryanti1	The application of STEAM learning in elementary schools has undergone various developments with various new innovations in its application, ranging from the selection of

No.	Title	Author	Results
	(Erawan dan Mariana, 2025)		topics and models to the learning media used.
9	Developing Digital Teaching Module Of Social-Science Subject Based Steam Method For Grade Four Elementary School Students(Rusmini, Lasmawan dan Candiasa, 2023)	Ni Nyoman Rusmini, I Wayan Lasmawan, I Made Candiasa	The development of STEAM- based learning modules for grade 4 is able to improve student understanding of science materials implemented in the independent curriculum.
10	STEAM-Integrated Project Based Learning Models: Alternative to Improve 21st Century Skills Zayyinah (Zayyinah *et al.*, 2022)	Zayyinah, Erman, Zainul A. I. Supardi, Eko Hariyono, Binar K. Prahani	STEAM integrated with the PjBL model in the independent curriculum can improve 21st century skills

The implementation of an independent curriculum is one of the results of the overhaul of the curriculum that has been implemented (Fitriyah dan Wardani, 2022). Teachers also have an important role in the implementation of this school operational curriculum, because they understand the situation and conditions in the learning environment. The Merdeka curriculum is a new paradigm in the education curriculum in Indonesia, providing autonomy to teachers in developing learning experiences tailored to student needs. This approach gives educators the freedom to design learning that meets these needs, which views the Merdeka Curriculum as a curriculum designed to overcome learning loss. The Merdeka Curriculum emphasizes diverse intracurricular learning, which aims to optimize learning outcomes and provide students with sufficient time to deepen and strengthen their competencies.

STEAM is the development of STEM which adds elements of art (art) in it. STEAM learning is able to foster and bring out children's understanding, ability to learn from experience, and construct knowledge through observing, exploring, detecting and analyzing objects around them (Fauziah, Ichsan dan Irbah, 2022). The implementation of STEAM learning in the independent curriculum is a relevant choice made at this time. STEAM learning provides space for students to experiment

with what is produced in a project. This is in line with the implementation of the independent curriculum which emphasizes project-based or problem-based learning. Just like the research conducted by Ella in 2022, who implemented project-based learning in the independent curriculum (Santi, 2022).

STEAM learning is a contextual learning approach where students are invited to see, understand, and identify phenomena around them. By prioritizing Science, Technology, Engineering, Art, Mathematics, it can be integrated into subjects and encourage students to explore their own abilities. STEAM learning is in accordance with the characteristics of 21st century learning to prepare a generation that has skills in communication, critical thinking, creativity, and collaboration (Nikmatin Mabsutsah dan Yushardi, 2022; Ismiati, 2024).

The application of the STEAM (Science, Technology, Engineering, Arts, Mathematics) approach in the Merdeka Curriculum shows a consistent positive impact in improving the quality of learning in elementary schools. Research by Umami, Saputra, and Kiswoyo (2023) shows that the application of STEAM-based learning in science materials significantly improves the learning outcomes of grade IV students, especially on the topic of changes in objects.

This is in line with the findings of Mabsutsah and Yushardi (2022) who stated that teachers need STEAM-based e-modules that are easy to understand and use in order to improve science process skills and student learning outcomes. The need for digital modules is reinforced by Rusmini et al. (2023), who developed a STEAM module in social studies lessons and found a significant increase in material understanding by students.

In terms of developing 21st century skills, research (Ismiati, 2024) underlines that the STEAM approach supports the development of critical thinking, creativity, and problem solving, which are the main pillars of the Merdeka Curriculum. (Zayyinah *et al.*, 2022) even shows that STEAM integration in the Project Based Learning (PjBL) model can effectively improve students' collaborative and creative thinking skills. At the implementation level, (Quigley *et al.*, 2020) emphasizes the importance of curriculum design that integrates problem-based units and the active role of teachers in facilitating questions from students as the core of STEAM learning. This is an important foundation for the successful implementation of STEAM in the classroom.

Other research by (June dan Muzaini, 2024; Rahayu dan Amanahtillah, 2024) reinforces these findings by showing that STEAM is able to overcome low student participation in science lessons and make the learning process more active and interactive. On the other hand, (Erawan dan Mariana, 2025) elaborates that although STEAM has evolved with innovations in its application-from topic selection, models, to media-challenges remain, especially in teacher readiness and resource availability.

Based on data and analysis related to the implementation of an independent curriculum implemented using STEAM learning, it can integrate the concepts of science, technology, engineering, art, and mathematics in working on a project collaboratively. This results in a product in the end. Students practice finding solutions to problems in the surrounding environment and are given freedom in the learning process. Learning using STEAM integrated project-based learning is student-centered. It engages students to gain deeper knowledge through active exploration of real-world challenges. This learning discusses the learning material in more detail to produce a product as a solution to some deep problems. This is in accordance with the meaning of the implementation of the independent curriculum (Vhalery, Setyastanto dan Leksono, 2022)

STEAM-integrated project-based learning in the independent curriculum has more value in its implementation, namely containing real problems, providing appreciation for student work, student independence in the learning process, and supporting learning by doing-based learning. This will be better for improving students' critical thinking skills and scientific performance performance (Fitriyah dan Ramadani, 2021). STEAM-PjBL learning can lead students to develop creative thinking skills, problem solving, and communication skills. Based on the previous explanation, many advantages can be obtained, especially in improving 21st century skills (Davies *et al.*, 2013; Fitriyah dan Ramadani, 2021).

CONCLUSION

This study explores, searches for, and relates the disbursement of the independent curriculum with STEAM learning using a qualitative approach. In general, the application of the STEAM approach in the Merdeka Curriculum in elementary schools has proven effective in improving learning outcomes, 21st century skills, and active participation of students. The STEAM approach in the Merdeka Curriculum in elementary schools shows significant potential in improving the quality of learning, especially in strengthening learning outcomes, creativity, 21st century skills, and student involvement in the learning process. The STEAM approach is effective in increasing students' understanding of science materials and other thematic lessons. In addition, integrating STEAM with other learning models applied in the independent curriculum encourages increased critical and creative thinking.

However, there are not many studies that explicitly integrate the STEAM approach with local values, cultural context, and the profile of Pancasila students as a whole. In addition, no systematic study has been found that summarizes and classifies the various approaches to implementing STEAM in elementary schools within the framework of the Merdeka Curriculum as a whole. However, its success remains highly dependent on the availability of adequate resources, the

development of relevant modules, and teacher training in designing and implementing STEAM-based learning.

The advantages of the independent curriculum highlight the autonomy of institutions to design learning according to environmental conditions in order to gain learning experiences. This flexibility enables the deepening of competencies and the development of 21st century skills, which are essential to prepare students for future challenges. The main challenges faced in implementing STEAM are the lack of teachers' understanding of the STEAM concept as a whole, limited teaching tools, and not optimal integration between subjects.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s)

REFERENCES

Adlina, N. (2022) "Inovasi Pembelajaran di Masa Pandemi COVID-19 dengan Pendekatan STEAM di Era Society 5.0," *JURNAL SYNTAX IMPERATIF : Jurnal Ilmu Sosial dan Pendidikan*, 2(6), hal. 120. Tersedia pada: https://doi.org/10.36418/syntax-imperatif.v2i6.134.

Davies, D. *et al.* (2013) "Creative learning environments in education—A systematic literature review," *Thinking Skills and Creativity*, 8, hal. 80–91. Tersedia pada: https://doi.org/https://doi.org/10.1016/j.tsc.2012.07.004.

Erawan, G.M. dan Mariana, N. (2025) "Development and Challenges of STEAM Learning Implementation in Elementary Schools : A Comprehensive Literature Review," 3(1), hal. 1–19.

Fauziah, N., Ichsan, I. dan Irbah, A.N. (2022) "Pengaruh Model Pembelajaran Steam Berbasis Loose Part Terhadap Kemandirian Anak Usia Dini," *Jurnal PG-PAUD Trunojoyo : Jurnal Pendidikan dan Pembelajaran Anak Usia Dini*, 9(2), hal. 18–27. Tersedia pada: https://doi.org/10.21107/pgpaudtrunojoyo.v9i2.14746.

Fitriyah, A. dan Ramadani, S.D. (2021) "Pengaruh Pembelajaran Steam Berbasis Pjbl (Project-Based Learning) Terhadap Keterampilan," *Journal Of Chemistry And Education (JCAE)*, X(1), hal. 209–226.

Fitriyah, C.Z. dan Wardani, R.P. (2022) "Paradigma Kurikulum Merdeka Bagi Guru Sekolah Dasar," *Scholaria: Jurnal Pendidikan dan Kebudayaan*, 12(3), hal. 236–243. Tersedia pada: https://doi.org/10.24246/j.js.2022.v12.i3.p236-243.

Huberman, M.B.M.A.M. (2014) *Analisis data kualitatif : buku sumber tentang metode-metode baru*. Jakarta: UI Press.

Ismiati, N. (2024) "Implementing STEAM education in the independent curriculum: Enhancing 21st century skills," *Tadibia Islamika*, 4(1), hal. 21–27.

June, N. dan Muzaini, M.C. (2024) "Effectiveness of STEAM-Integrated Project-Based Learning to Improve Creative and Collaborative Thinking Skills of Elementary School Students," 14(1), hal. 106–120. Tersedia pada: https://doi.org/10.18952/aladzkapgmi.v14i1.13749.

Leavy, A. *et al.* (2023) "The prevalence and use of emerging technologies in STEAM education: A systematic review of the literature," *Journal of Computer Assisted Learning*, 39(4), hal. 1061–1082. Tersedia pada: https://doi.org/10.1111/jcal.12806.

Marsela Yulianti *et al.* (2022) "Peran Guru Dalam Mengembangan Kurikulum Merdeka," *Jurnal Ilmu Pendidikan dan Sosial*, 1(3), hal. 290–298. Tersedia pada: https://doi.org/10.58540/jipsi.v1i3.53.

Mu'minah, I.H. (2021) "Studi Literatur: Pembelajaran Abad-21 Melalui Pendekatan Steam (Science, Technology, Engineering, Art, and Mathematics) dalam Menyongsong Era Society 5.0," *Prosiding Seminar Nasional Pendidikan*, 3, hal. 584–594.

Nikmatin Mabsutsah dan Yushardi, Y. (2022) "Analisis Kebutuhan Guru terhadap E Module Berbasis STEAM dan Kurikulum Merdeka pada Materi Pemanasan Global," *Jurnal Pendidikan Mipa*, 12(2), hal. 205–213. Tersedia pada: https://doi.org/10.37630/jpm.v12i2.588.

Pahri (2023) "Peran Pendidikan dalam Pengembangan Karakter di Era 4.0 - Kompasiana.com," 5(7), hal. 275–283. Tersedia pada: https://www.kompasiana.com/pahrirzk2646/64b28948e1a1670e5d2faff2/peran-pendidikan-dalam-pengembangan-karakter-di-era-4-0.

Permatasari, N.S. (2023) "Pentingnya Pendidikan Karakter Untuk Siswa Sekolah Dasar di Era 4.0," *Al-Abshar: Journal of Islamic Education Management*, 2(2), hal. 176–189. Tersedia pada: https://doi.org/10.58223/al-abshar.v2i2.107.

Quigley, C.F. *et al.* (2020) "STEAM Designed and Enacted: Understanding the Process of Design and Implementation of STEAM Curriculum in an Elementary School," *Journal of Science Education and Technology*, 29(4), hal. 499–518. Tersedia pada: https://doi.org/10.1007/s10956-020-09832-w.

Rahayu, N. dan Amanahtillah, D. (2024) "The Effect of STEAM on Student Learning Activities in Elementary School," 13(3), hal. 1–14.

Ripandi, A.J. (2023) "Hakikat Kurikulum Dalam Pendidikan," *Jurnal Al Wahyu*, 1(2), hal. 123–133. Tersedia pada: https://doi.org/10.62214/jayu.v1i2.129.

Rusmini, N.N., Lasmawan, I.W. dan Candiasa, I.M. (2023) "Developing Digital Teaching Module of Social-Science Subject Based Steam Method for Grade Four Elementary School Students," *Indonesian Journal of Educational Development (IJED)*, 4(2), hal. 150–157. Tersedia pada: https://doi.org/10.59672/ijed.v4i2.2974.

Santi, E.L. (2022) "Pendekatan STEAM Pada Project Based Learning Mewujudkan Merdeka Belajar Untuk Meningkatkan Kreativitas Siswa," *Jurnal Pendidikan Dasar*, 3(2), hal. 77–81. Tersedia pada: http://jurnal.umpwr.ac.id/index.php/jpd/article/view/2240.

Umami, M.R., Saputra, H.J. dan Kiswoyo, K. (2023) "Efektifitas Pembelajaran Melalui Steam Pada Kurikulum Merdeka Di Sdn Palebon 01 Semarang," *Wawasan Pendidikan*, 3(2), hal. 669–678. Tersedia pada: https://doi.org/10.26877/wp.v3i2.16277.

Vhalery, R., Setyastanto, A.M. dan Leksono, A.W. (2022) "Kurikulum Merdeka Belajar Kampus Merdeka: Sebuah Kajian Literatur," *Research and Development Journal of Education*, 8(1), hal. 185. Tersedia pada: https://doi.org/10.30998/rdje.v8i1.11718.

Zayyinah, Z. *et al.* (2022) "STEAM-Integrated Project Based Learning Models: Alternative to Improve 21st Century Skills," *Proceedings of the Eighth Southeast Asia Design Research (SEA-DR) & the Second Science, Technology, Education, Arts, Culture, and Humanity (STEACH) International Conference (SEADR-STEACH 2021)*, 627, hal. 251–258. Tersedia pada: https://doi.org/10.2991/assehr.k.211229.039.