Nusantara: Jurnal Pendidikan Indonesia
P-ISSN: 2774-3829|E-ISSN: 2774-7689
Vol. 6, No. 2, April 2026
https://journal.rumahindonesia.org/index.php/njpi/index

Community Needs Assessment for Developing a Culturally Responsive STEAM Activity Guide in Dusun Bengkung Magelang

Nora Saiva Jannana[1], Najwa Husna Nur Syifana[1]
[1]Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia

ABSTRACT
Purpose – This study assesses community needs to inform the development of a culturally responsive STEAM (Science, Technology, Engineering, Arts, and Mathematics) activity guide for a rural non-formal learning context in Dusun Bengkung, Magelang. The study addresses gaps in community readiness, preferred STEAM domains, and practical constraints relevant to guide development.
Methods – The study used a descriptive survey as a community needs assessment. Data were collected through a Google Forms questionnaire from youth aged 12-25 in Dusun Bengkung (n = 22) and analyzed descriptively to map respondent characteristics, familiarity with STEAM, domain preferences, perceived barriers, and expectations for future activities.
Findings – Most respondents had heard of STEAM (68.2%), although their understanding of its elements varied. Interest was highest in Technology (31.8%) and Arts (27.3%). The most frequently reported participation barriers were limited facilities (31.8%), limited initial knowledge (31.8%), and time constraints (31.8%). Taken together, these findings indicate that the proposed guide should priorities low-cost, beginner-friendly, and hands-on activities, especially those integrating technology and arts, using simple locally available materials and facilitation structures that fit the community context.
Research Implications – The findings provide an empirical basis for specifying early design priorities for a culturally responsive STEAM activity guide in a TBM-related context. However, the study is limited by its small single-site sample, reliance on self-reported data, and descriptive design. The results therefore cannot support subgroup comparisons or broader community generalisation. This article reports only the needs assessment stage; further research is required to develop, validate, pilot, and evaluate the guide.

OPEN ACCESS

ARTICLE HISTORY
Received: 25-02-2026
Revised: 01-04-2026
Accepted: 02-04-2026

KEYWORDS
community needs assessment, culturally responsive steam, steam activity guide, rural non-formal education, community reading park

Corresponding Author:

Nora Saiva Jannana
Islamic Education Management Study Program, Faculty of Tarbiyah and Education, Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia
Email: nora.jannana@uin-suka.ac.id

Introduction

Science, Technology, Engineering, Arts, and Mathematics (STEAM) has been widely promoted as an educational approach for strengthening creativity, problem solving, and other 21st-century competencies across age groups and learning settings (Aguilera & Ortiz-Revilla, 2021; Hunter-Doniger, 2021). A growing body of research shows that STEAM can support critical and creative thinking when implemented through project-based, hands-on, and interdisciplinary learning designs (Jumerah & Hindriana, 2024; Shenita et al., 2022; Gu et al., 2023). However, most of this evidence comes from formal educational institutions, whereas its application in rural and non-formal learning environments remains less developed and less systematically documented (Casado Fernández & Checa Romero, 2023; Chang et al., 2024).

This limitation is important in the context of community reading parks (TBM) and other community-based learning spaces. In such settings, STEAM cannot simply be transferred from school-based models because participation patterns, facilities, facilitator capacity, and learning expectations are shaped by local community conditions. Prior studies have discussed STEAM in relation to creativity, project-based learning, environmental themes, local wisdom, and informal learning experiences (Ju et al., 2022; Khoiri et al., 2023; Rahmadani, 2024). Yet these studies do not adequately explain what local communities in rural non-formal settings actually need before a feasible STEAM activity guide can be designed and implemented.

Accordingly, the central gap addressed in this article is not the broad absence of STEAM research in general, nor the full development of a STEAM model or guide, but the limited availability of context-specific community needs assessments that can inform the design of culturally responsive STEAM activities in a rural TBM context. This distinction is important. Before proposing a guide, programme model, or implementation framework, it is necessary to understand who the participants are, what STEAM domains interest them, what barriers they face, what forms of facilitation they prefer, and what local resource constraints shape implementation. Without such an empirical foundation, guide development risks being normatively attractive but practically misaligned with the community context.

The relevance of a culturally responsive orientation in this study lies in the need to align future STEAM activities with local conditions, participation patterns, available materials, and forms of expression that are meaningful to the community. In this sense, cultural responsiveness is treated not as a fully operationalised variable tested in the present study, but as a design orientation for interpreting community needs and specifying early implications for guide development. This framing is more appropriate for a needs assessment stage, where the goal is to identify locally relevant design requirements rather than to evaluate a completed culturally based product.

Against this background, this study conducts a community needs assessment involving youth in Dusun Bengkung, Magelang, who are connected to TBM Pelopor Literasi Dusunku. The study aims to identify community readiness, Preferred STEAM domains and activity formats, perceived barriers, and practical expectations relevant to future programme design. The contribution of this article therefore lies in providing an empirical basis for the early development of a culturally responsive STEAM activity guide for a rural non-formal learning context, rather than claiming to present the guide itself or a full implementation model.

Methods

This study used a descriptive cross-sectional survey as a community needs assessment to inform the development of a culturally responsive STEAM activity guide in Dusun Bengkung, Magelang. The study was conducted in Dusun Bengkung, Magelang, and data were collected from early October to late October 2024. The target population comprised youth aged 12–25 residing in Dusun Bengkung and/or engaged in TBM activities; participants were recruited through TBM/community networks using convenience sampling, resulting in 22 completed responses (n = 22).

Data were gathered through an online questionnaire administered via Google Forms covering demographic information, familiarity with STEAM, interest across STEAM domains, perceived barriers to participation, and expectations for activity formats and guide characteristics. Prior to distribution, the instrument underwent expert review (expert judgment) to assess face validity, content relevance, and readability: a doctoral-level student in Educational Research and Evaluation (PEP) examined item clarity, appropriateness for the youth target group, and alignment with the needs-assessment indicators, and feedback was used to refine wording and response options. Data were analyzed descriptively using frequencies and percentages, and the findings were interpreted to formulate design implications (design requirements) for the forthcoming guide. Participation was voluntary and anonymous, and no personally identifying information is reported.

Result

This section reports findings from the community needs assessment survey conducted in Dusun Bengkung (n = 22). Rather than presenting the data only as isolated frequencies, the Results are organised to show how empirical evidence from the survey leads to specific interpretations and early claims relevant to the development of a culturally responsive STEAM activity guide in a rural non-formal learning context.

1. Respondent Profile and initial familiarity with STEAM

The respondent group consisted of 22 youth participants. women represented 63.6% of respondents (14 people), while men accounted for 36.4% (8 people). In terms of Educational background, 77.3% (17 people) had completed senior secondary education, while 22.7% (5 people) came from other educational categories. Regarding initial familiarity, 15 respondents (68.2%) reported that they had heard of STEAM, while 7 respondents (31.8%) had not.

Table 1. Respondent profile and STEAM awareness

Indicator	Category	n	Percentage
Gender	Women	14	63.6%
Gender	Men	8	36.4%
Educational background	High School/Vocational School/Islamic Senior High School	17	77.3%
Educational background	Other	5	22.7%
Awareness of STEAM	Have heard of STEAM	15	68.2%
Awareness of STEAM	Have not heard of STEAM	7	31.8%

Table 1 provides initial evidence that the prospective participant base is composed largely of youth with secondary-level educational experience and a moderate degree of prior exposure to STEAM. This pattern suggests that future activities may build on some existing recognition of the concept, but not on a stable or shared foundation of understanding. The first claim that emerges from this evidence is that guide development should assume partial familiarity rather than prior mastery, meaning that introductory scaffolding remains necessary even for participants who report having heard of STEAM.

The evidence in Table 2 shows an uneven pattern of understanding across STEAM elements. Science, technology, and mathematics were relatively more familiar, whereas arts and engineering were clearly less understood. This imbalance becomes more meaningful when read alongside the reported barriers, especially limited access to resources, perceived conceptual difficulty, and lack of facilitators. Taken together, these findings support the claim that the future guide should not treat the five STEAM components as equally accessible to participants. Instead, the design needs to provide stronger conceptual and practical entry points for arts and engineering, especially through simple explanation, demonstration, and facilitation.

Table 2. Self-reported understanding of STEAM elements and barriers to understanding

Indicator	Category	Percentage
Understanding of STEAM elements	Science	60%
Understanding of STEAM elements	Technology	45%
Understanding of STEAM elements	Mathematics	40%
Understanding of STEAM elements	Arts	25%
Understanding of STEAM elements	Engineering	20%
Barriers to understanding	Limited access to resources	55%
Barriers to understanding	Perceived difficulty of STEAM concepts	45%
Barriers to understanding	Lack of facilitators	36%

2. Interests, preferred activities, and learning formats

Respondents' interest was highest in Technology (31.8%) and Arts (27.3%), followed by Science (22.7%), Mathematics (13.6%), and Engineering (4.5%). In terms of activities, Science experiments were the most preferred (70%), followed by art projects (45%), basic coding (36%), and simple engineering activities (27%). Respondents also preferred participatory delivery methods, especially interactive workshops (80%), project-based learning (65%), and game-based activities (55%). In addition, 65% expressed interest in collaborative projects combining science and arts, while 55% were interested in simple technology experiments aligned with everyday needs.

Table 3. Preferred STEAM domains, activities, and delivery methods

Indicator	Category	n	Percentage
Preferred STEAM domain	Technology	-	31.8%
Preferred STEAM domain	Arts	-	27.3%
Preferred STEAM domain	Science	-	22.7%
Preferred STEAM domain	Mathematics	-	13.6%
Preferred STEAM domain	Engineering	-	4.5%
Preferred activity	Science experiments	16	70%
Preferred activity	Art projects	10	45%
Preferred activity	Basic coding	8	36%
Preferred activity	Simple engineering	6	27%
Preferred delivery method	Interactive workshops	18	80%
Preferred delivery method	Project-based learning	14	65%
Preferred delivery method	Game-based activities	12	55%
Additional preference	Collaborative projects combining science and arts	-	65%
Additional preference	Simple technology experiments for everyday needs	-	55%

The evidence in Table 3 indicates a consistent preference pattern: respondents were more attracted to domains and activities that combine practicality, creativity, and direct engagement than to more abstract or technically demanding areas. Technology and arts attracted the highest domain-level interest, while interactive workshops and project-based formats were preferred over passive learning approaches. This suggests that participants do not merely want STEAM as content, but as an experience that is hands-on, collaborative, and visibly relevant to everyday life. The resulting claim is that the guide should prioritise technology-arts integration, practical experimentation, and participatory facilitation formats, rather than beginning with engineering-heavy or theory-dominant activities.

3. Existing skills, support, and implementation constraints

Respondents reported varied baseline skills, with Creative skills mentioned most frequently (55%), followed by basic technical skills (45%) and critical thinking ability (40%). At the same time, 60% reported low confidence in using more advanced technology, and 50% indicated a need for further training in engineering and applied arts. several enabling conditions were also identified: 70% stated that the TBM provides adequate space for learning activities, 65% highlighted broader community support, and 45% pointed to the presence of volunteers and facilitators. However, implementation challenges remained substantial. the most commonly reported issues were limited access to tools and materials (60%), time constraints (50%), and limited facilitator training (41%). Participants also identified specific barriers to participation, namely lack of facility (31.8%), uncertainty about how to get started (31.8%), and lack of time (31.8%), while only 4.5% cited no interest as a barrier.

Table 4. Baseline skills, support, and implementation challenges

Indicator	Category	n	Percentage
Baseline skill	Creative skills	12	55%
Baseline skill	Basic technical skills	10	45%
Baseline skill	Critical thinking ability	9	40%
Skill gap	Technology use (advanced tools)	13	60%
Skill gap	Engineering and applied arts	11	50%
Existing support	TBM facilities	15	70%
Existing support	Community support	14	65%
Existing support	Volunteers and facilitators	10	45%
Implementation challenge	Access to tools and materials	13	60%
Implementation challenge	Time constraints	11	50%
Implementation challenge	Lack of facilitator training	9	41%
Participation barrier	Lack of facility	-	31.8%
Participation barrier	Do not know how to get started	-	31.8%
Participation barrier	Lack of time	-	31.8%
Participation barrier	No interest	-	4.5%

Table 4 presents a more complex pattern than a simple deficit narrative. On the one hand, respondents already possess useful starting assets, especially creative skills, some basic technical ability, available space, and community support. On the other hand, these assets are constrained by weak technological confidence, limited materials, insufficient facilitator preparation, and practical participation barriers. The interpretation, therefore, is not that the community lacks readiness altogether, but that readiness is partial and uneven. The claim supported by this evidence is that implementation should be designed around a low-threshold entry model: one that builds from existing creative capacities and social support while deliberately reducing technological, material, and facilitation barriers.

4. Facility needs and community recommendations

Respondents specified that the most needed facilities for future STEAM activities were Technology equipment such as computers or laptops (35%), materials for science experiments (25%), creative learning spaces (20%), and other supporting facilities (20%). To address the identified challenges, respondents recommended prioritising the procurement of tools and materials (70%), providing routine facilitator training (55%), and applying flexible scheduling to increase participation (45%).

Table 5. Facility needs and community recommendations

Indicator	Category	n	Percentage
Facility requirement	Technology equipment (computer/laptop)	-	35%
Facility requirement	Materials for science experiments	-	25%
Facility requirement	Creative learning space	-	20%
Facility requirement	Other supporting facilities	-	20%
Recommendation	Procurement of tools and materials	15	70%
Recommendation	Routine facilitator training	12	55%
Recommendation	Flexible scheduling	10	45%

The evidence in Table 5 shows that respondents' recommendations were highly pragmatic. They did not primarily ask for abstract curricular reform, but for concrete enabling conditions: equipment, materials, facilitator development, and scheduling flexibility. This indicates that the gap between interest and implementation lies less in motivation than in operational support. The claim emerging from this final set of findings is that guide development should be accompanied by minimum implementation requirements, including resource planning, facilitator preparation, and flexible delivery arrangements. Without these supports, even a well-designed guide would likely remain underused or difficult to sustain.

Overall, the findings converge on a clear empirical argument: youth in Dusun Bengkung show sufficient interest and partial readiness for STEAM participation, but this readiness is uneven and strongly conditioned by resource access, facilitation, and the need for accessible activity design. Therefore, the most defensible direction for guide development is not a broad or technically ambitious model, but a culturally responsive,

low-cost, beginner-friendly, and hands-on activity structure grounded in the actual conditions identified through the needs assessment.

Discussion

The discussion should remain closely tied to what the data can reasonably support. In this study, the most defensible conclusion is not that STEAM participation in Dusun Bengkung is shaped by gendered experience, measurable creativity outcomes, or a strongly operationalised cultural construct. Rather, the findings show that respondents demonstrated partial familiarity with STEAM, stronger interest in technology and arts, preference for hands-on and project-based formats, and clear concern about limited facilities, initial knowledge, and time constraints. These patterns provide a practical basis for design decisions, but they do not justify broader claims beyond the scope of the survey.

One important implication concerns the level of accessibility required in the future guide. Although a majority of respondents had heard of STEAM, their reported understanding was uneven, especially in arts and engineering. This suggests that future activities should be introduced gradually through simple, facilitated, and beginner-friendly sequences rather than through technically dense or conceptually advanced modules. In other words, the issue is not merely whether STEAM is attractive to the community, but whether it can be made understandable and workable under existing learning conditions.

A second implication concerns the preferred form of engagement. The combination of stronger interest in technology and arts, high preference for science experiments, and support for interactive workshops and project-based learning indicates that respondents favour practical and participatory experiences over abstract instruction. This does not mean that all participants share identical motivations, nor does it justify claims about broader developmental outcomes. However, it does support a focused design principle: the guide should prioritise concrete activities that are experiential, staged, and closely connected to everyday relevance.

A third implication concerns feasibility. The findings consistently show that community interest alone is insufficient for implementation. Respondents pointed to limited facilities, uncertainty about how to get started, time constraints, and the need for facilitator support. These results indicate that the central design challenge lies in reducing entry barriers. Therefore, a realistic guide for this context should not depend on advanced equipment, highly specialised facilitation, or intensive scheduling. Instead, it should be structured around low-cost materials, flexible delivery, clear instructions, and modest implementation requirements that fit the actual conditions of the setting.

The cultural responsiveness claimed in this article should also be understood carefully. The present study does not measure culture as a formal variable, nor does it test specific cultural mechanisms. What it does provide is a basis for interpreting design needs in relation to local context, available resources, participation patterns, and forms of activity likely to be meaningful and feasible within the community. Accordingly, cultural responsiveness is better treated here as a design orientation rather than as a demonstrated outcome or fully elaborated construct.

Taken together, the discussion supports a narrower but stronger conclusion: the main contribution of this study lies in identifying the design conditions under which STEAM activities are more likely to be feasible in a rural non-formal learning setting. Those conditions include gradual introduction, practical facilitation, project-based engagement, resource sensitivity, and operational simplicity. Framed this way, the study makes a clearer and more defensible contribution than if it attempted to infer empowerment, creativity outcomes, or broader social transformation from descriptive survey data alone.

Future research may build on these findings by involving community members more directly in co-design, piloting specific activity modules, and examining how participation unfolds across different groups and implementation conditions. Such work would be necessary before making stronger claims about inclusion, cultural processes, or longer-term educational outcomes.

Conclusion

This study provides empirical evidence to inform the early development of a culturally responsive STEAM activity guide in Dusun Bengkung, Magelang through a community needs assessment. The findings indicate that most respondents (n = 22) had initial awareness of STEAM (68.2%), with strongest interest in Technology (31.8%) and Arts (27.3%), while participation was constrained primarily by limited facilities, limited initial knowledge, and time constraints (each 31.8%). Taken together, these results support the argument that STEAM programming in rural non-formal settings should be designed as a culturally responsive, low-cost, and beginner-friendly pathway rather than assuming prior readiness or abundant resources.

These findings should be understood as preliminary design implications rather than as a validated implementation framework. At this stage, the study supports the early specification of guide characteristics, especially the need for modular activities, technology-arts integration, locally available materials, hands-on facilitation, and flexible delivery arrangements. Further research is required to co-design the guide with relevant stakeholders, validate its content, pilot selected modules, and evaluate its use across broader settings before stronger practical or generalisable claims can be made.

References

Aguilera, D., & Ortiz-Revilla, J. (2021). STEM vs. STEAM Education and Student Creativity: A Systematic Literature Review. *Education Sciences*, *11*(7), 331. https://doi.org/10.3390/educsci11070331

Ananda, N., Parwoto, P., & Ilyas, S. N. (2023). Effectiveness of STEAM-Based Learning with Loose Media Parts on Early Childhood Creativity. *Buah Hati Journal*, *10*(2), 76–92. https://doi.org/10.46244/buahhati.v10i2.2276

Anggraeni, G., Sagita, L., & Susetyowati, M. E. (2021). *Perintisan Rumah Belajar STEAM melalui Aktivitas Pendampingan Belajar STEAM di Rumah Singgah Anak Negeri Magelang*.

Anggraini, S. V., Muti'ah, S., Panjaitan, R., & Setiawan, R. (2024). *Utilization of Learning Facilities and Infrastructure in Implementing the Merdeka Curriculum at Muhammadiyah Middle School 57 Medan*. *3*(1).

Anisak, D., Fitri, N., & Suryana, D. (2022). *STEAM Learning in Developing Early Childhood Creativity Skills*.

Casado Fernández, R., & Checa Romero, M. (2023). Creatividad, pensamiento crítico y trabajo en equipo en educación primaria: Un enfoque interdisciplinar a través de proyectos STEAM. *Revista Complutense de Educación*, *34*(3), 629–640. https://doi.org/10.5209/rced.79861

Chang, Y.-S., Wang, Y.-Y., & Ku, Y.-T. (2024). Influence of online STEAM hands-on learning on AI learning, creativity, and creative emotions. *Interactive Learning Environments*, *32*(8), 4719–4738. https://doi.org/10.1080/10494820.2023.2205898

Ellianawati, E., Subali, B., Putra, B. R., Wahyuni, S., Dwijananti, P., Adhi, M. A., & Yusof, M. M. M. (2025). Critical thinking and creativity in STEAM-based collaborative learning on renewable energy issues. *Journal of Education and Learning (EduLearn)*, *19*(1), 112–119. https://doi.org/10.11591/edulearn.v19i1.21638

Erol, A., Erol, M., & Başaran, M. (2023). The effect of STEAM education with tales on problem solving and creativity skills. *European Early Childhood Education Research Journal*, *31*(2), 243–258. https://doi.org/10.1080/1350293X.2022.2081347

Gita, R. S. D., & Jayawardana, H. B. A. (2023). RBL-STEM Model Learning Activity Framework: VCO (Virgin Coconut Oil) Development Analysis Using Artificial Neural Network to Improve Student Metacognition. *1st International Conference on Neural Networks and Machine Learning 2022 (ICONNSMAL 2022)*, 157–173.

Gu, X., Tong, D., Shi, P., Zou, Y., Yuan, H., Chen, C., & Zhao, G. (2023). Incorporating STEAM activities into creativity training in higher education. *Thinking Skills and Creativity*, *50*, 101395. https://doi.org/10.1016/j.tsc.2023.101395

Hasibuan, F. A., & Hasibuan, T. (2023a). Effectiveness of PJBL-Based STEAM Learning in Improving the Creativity of Civil Engineering Students in Fluid Mechanics and Hydraulics Courses. *Concept: Journal of Social Humanities and Education*, *2*(3), 81–94. https://doi.org/10.55606/concept.v2i3.547

Hasibuan, F. A., & Hasibuan, T. (2023b). Effectiveness of PJBL-Based STEAM Learning in Increasing the Creativity of Civil Engineering Students in Fluid Mechanics and Hydraulics Courses. *Concept: Journal of Social Humanities and Education*, *2*(3), 81–94. https://doi.org/10.55606/concept.v2i3.547

Heenan, C. (2021). *4 Tips For Implementing A STEAM Program In Your Classroom*. TeachThought.Com. https://www.teachthought.com/technology/4-tips-for-implementing-a-steam-program-in-your-classroom/

Hunter-Doniger, T. (2021). Early Childhood STEAM Education: The Joy of Creativity, Autonomy, and Play. *Art Education*, *74*(4), 22–27. https://doi.org/10.1080/00043125.2021.1905419

Ju, H., Park, H., Jung, E. Y., & Paik, S.-H. (2022). Proposal for a STEAM education program for creativity exploring the roofline of a hanok using GeoGebra and 4Dframe. *Thinking Skills and Creativity*, *45*, 101062. https://doi.org/10.1016/j.tsc.2022.101062

Jumerah, J., & Hindriana, A. F. (2024). Implementation of STEAM Approach Based on PjBL Model Through Online Learning in Improving Critical Thinking Skills and Students' Creativity on Environmental Pollution Material in Class X of SMA Negeri 1 Dukupuntang. *Edubiologica: Journal of Research in Biological Science and Education*, *10*(2), 64–75. https://doi.org/10.25134/edubiologica.v10i2.10269

Khoiri, N., Roshayanti, F., & Widarti, R. (2023). Integration of STEAM and ESD: Improving the understanding of fluid concepts and creativity. *Journal of Education and E-Learning Research*, *10*(3), 578–584. https://doi.org/10.20448/jeelr.v10i3.4987

Kumala, M., Ramdani, A., & Handayani, B. S. (2025). The Influence of the Implementation of the Project Based Learning Model Learning (PjBL) on Students' Creative Thinking Skills. *Journal of Classroom Action Research*, *7*(2). https://doi.org/10.29303/jcar.v7i2.11351

Lage-Gómez, C., & Ros, G. (2023). How transdisciplinary integration, creativity and student motivation interact in three STEAM projects for gifted education? *Gifted Education International*, *39*(2), 247–262. https://doi.org/10.1177/02614294231167744

Li, Y., Chen, Y., Wei, G., Ma, F., Hu, Q., Wei, W., & Bai, Y. (2025). Application of desktop virtual reality technology in nursing student education: A realist review. *BMC Medical Education*, *25*(1). https://doi.org/10.1186/s12909-025-06697-8

Mansur, N. R., Ratnasari, J., & Ramdhan, B. (2022). STEAM Model on Collaboration Ability and Creativity of Students. *BIODIK*, *8*(4), 183–196. https://doi.org/10.22437/bio.v8i4.19123

Nur, N., & Nugraha, M. S. (2023). Implementation of the STEAM Learning Model in Improving Student Creativity at RA Al-Manshuriyah, Sukabumi City. *Arjuna Journal: Publication of Educational Sciences, Language and Mathematics*, *1*(5), 73–93. https://doi.org/10.61132/arjuna.v1i5.158

Pegia, F. N., Suharta, I. G. P., & Supir, I. K. (2024). *STEAM Learning Method to Develop Mathematical Concepts and Creativity*. *14*(2).

Rahmadani, D. (2024). *The STEAM (Science, Technology, Engineering, Art, and Mathematic) to Improve Creativity in Science Subjects on Local Wisdom for Grade IV Students of SD Negeri 1 Kedungwinangun*. https://digilib.uns.ac.id/dokumen/detail/113082/Pendekatan-STEAM-Science-Technology-Engineering-Art-and-Mathematic-guna-Meningkatkan-Kreativitas-pada-Mata-Pelajaran-IPAS-tentang-Kearifan-Lokal-untuk-Siswa-Kelas-IV-SD-Negeri-1-Kedungwinangun

Satriani, A. D. (2023). *The Influence of Creative Problem Solving Learning Model with STEAM Approach on Student Learning Creativity in Acid Base Material at SMA N 1 Muaro Jambi* [Universitas Jambi]. https://repository.unja.ac.id/

Shenita, A., Oktavia, W., Aditya Rahman, N., Lisfi Irmareta, I., Subrata, H., Rahmawati, I., & Lutfi Choirunnisa, N. (2022). Project-Based Glass Bottle Music Art Learning with a STEAM Approach to Enhance Creativity. *ENGGANG: Journal of Education, Language, Literature, Arts, and Culture*, *2*(2), 155–167. https://doi.org/10.37304/enggang.v3i1.4939

Sugita, D., Sabela, E., Sari, F. M., Idayanti, R., & Erika, F. (2025). Literature Review: Implementation of STEAM Approach in Science Learning to Improve Students' Critical Thinking and Creativity. *EDUCATIONAL: Journal of Educational Innovation & Teaching*, *5*(1). https://doi.org/10.51878/educational.v5i1.3652

Timotheou, S., & Ioannou, A. (2021). Collective creativity in STEAM Making activities. *The Journal of Educational Research*, *114*(2), 130–138. https://doi.org/10.1080/00220671.2021.1873721

Tran, N.-H., Huang, C.-F., Hsiao, K.-H., Lin, K.-L., & Hung, J.-F. (2021). Investigation on the Influences of STEAM-Based Curriculum on Scientific Creativity of Elementary School Students. *Frontiers in Education*, *6*, 694516. https://doi.org/10.3389/feduc.2021.694516

Umaisaroh, U., Dafik, D., Kristiana, A. I., Maylisa, I. N., Izza, R., & Supandi, S. R. (2023). *RBL-STEAM Learning Activity Framework: Implementation of Mitigation Actions in Disaster Prevention Efforts by Creating a Miniature Park Model Realizing a Green School to Increase Teacher Creativity Facilitating Students in Realizing IKL Change Literacy*.

Yuliantino, H. A., Hapsari, J., Raihan, M., Putri, S. A., & Sufyan, A. (2024). The Use of Papercraft in the Steam Method Application to Stimulate Elementary School Students' Creativity. *SENADA (National Seminar on Management, Design and Application of Technology Business)*, *7*, 231–240.

Zaqiah, Q. Y., Hasanah, A., & Heryati, Y. (2024). The Role of Steam Education in Improving Student Collaboration and Creativity: A Case Study in Madrasah. *Journal of Islamic Education*, *10*(1), 101–112. https://doi.org/10.15575/jpi.v10i1.35207