



# Development of STEAM-Based Learning Tools Based on the Sasak Heritage Project

Nurwahidah<sup>1</sup>, Iva Nurmawanti<sup>1\*</sup>, Setiani Novitasari<sup>1</sup>, Anindita Suliya Hangesti Mandra Kusuma<sup>1</sup>

<sup>1</sup>Program Studi Pendidikan Guru Sekolah Dasar, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Mataram, Indonesia.

Received: October 11, 2022  
Revised: December 10, 2022  
Accepted: December 25, 2022  
Published: December 31, 2022

Corresponding Author:  
Iva Nurmawanti  
[ivanurmawanti@unram.ac.id](mailto:ivanurmawanti@unram.ac.id)

© 2022 The Authors. This open access article is distributed under a (CC-BY License)



DOI: [10.29303/jppipa.v8i6.2550](https://doi.org/10.29303/jppipa.v8i6.2550)

**Abstract:** This research is a research and development (R&D) study using the 4-D model. The research aims to produce a valid STEAM learning tool based on the Sasak Heritage Project. The data sources consisted of six expert validators who used validity instruments with four indicators (structure, organization of material, language, and appearance). The research data were analyzed using a quantitative descriptive method. Test the validity of the learning tool using Aiken's V analysis. The results of the validity test show that the STEAM learning tool based on the Sasak Heritage Project is valid, with a minimum validity coefficient of 0.78 for each indicator.

**Keywords:** STEAM; Sasak Heritage Project; Project Module.

## Introduction

In the era of Industry 4.0, there are lots of challenges to be overcome, one of which is the requirement for human resources. Worker skills are closely related to the education system that produces superior human resources. However, currently, the pace of technological development is so fast that it exceeds the rate of change in the education system (Shatunova et al., 2019). If education is not able to produce students who can meet industry needs, there will be many jobs that cannot be filled. Therefore, we need a model, one of which is a learning approach that can create students' abilities to meet industry needs.

The learning approach with the integration of science, technology, engineering, arts, and mathematics (STEAM) is a very comprehensive approach to answering the challenges of the Industrial Age 4.0. The combination of art and STEM concepts aims to develop problem-solving skills, creativity, innovation, student engagement, and cognitive abilities. (Perignat & Katz-Buonincontro, 2019). STEAM in the classroom is an

important learning opportunity because it allows teachers to integrate multiple disciplines at once and trains students to explore, discover, ask questions, conduct research, and create innovations. (DeJarnette, 2018). This is because STEAM emphasizes design and creativity (Sharapan, 2012).

Creativity can be enhanced by implementing an innovative learning model, such as STEAM-based project-based learning. A growing project may be based on local culture. This is also to strengthen the *Gerakan Literasi Nasional* Hadiansyah & Firman (2017), which is concerned with developing skills in understanding and defending Indonesian national identity. One of the forms of literacy that must be developed is cultural literacy. Cultural literacy is very closely related to local culture, which is related to daily life (Ibda & Rahmadi, 2018). In this context, it relates to Lombok culture, namely "Sasak Heritage". This is also in accordance with STEAM learning, namely in the art section.

Sasak Heritage is a culture owned by the Sasak tribe in West Nusa Tenggara and is included in local wisdom. Sasak culture is based on the way of the world toward

## How to Cite:

Nurwahidah, N., Nurmawanti, I., Novitasari, S., & Kusuma, A. S.H.M. (2022). Development of STEAM-Based Learning Tools Based on the Sasak Heritage Project. *Jurnal Penelitian Pendidikan IPA*, 8(6), 2900-2908. <https://doi.org/10.29303/jppipa.v8i6.2550>

the world, which is a way of life where cultural values are closely related and manifest in everyday life. (Hidjaz, 2018). Teachers not only serve as facilitators to develop students' abilities in learning but also introduce and preserve Sasak culture as local wisdom in West Nusa Tenggara. Local cultural wisdom is a concept, idea, and aspect of local culture that is wise and used as a way of life for the local community.

The results of a literature review related to STEM that has been carried out previously show that STEM learning can support the development of 4C abilities (Nurmawanti et al., 2021). STEM learning with PjBL is very relevant for use in both school and distance learning. In STEM distance learning, it can be applied in collaboration with parents by providing projects that can be completed with parental guidance at home.

Based on the explanation above, it is necessary to develop STEAM learning tools based on the Sasak Heritage Project. The goal is that the results of the products developed can be used by elementary school teachers, especially in Lombok, for the development of learning innovations. This is in accordance with the explanation that STEAM learning is related to activities in everyday life through physical phenomena that can increase the interest of elementary school students. (Mullins, 2019).

## Method

This research is a research and development (R&D) study. The research and development design used in this study is the 4-D model (Thiagarajan, 1974). The research aims to produce a valid STEAM learning tool based on the Sasak Heritage Project. The data sources consisted of six expert validators and used validity instruments with four indicators (structure, organization of material, language, and appearance). The research data were analyzed using a quantitative descriptive method. Test the validity of the learning tool using Aiken's V analysis. The stages of research are as follows:

### *Define*

The define stage refers to the process of defining the existing situation in terms of problem analysis and the potential that exists in the research object. "Defining" is the stage for establishing and defining needs in the learning process. The series of analyses carried out consisted of two main steps, namely, problem analysis and development resource and material need analysis. The define stage is described as follows: The stages of research are as follows:

### *Problem analysis*

The first stage of research for curriculum analysis was carried out. This study uses the Merdeka Curriculum as a reference for the curriculum being

developed because, in the 2022–2023 academic year, as many as 3292 schools in West Nusa Tenggara have started implementing the Merdeka Curriculum (Kemendikbudristek, 2022). One of the goals of the Merdeka Curriculum is to optimize the achievement of the Pancasila Student Profile to create democratic, superior and productive Indonesian citizens in the 21st century. "Pancasila Student Profile" is a term in the Merdeka Curriculum that means a list of characters and competencies that are expected to be achieved by students and are based on the noble values of Pancasila (Sufyadi, Susanti, 2021). The implementation of Pancasila Student Profile in the Independent Curriculum is carried out through the Project to Strengthen Pancasila Student Profile. "Project to Strengthen Pancasila Student Profile" is a term in the Merdeka Curriculum that means a project-based co-curricular activity.

Implementation of the Pancasila Student Profile Strengthening Project requires many references to learning tools in its implementation. One of the learning tools in the Merdeka Curriculum is the project module. The government has provided examples of several project module references for teachers, but these project modules have not been integrated with Sasak culture. This is a challenge, and there is a need for teachers to develop project modules based on Sasak culture. In addition, based on the results of the analysis, the project modules provided by the government have integrated STEAM learning, but none have specifically integrated STEAM with Sasak culture. Therefore, this study aims to develop a learning tool in the form of the Pancasila Student Profile Strengthening Project Module, which integrates STEAM and Sasak culture in the form of the Sasak Heritage Project.

### *Identify development reference sources*

The reference sources in the development of project modules include: 1) Guidelines for Implementing Curriculum in the Framework of Learning Recovery, 2) Guidelines for Project Development for Strengthening Pancasila Student Profiles for Elementary and Secondary Education (SD/MI, SMP/MTs, SMA/MA), 3) Dimensions, elements, and sub-elements of the Pancasila Student Profile in the Independent Curriculum, 4) Assessment Guide for Elementary Schools (SD), 5) Learning Guide and Assessment of Basic and Secondary Education Levels (SD/MI, SMP/MTs, SMA/SMK/MA), 6) References to Sasambo and Sasak culture.

### *Design*

This stage is the design of the Pancasila Student Profile Strengthening Project module. The design of this project module refers to the Guidelines for the Development of the Pancasila Student Profile

Strengthening Project by the Ministry of Education and Culture. The stages of project module development are as follows:

*Theme*

The themes in the Project to Strengthen Pancasila Student Profiles consist of seven themes, four of which can be applied at the elementary level. They include: 1) a sustainable lifestyle, 2) local wisdom, 3) diversity in diversity, 4) engineering and technology to build the Unitary State of the Republic of Indonesia. This project module uses Local Wisdom as the project theme. This is based on the results of the problem analysis, namely that there is no project module based on Sasak culture.

*Topic*

This project module discusses the topic of Sasak culture in particular and Sasak Samawa Mbojo (Sasambo) culture in general.

*Dimensions, elements and sub elements*

"Dimension" is a term in the Pancasila Student Profile which means the character values of the students, which are expected to be achieved through the Project to Strengthen Pancasila Student Profiles. "Element" and "sub-element" are terms that mean the elaborations of character values, which are the competencies that students must achieve in the project. The dimensions in the Pancasila Student Profile consist of six dimensions: 1) faith, fear of God Almighty, and have noble character,

2) global diversity, 3) mutual cooperation, 4) independent, 5) critical reasoning and 6) creative. This module combines the two dimensions of the Pancasila Student Profile namely, global diversity and creativity.

*Fase*

In the Merdeka Curriculum, students in educational units are grouped into several groups, known as "phases". The phases in elementary schools are divided into three phases: phase A (classes I and II), phase B (classes III and IV), and phase C (classes V and VI). It is critical to establish a timeline for the preparation of this project module so that it can be developed by students' developmental goals. In this project module, choose phase C (classes V and VI) as the one that will carry out a series of project activities. The reason for choosing phase C as the phase to be developed is that in the 2022–2023 school year, students implementing the Independent Curriculum will be among those in Class IV.

*Achievement Targets*

In the Pancasila Student Profile Strengthening Project, project goals are known as "Targets of Achievement". The achievement targets in this project module refer to the achievement targets for each phase contained in the Pancasila Student Profile document. The Dimensions, Elements, Sub Elements and Achievement Targets are presented in Table 1.

**Table 1.** Dimensions, Elements, Sub Elements, and Achievement Targets

Dimensions	Elements	Sub Elements	Achievement Targets in the Final of Phase C
Global Diversity	Elements of knowing and elements of knowing and appreciating culture	Deep culture and cultural identity	Identify the cultural diversity around it; as well as explain the role, culture, and language in shaping his identity
Creativity	Generate original ideas	Explore and compare cultural knowledge, beliefs, and practices	Describe and compare the knowledge, beliefs, and practices of different cultural groups. Developing the ideas has to create new and imaginative combinations of things to express his thoughts and/or feelings.

*Project Determination*

The projects in this project module are related to the diversity of Sasak culture. This project module consists of three series of major projects, namely making a collage of Sasak cultural diversity, conducting field observations of Sasak cultural diversity, and making a miniature of the Lumbung building. The three series of projects are summarized into one big project, namely the Sasak Heritage Project.

*Determination of stages and series of project activities*

The stages in Sasak Heritage Project are divided into several stages, namely the introduction stage, the contextual stage, the action stage, the reflection stage, and the follow-up stage. The details of the series of activities in the Sasak Heritage Project include: Introduction stage: 1) Investigate Sasambo cultural diversity: language, traditional houses, and traditional clothing, 2) Investigate Sasambo cultural diversity: traditional food and dance, 3) Sasak Heritage Collage, 4) Presentation of the results of the Sasak culture collage.

Contextual stages: 5) planning the Sasak culture trace; 6) the Sasak culture trace; 7) presentation of the results of the Sasak culture trace. Action Stage: 8) Design of the Creation of the Granary Building; 9) Project of the Creation of the Granary Building. Reflection Stage: 10) Trial and Presentation; 11) Reflection and Evaluation. Follow-up stages: 12) exhibition of work; 13) project reward

#### *Determination of time allocation*

The project module uses the term "JP" (Lesson Hour) for the learning time unit. 1 JP (one hour lesson) equals 35 minutes. The time allocation for implementing this series of module projects is 52 JP distributed to:

- Introduction stage: 12 JP
- Contextual stage: 16 JP
- Action stage: 10 JP
- Reflection stage: 10 JP
- Follow-up stage: 7 JP

Determination of the assessment instrument, the assessment instrument used in this project module uses cognitive, affective, and psychomotor assessments. Collection of pictures, reading materials, and materials. Images, materials, and reading materials in this project module were obtained via the internet, books, and articles. Determination of the product name, based on the results of the research team's discussion and the series of materials listed in the learning tools, an agreement was reached that the name of this research product was "the Sasak Heritage Project Module".

#### *Development*

This development stage aims to produce valid STEAM learning tools based on the Sasak Heritage Project. Learning tools are assessed by the validator, and the results of the assessment are analyzed by testing their validity. After the validator assessed the STEAM learning tools based on the Sasak Heritage Project, the researcher made revisions to finalize the product based on input from the validator.

#### *Disseminate*

This stage is carried out after finalizing the product, namely disseminating research results through the publication of articles in journals.

## **Result and Discussion**

#### *Validity Test*

The STEAM learning tools based on the Sasak Heritage Project that has been developed meet the product criteria that are valid or suitable for use. The value of the content-validity coefficient for each statement item is in the range of 0.78–1.00. Referring to the table of Right-Tail Probabilities (p) for Selected Values of the Validity Coefficient (V) it is known that the

minimum validity coefficient (V) that must be obtained is 0.78 (Aiken, 1985). Based on the results of the assessment and calculation of the content-validity coefficient, it is known that each indicator has a valid coefficient value so that it can be concluded that the STEAM learning tool based on the Sasak Heritage Project is declared feasible so that it can be used as a project module.

#### *Validator Comments and Suggestions*

The STEAM learning tool based on the Sasak Heritage Project was validated by the validator using four assessment indicators and four rating scales supplemented with comments. The following are comments and suggestions from the validator regarding the STEAM learning tool based on the Sasak Heritage Project.:

#### *The structure of the learning tool*

Validator 1, the display needs to be changed to make it more attractive by adding/replacing a few things namely: Forms of layout goals, time, and others need to be replaced, not monotonous box-shaped. Need to add headers and footers in the form of lines and add pages at the bottom of the learning tools. The color in each phase of the activity needs to be distinguished so that it becomes a sign, for example, the green color recognition stage, the orange contextual stage and so on. The cover of learning tools is added with an image of a traditional house with low transparency and a Sasambo batik motif. Validator 2, It's already very interesting, it's just that it needs to be displayed in colors that are characteristic of the local area.

Validator 3, The consistency of writing SD or elementary school, if it is written with SD, it is better to explain what it stands for first. It is better if the writing of Sasambo is explained first. Stages or flow should be made in the form of a chart as well so that it is more practical. Making the same template for each variety so that there are differences between varieties, for example, food templates that have food characters. Validator 4, In the aspect of the learning tools structure, several things need to be considered including: Add a project mapping chart to the module so that it's easier for readers to understand. In the project stages, it is better to give Boundaries/phasing sections by the elaboration of 52 JP. Add a glossary because many terms are new in the learning tools. Validator 5 is none, Validator 6, The module structure is very good, clear, and attractive.

#### *Material Writing Organization*

Validator 1; The organization of material writing as a whole is quite good and clear. It is necessary to add several book references about Sasambo culture for teachers to enrich the teacher's insight to be given to students. Validator 2; It is very complete, only need to

add material that will be discussed briefly. Need to add traditional games that can be directly practiced by students. Validator 3; Page 11 should form the desired observation results. Given that the projects given to the module are so dense, it is necessary to calculate the time spent in one semester or one academic year to complete the project. It may be necessary to break down or classify the various Sasambo cultures that will be developed in the project. Example: Discussing separately the various aspects of Sasambo culture including 1) food, 2) dance, 3) language, 4) houses, 5) clothing. On page 27 it is necessary to adjust the form of the project according to the age of the students so that it is not too difficult for them, designing is difficult. Image sources may need to list their references. Validator 4; In the organizational aspect of material writing, several things need to be considered namely: Achievement targets and activity objectives are made in relational tables to make them clearer and more specific. Project activities in the activities displayed (assignments) are assessed based on the level of knowledge of students. Validator 5; is none Validator 6; The organization of the writing material is very good.

#### *Language*

Validator 1; The language used is by EYD and is very easy for the teacher to understand when used. Validator 2; It's very good, although there is a little use of capital letters that are not right. Validator 3; Pay attention to consistency and EYD, for example writing LCD, PPT, and others. Validator 4; Language consistency is improved, for example: "kamu" should be "anda". Corrected punctuation on questions, and notes on attachments. For example, ask "?" be a narrative multiplechoice question according to the given. Validator 5; There are some typing errors (typos). Several writings are not in accordance with the EYD rules. Validator 6; The language is very good and by the level of students' cognition.

#### *Display*

Validator 1; The size of the pictures and the selected pictures are good and present the intended explanation in each section. Maybe some images can use images that reflect locality. Validator 2; The images presented must be by the local culture (do not display images/culture outside of NTB). Validator 3; The text needs to be enlarged. Use images with domestic characteristics only (pages 23, 28, and 31 should be replaced). Replacing some images with domestic ones only. Validator 4; Some things to note in terms of appearance include: Images displayed on the module use images in existing local activities by including the source (use bit.ly) to beautify the text on the images and equipped with image captions for each activity displayed. Image/layout consistency needs improvement. Writing adapted to the

rules. For example, Heritage is used consistently in italics and other words that appear according to the proper writing conventions. Validator 5; is none. Validator 6; The font size is not large, both when accessed via a cellphone or desktop PC.

#### *General comments*

Validator 1; Overall the Sasak Heritage Project module is suitable and interesting, but there are some suggestions to make the module look even more attractive. Validator 2; Overall the modules that have been made are very good and modules like this help elementary school teachers by providing interesting material and experiences. Educational activities based on local cultural wisdom will have an impact on the love for local culture which is starting to erode in students. Validator 3; In the preparation and implementation of projects given to children/students, it is necessary to pay close attention to the abilities of students to complete the project, it is better to consider the conditions of the school as well as to facilitate the project to be given. Make reserves for other projects with the same weight so that alternative alternatives can be explained if the previous project cannot be carried out. Can be equipped with a timeline model for implementing modules that will be carried out in one academic year or one semester, so that implementers have an overview of implementing projects in one year or one semester. Validator 4; The resulting learning tools is generally good but need to be improved in several aspects including the addition of an initial chart at the project stages so that the module is easier for readers to understand, a glossary is added because many new terms appear in the module, consistency of image layout and consistency of writing The language used in modules and punctuation need to be considered again. Validator 5; Verify the work twice before submitting it to avoid typos. Validator 6; The content is well-written and the application is great and captivating. Increasing the font size and module size is a suggestion for improvement (display size).

Suggestions and input from the validator then become material for revision in the appearance and content of the Sasak Heritage Project module. Revisions made in the form of coloring at each stage. So that there are differences at each stage and make the display more attractive. Page numbering on each module sheet needs to be done. In addition, the background cover of the module should be adjusted to the Sasak Heritage image. Some of the image in the module should use images related to local Sasak culture. This aims to facilitate students in the learning process contextually. In addition, based on research conducted by Samo et al. (2018) explained that learning with a culture-based contextual approach can improve problem-solving abilities.



Figure 1. Display of the module cover before and after revision

A description of the definition of Sasambo culture is added to the contents section based on the validator’s recommendations. The module’s introduction is where the description is located. Users of the module are expected to have a deeper understanding of Sasambo

culture. The stages and project flow are also added and explained by including flowcharts and using different colors to highlight each project stage.

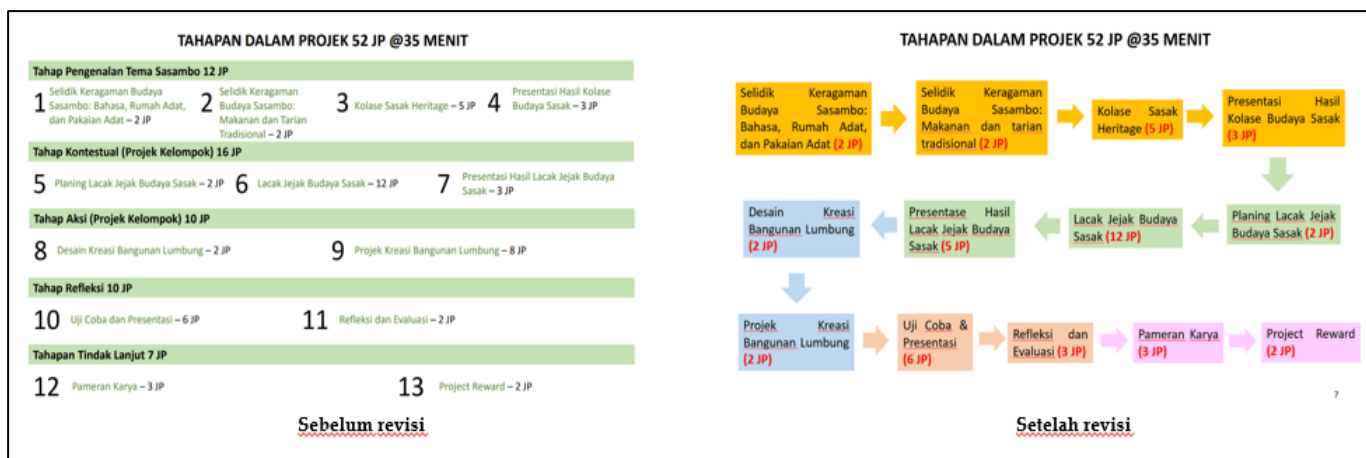


Figure 2. Addition of Project Stage Flow in the Sasak Heritage Project Module

A list of references from literature is also added to make it easier for users to find references pertaining to Sasak culture. To aid students in their exploration of Sasambo culture, a full table of observations from the Sasambo Diversity Investigation study is included. To aid students in understanding and answering the questions, a description of the questions is provided in the evaluation section. Alternative project themes are also included so that users have other options if the prepared project does not fit the requirements and characteristics of the students. This is in line with Rachmawati et al. (2022) that teachers are allowed to innovate in the Pancasila Student Strengthening Project implementation according to the requirements and characteristics of students.

*STEAM on the Sasak Heritage Project Module*

The Sasak Heritage Project module is developed based on STEAM integration. The STEAM component in the Sasak Heritage Project Module is listed in Table 2.

The Sasak Heritage Project module being developed is integrated with the STEAM component. The STEAM component contained in this project are separately divided into several activities. One activity can contain one or more than one STEAM components.. This is to the explanation from Larkin & Jorgensen (2017) that each STEAM discipline in learning can be presented separately or several STEAM disciplines integrated, namely two or three but presented separately. STEAM components can be integrated individually or collaboratively (Nurmawanti et al., 2021).

In the science component, activities are carried out by linking science with local culture, namely Sasak culture. In the Sasak culture, especially in household products, house buildings, musical instruments, and so on there is biodiversity that is used as the basic material for Sasak cultural products (traditional buildings, household appliances, musical instruments, traditional clothing, etc.). Online-based science learning by integrating local

wisdom can motivate and make it easier for students to understand learning material (Talib et al., 2021) .

**Table 2.** The STEAM Framework in the Sasak Haritage Project

Science	Knowledge of biodiversity which is used as a basic ingredient of Sasak cultural products (traditional buildings, household instruments, musical instruments, traditional clothing, etc.) (Activity 1, 2, 6)
Technology	Use of Technology in gathering information regarding types of Sasak culture (Activity 1, 2, 3) Pasting pictures into a collage (Activity 3) The number of straws used in each building element so that the shape of the Strong Barn building is following the specified design (Activity 8)
Engineering	Knowledge of the processes and tools used in making tools from the Sasak Culture (Examples of weaving, building, food cooking processes, etc.) (Activity 6) The process of combining straws into the design of the Lumbung building (Activity 8).
Art	Observations on the beauty of the types of Sasak culture both in the color of traditional clothes, the shape of buildings, folk songs, musical instruments, dances, etc. (Activity 1,2,6) Beauty in creating collage products (Activity 3) The beauty of the building design from the collaborative Lumbung building following the design development that has been made (Activity 8)
Mathematics	Counting data related to the many types of Sasak culture (Activity 1) Count the number of straws in each building element and test its strength by counting the number of coins that are accommodated in the building made (Activity 8) Count the number of straws used in each structure of the Barn building (Activity 8)

Several STEAM disciplines may be combined or presented independently, notably two or three; however, this is easier for integration of technology into education is also crucial. Technology in STEAM-based education refers to more than just the employment of technical tools for instruction. The actions of finding, developing, and producing designs or systems are how technology is seen in STEAM learning (Kang, 2019). The technology part of STEAM was illustrated in the project by use of technology to obtain knowledge on the various Sasak cultural subgroups, the method of pasting images into collages, and the design of how many straws were used in each architectural component, such that it maintains the granary building's shape in accordance with the intended design.

In the engineering component of the module developed, students are expected to be able to know about the processes and tools used in making tools from the Sasak Culture (Examples of weaving, building, the process of cooking food, etc.) and practice combining straws into the design of a Lumbung building. In this activity the STEAM engineering component can be carried out by defining and understanding engineering problems (design goals, characteristics, and constraints related to solutions in achieving success), developing possible solutions related to the use of engineering models, optimizing solution designs namely evaluating several solutions and making final decisions (NGSS Lead States, 2013).

The Art component in the project in the module can be seen from student activities regarding observations regarding the beauty of the types of Sasak Culture both

in traditional dress colors, building shapes, folk songs, musical instruments, dances, etc. Apart from that, student activities regarding considering beauty in making collages and building designs from the collaborative Lumbung buildings following the design developments that have been made are also an embodiment of art. According to the explanation(Uştu et al., 2022) the Art process can be placed in more than one or two activities at the planning and implementation stages which can also be integrated between component disciplines in other STEAM.

In the activities in the Sasak Heritage project, mathematics is integrated with another dimension, namely by involving students to calculate data related to the many types of Sasak culture, counting the number of straws in each building element, and testing strength by counting the number of coins that are accommodated in the building made. and counting the number of straws used in each structure of the Lumbung building. Mathematics in this project also integrates creative thinking skills, especially in determining how many straws are in the design of the Lumbung building so that the building is strong. This is following the explanation of Kim et al. (2019) that STEAM learning that focuses on mathematics can create positive results in developing convergent thinking skills, positive attitudes toward mathematics, and students' creative thinking.

## Conclusion

The development of STEAM learning tools based on the Sasak Heritage Project uses the 4D stages, namely

define, design, develop, and disseminate. At the define stage, a problem analysis and needs analysis of the developed learning tools were carried out, such as a review of literature sources related to STEAM learning, Lombok culture, and the Independent Curriculum. At the design stage, a module prototype was designed for the Strengthening Pancasila Student Profile Project. Furthermore, at the development stage, the feasibility test of the project module is carried out through a validity test. The results of the validation show that the developed module is valid with a validity coefficient for each indicator of at least 0.78. At this stage, product finalization is carried out based on suggestions and input from the validator. The next stage is disseminating research results in the form of article publication.

## Acknowledgements

This work was supported by the Universitas Mataram under grant Number: 1740/UN18.L1/PP/2022. We would like to thank for continuing support and feedback from colleagues in the faculties of education

## References

- Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement*, 45, 131–134.
- DeJarnette, N. K. (2018). Implementing STEAM in the Early Childhood Classroom. *European Journal of STEM Education*, 3(3), 1–9. <https://doi.org/10.20897/ejsteme/3878>
- Hadiansyah, Firman, D. (2017). *Materi pendukung literasi budaya dan kewargaan*. In Kementerian Pendidikan dan Kebudayaan.
- Hidjaz, T. (2018). Arsitektur Mesjid Sebagai Adaptasi Dan Orientasi Ruang. *Jurnal Arsitektur Zonasi*, 1(1), 1–15. <https://doi.org/10.17509/jaz.v1i1.11737>
- Ibda, H., & Rahmadi, E. (2018). Penguatan Literasi Baru pada Guru Madrasah Ibtidaiyah dalam Menjawab Tantangan Era Revolusi Industri 4.0. *JRTIE: Journal of Research and Thought of Islamic Education*, 1(1), 1–21. <https://doi.org/10.24260/jrtie.v1i1.1064>
- Kang, N. H. (2019). A review of the effect of integrated STEM or STEAM (science, technology, engineering, arts, and mathematics) education in South Korea. *Asia-Pacific Science Education*, 5(1), 1–22. <https://doi.org/10.1186/s41029-019-0034-y>
- Kemendikbudristek. (2022). *Lokasi Implementasi Kurikulum Merdeka di 34 Provinsi dan 514 Kabupaten / Kota*. Kementerian Pendidikan, Kebudayaan, Riset, Dan Teknologi. Retrieved from <https://kurikulum.gtk.kemdikbud.go.id/>
- Kim, M. K., Lee, J. Y., Yang, H., Lee, J., Jang, J. N., & Kim, S. J. (2019). Analysis of elementary school teachers' perceptions of mathematics-focused STEAM education in Korea. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(9), 1–13. <https://doi.org/10.29333/ejmste/108482>
- Larkin, K., & Jorgensen, R. (2017). *STEM education in the junior secondary: The state of play*. In *STEM Education in the Junior Secondary: The State of Play*. <https://doi.org/10.1007/978-981-10-5448-8>
- Mullins, R. (2019). Using Dewey's Conception of Democracy to Problematize the Notion of Disability in Public Education. *Journal of Culture and Values in Education*, 2(1), 1–17. <https://doi.org/10.46303/jcve.02.01.1>
- NGSS Lead States. (2013). *Next generation science standards: For States, by States*. The National Academies Press.
- Nurmawanti, I., Darmiany, D., Nurwahidah, N., & Kusuma, A. S. (2021). STEAM and Critical Thinking: Alternative Learning Collaboration between Teachers and Parents in The New Normal Era. *SOSHUM: Jurnal Sosial Dan Humaniora*, 11(3), 293–304. <https://doi.org/10.31940/soshum.v11i3.293-304>
- Perignat, E., & Katz-Buonincontro, J. (2019). STEAM in practice and research: An integrative literature review. *Thinking Skills and Creativity*, 31, 31–43. <https://doi.org/10.1016/j.tsc.2018.10.002>
- Rachmawati, N., Marini, A., Nafiah, M., & Nurashiah, I. (2022). *Projek Penguatan Profil Pelajar Pancasila dalam Impelementasi Kurikulum Prototipe di Sekolah Penggerak Jenjang Sekolah Dasar*. *Jurnal Basicedu*, 6(3), 3613–3625. <https://doi.org/10.31004/basicedu.v6i3.2714>
- Samo, D. D., Darhim, & Kartasasmita, B. G. (2018). Culture-based contextual learning to increase problem-solving ability of first year university student. *Journal on Mathematics Education*, 9(1), 81–93. <https://doi.org/10.22342/jme.9.1.4125.81-94>
- Sharapan, H. (2012). From STEM to STEAM: How early childhood educators can apply fred rogers' approach. *ERIC*, 67(1), 36–40.
- Shatunova, O., Anisimova, T., Sabirova, F., & Kalimullina, O. (2019). Journal of Social Studies Education Research STEAM as an Innovative Educational Technology. *Journal of Social Studies Education Research*, 10(2), 131–144.
- Sufyadi, S., Harjatanaya, T. Y., Adiprima, P., Satria, M. R., Andiarti, A., & Herutami, I. (2021). *Panduan pengembangan projek penguatan profil pelajar pancasila. Pusat Kurikulum dan Pembelajaran Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi*. Retrieved from <http://ditpsd.kemdikbud.go.id/hal/profil-pelajar-pancasila>
- Talib, C., Aliyu, F., & Anggoro, S. (2021). *Online Learning Science through STEAM based on the Local Wisdom*.



<https://doi.org/10.4108/eai.19-7-2021.2312479>

Thiagarajan, S. (1974). Instructional development for training teachers of exceptional children: A sourcebook. In *National Center for Improvement of Educational Systems*. [https://doi.org/10.1016/0022-4405\(76\)90066-2](https://doi.org/10.1016/0022-4405(76)90066-2)

Uştu, H., Saito, T., & Mentiş Taş, A. (2022). Integration of Art into STEM Education at Primary Schools: an Action Research Study with Primary School Teachers. *Systemic Practice and Action Research*, 35(2), 253-274. <https://doi.org/10.1007/s11213-021-09570-z>