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Profiling Students' Problem-Solving Skills through the Ethno-STEAM Approach in Elementary School Contexts

Imarotul Azizah*
Faculty of Education, State University of Surabaya, Surabaya, Indonesia

Suryanti
Faculty of Education, State University of Surabaya, Surabaya, Indonesia

Neni Mariana
Faculty of Education, State University of Surabaya, Surabaya, Indonesia

***Corresponding Author:** 24010855169@mhs.unesa.ac.id

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Abstract
This research aims to explore and describe the profile of fifth-grade students' problem-solving abilities through the integration of an Ethno-STEAM approach at SDN Kendangsari IV Surabaya. Using a descriptive quantitative design, the study involved 18 students and focused on analyzing their performance across five problem-solving stages based on Polya's problem-solving framework: identifying the problem, generating solutions, planning and designing, implementing, and evaluating. Students were given a contextual task that integrated cultural (ethno) elements and STEAM (Science, Technology, Engineering, Arts, and Mathematics) to solve real-life environmental issues related to plastic waste in their school environment. The results revealed that 72% of students were at the Developing Level, indicating emerging capabilities in identifying problems and proposing basic solutions, yet requiring substantial teacher assistance in planning, implementation, and evaluation stages. Meanwhile, 28% reached the Proficient Level, demonstrating more independent and systematic thinking, although further support was still needed for deeper reflection and evaluation. No students reached the Excellent Level, and none remained at the Initial Level. A detailed analysis across Polya's stages showed strong performance in problem identification (67% at Good to Excellent levels), but significant challenges in the evaluation stage, where 89% of students were categorized as "Needs Improvement." These findings suggest that metacognitive scaffolding, localized content, and collaborative projects are essential to enhance higher-order thinking skills. The Ethno-STEAM approach shows strong potential in connecting scientific concepts with students' cultural backgrounds, encouraging both relevance and engagement in learning. However, its implementation must be supported by structured pedagogical strategies to maximize its effectiveness in elementary education contexts.

INTRODUCTION

21st century education requires students to master a variety of essential skills to respond to increasingly complex global challenges. One of the key skills that is highly emphasized in various global competency frameworks is critical thinking and *problem solving skills*, which are included in the four main competencies or *4Cs* (Aziz et al., 2024). These competencies not only support academic success, but also serve as a foundation for success in personal, social, and professional life. The Government of Indonesia responds to this challenge through the implementation of the Independent Curriculum which emphasizes contextual, applicative, and participatory learning. In this context, strengthening problem-solving skills is an integral part of the development of Pancasila Student Profiles that are adaptive to the dynamics of the times. However, the results of international studies such as PISA show that the problem-solving skills of Indonesian students are still below the global average (Supiarmo & Susanti, 2021). This reflects the gap between curriculum expectations and the reality of student achievement in the field. Therefore, a more transformative learning approach is needed to overcome these problems.

One of the promising approaches in improving students' problem-solving skills is STEAM (Science, Technology, Engineering, Arts, and Mathematics). This approach integrates various disciplines transdisciplinarily, allowing students to develop analytical, creative, and collaborative skills simultaneously (Supriyadi et al., 2023). STEAM emphasizes solving real problems through context-based projects, which reflect the complexity of the real world. In elementary school, the STEAM approach can be an effective means of building high-level thinking skills early on. However, the implementation of STEAM in Indonesia often faces obstacles such as limited resources, lack of teacher training, and the irrelevance of the local cultural context which leads to low student engagement (Azcárate & Garcia, 2022). In this case, the integration of local culture in STEAM learning is an aspect that needs to be seriously considered. Mariana et al. (2023) also noted that pedagogical and technical challenges are significant obstacles in the implementation of STEAM learning at the elementary level. Therefore, it is necessary to develop a STEAM learning model that is not only technical, but also contextual and cultural.

The integration between STEAM and a local culture-based approach or ethnoscience resulted in the concept of Ethno-STEAM. This approach combines the advantages of STEAM with a wealth of local cultural values and practices to create a holistic and meaningful learning experience (Suryanti et al., 2021). Ethno-STEAM aims to increase learning motivation, strengthen students' cultural identity, and enrich the critical and creative thinking process. Local knowledge such as ethnomathematics and ethnoscience has great potential to be used as a meaningful learning context, especially for elementary school students who are still in the stage of concrete operational development according to Piaget's theory. The cultural context provides a concrete stimulus that is in accordance with the student's cognitive stages, so that it is able to bridge the understanding of abstract concepts. Solihin & Rahmawati (2024) explained that ethnomathematics is able to transmit mathematical concepts through socio-cultural practices, making it easier for students to understand. By integrating STEAM principles and local wisdom, learning can become more applicative, contextual, and participatory. This is a strategic opportunity in designing learning that accommodates the needs of students in the modern era.

Problem solving skills are inherently inseparable from a critical thinking framework. Arista et al. (2022) identified four steps in solving problems, namely understanding the problem, planning the solution, implementing the plan, and evaluating the results. This process requires students to not only understand the information literally, but also to process it into creative and appropriate solutions. This ability is cross-disciplinary and is very important in basic education because it is the foundation for rational decision-making in daily life (Salahuddin & Ramdani, 2021). Unfortunately, many elementary school students still have difficulty in applying mathematics and science knowledge in a real context, as found in the initial observations at SDN Kendangsari IV Surabaya. As many as 60% of students experience obstacles in applying the concept to their daily lives, which shows the weak linkage between learning and the local context. This problem is exacerbated by the lack of systematic mapping of individual students' problem-solving profiles. In fact, a deep understanding of student characteristics is needed to design appropriate and effective interventions.

In the context of the development of basic education, a contextual approach based on local culture is highly relevant to the cognitive characteristics of elementary school age students. According to Piaget's theory of cognitive development, students aged 7–12 years are in the concrete operational stage, that is, the phase in which they can think logically towards concrete objects, but still have difficulty understanding abstract concepts without visual aid or direct experience (Diva et al., 2024). Therefore, contextual, concrete, and cultural learning will be more effective in facilitating their understanding. Surabaya as a research location has cultural riches that have not been fully utilized in learning, such as the Heroes Monument, Kalimas River, Surabaya batik, and Remo Dance. This local potential can be an authentic source of learning and be able to bridge scientific concepts with the socio-cultural reality of students. Unfortunately, this potential has not been systematically integrated in science and mathematics learning. Such integration will be very effective if combined within the framework of Ethno-STEAM that allows for the transdisciplinary of knowledge. Therefore, the local context needs to be the main entry point in the development of STEAM-based problem solving learning models (Subai et al., 2023).

The urgency of developing an Ethno-STEAM-based learning model is getting stronger along with the need for education that is more relevant and adaptive to the diversity of students' backgrounds. In practice, Ethno-STEAM allows for a synergistic fusion of cultural values with scientific knowledge, thereby encouraging students' active involvement in the learning process (Cuhanazriansyah et al., 2023). Students not only learn to know, but also to experience and understand the relationship between science and everyday life. This active involvement is very important in forming an applicative and reflective problem-solving mindset. On the other hand, the absence of mapping students' abilities within the framework of Ethno-STEAM causes learning to be generalist and non-contextual. Individual student profiles in solving problems, especially in the aspects of planning, implementation, and evaluation, are often overlooked in learning planning. Without a deep understanding of this profile, teachers struggle to determine the right strategies to develop each student's potential to the fullest. Therefore, it is important to thoroughly identify students' problem-solving abilities based on the stages of Polya thinking that are integrated with the Ethno-STEAM context.

Based on the description above, it can be concluded that problem solving skills are very important competencies for elementary school students, but their implementation still faces various challenges. These challenges include the low relevance of learning to local culture, the limitations of a holistic learning approach, and the lack of optimal mapping of student ability profiles. The Ethno-STEAM approach offers a promising solution because it is able to combine cultural values with science in a concrete and applicative form. This research was specifically conducted at SDN Kendangsari IV Surabaya to identify the problem solving profile of grade V students based on the Polya frame of thinking. The results of this research are expected to be the basis for the development of learning models that suit the needs and characteristics of students. This identification is important so that teachers can develop appropriate strategies in guiding students to solve problems independently and reflectively. Thus, learning is not only informative, but also transformative. This research is the first step to realize basic education that is relevant to the needs of the 21st century and local Indonesian culture.

METHODS

This research employed a descriptive quantitative method, which is considered appropriate for the purpose of this study, namely, to map the problem-solving profiles of elementary school students. Unlike experimental or correlational designs, the descriptive approach allows for an objective portrayal of students' current abilities without manipulating variables or testing hypotheses.

The participants in this study were 18 students from Class VB at SDN Kendangsari IV Surabaya. These students were selected based on purposive sampling, representing a class with diverse academic characteristics and relevant to the contextual problem chosen.

The data collection procedure involved three main stages: (1) socialization of the task and instructions to students; (2) administration of the Ethno-STEAM-based problem-solving test under teacher supervision during classroom hours; and (3) collection of students' written responses for analysis. The entire process was carried out over the course of one week.

The measurement of students' problem-solving abilities was conducted using a Polya-based test instrument that integrates Ethno-STEAM (Science, Technology, Engineering, Art, and Mathematics in an ethnocultural context). This instrument was designed to reflect real-life issues and local cultural elements, enabling students to apply their knowledge holistically.

The development of the test instrument involved expert judgment from education specialists and elementary school teachers to ensure content validity. A pilot test was conducted with 12 students outside the research sample, and necessary revisions were made based on feedback. The reliability of the instrument was measured using Cronbach's alpha, which resulted in a coefficient of 0.82, indicating good internal consistency.

The test yielded quantitative data, which were then analyzed to identify patterns and classify students into distinct problem-solving proficiency levels. Students' responses were analyzed through five problem-solving stages, adapted from Polya's framework (Schoenfeld, 1987), which include Identifying the Problem, Generating Solutions, Planning and Designing, Implementing, and Evaluating. These stages are instrumental in understanding not only the final outcomes but also the underlying cognitive and creative processes students engage in while solving problems.

Table 1 provides a detailed breakdown of the five problem-solving stages along with their operational indicators, which serve as benchmarks in evaluating student performance at each stage. The problem presented in the test revolves around plastic waste management in the school environment, a contextually relevant and culturally adaptable issue. Each stage involves a combination of cognitive, creative, and collaborative tasks aligned with the Ethno-STEAM approach.

Table 1. Stages of Problem Solving According to Polya and Their Indicators

Problem-Solving Stage	**Indicators**
Identifying the Problem	- Observing the issue of plastic waste in the school environment. - Clearly articulating the environmental impact of unmanaged plastic waste.
Generating Solutions	- Proposing creative and practical ideas to resolve the problem. - Utilizing Ethno-STEAM elements, such as integrating traditional knowledge, arts, or local technology.
Planning and Designing	- Outlining step-by-step procedures for waste management. - Designing tools or systems (e.g., recycling containers or awareness campaigns) inspired by local culture or environment.
Implementing	- Constructing or applying the designed solution in a practical context. - Demonstrating feasibility and adherence to the original plan.
Evaluating	- Testing and analyzing the effectiveness of the solution implemented. - Identifying any challenges encountered and how they were addressed. - Reflecting on the entire problem-solving process and suggesting improvements.

This comprehensive table not only functions as a rubric for performance analysis but also facilitates deeper insights into how students engage with contextual problems through interdisciplinary and culturally responsive approaches. The findings derived from this analysis are expected to inform the development of a more targeted and culturally grounded Ethno-STEAM learning model in primary education.

RESULTS AND DISCUSSION

Results

The research findings from 18 fifth-grade students at SDN Kendangsari IV Surabaya revealed varied levels of problem-solving abilities when integrated with the Ethno-STEAM approach. A majority of the students—72% (13 students)—were categorized at the "Practitioner Level", indicating that they demonstrated a reasonably good ability to identify problems and generate relevant solutions, albeit with occasional guidance. Meanwhile, the remaining 28% (5 students) were classified at the "Apprentice Level", suggesting they are still in the early stages of developing problem-solving skills. Notably, no students achieved the "Expert Level", which would require fully independent and highly proficient performance. These results imply that most students possess a foundational understanding of problem-solving but still require structured support and development to reach higher levels of mastery. Table 2 presents the distribution of students based on their overall problem-solving proficiency levels.

Table 2. Student Problem-Solving Ability Levels

Proficiency Level	Number of Students	Percentage
Novice	0	0%
Apprentice	13	72%
Practitioner	5	28%
Expert	0	0%

The five students identified at the Practitioner level scored between 11 to 14 points on the Ethno-STEAM problem-solving test. These students demonstrated strong capabilities in problem identification, innovative solution design, implementation, and preliminary evaluation. However, they still needed to improve in the evaluation phase to develop a deeper analytical capacity. Meanwhile, the 13 students at the Apprentice level, who scored between 6 to 10 points, had begun to show progress in identifying problems and formulating basic solutions. However, they required teacher assistance during the planning, implementation, and evaluation stages. These students are on a developmental trajectory and would benefit from continuous scaffolding to achieve greater independence in problem-solving. To better understand students' performance across the five stages of Polya's problem-solving process, Table 3 outlines the distribution of students' proficiency levels at each stage.

Table 3. Distribution of Students' Mastery Levels in Each Stage of Polya's Problem-Solving Framework

Polya's Stage	Proficiency Level	Number of Students	Percentage
Identifying the Problem	Excellent (4)	4	22%
	Good (3)	8	45%
	Fair (2)	6	33%
	Needs Improvement (1)	0	0%
Generating Solutions	Excellent (4)	2	11%
	Good (3)	6	33%
	Fair (2)	8	45%
	Needs Improvement (1)	2	11%
Planning & Designing	Excellent (4)	0	0%
	Good (3)	2	11%
	Fair (2)	10	56%
	Needs Improvement (1)	6	33%
Implementing	Excellent (4)	0	0%
	Good (3)	0	0%
	Fair (2)	18	100%
	Needs Improvement (1)	0	0%
Evaluating	Excellent (4)	0	0%
	Good (3)	2	11%
	Fair (2)	0	0%
	Needs Improvement (1)	16	89%

A deeper analysis of Table 3 provides insight into each stage:

1. Identifying the Problem: 22% of students performed at an *Excellent* level, demonstrating detailed recognition of plastic waste types and their environmental impacts. While 45% performed *Well*, their understanding was somewhat general. The remaining 33% were rated *Fair*, indicating only partial identification of the problem. This suggests that while the majority can identify issues, there is room to deepen their understanding through contextual examples, such as environmental issues in local mangrove ecosystems.
2. Generating Solutions: Only 11% offered *Excellent* solutions, characterized by creative, contextually relevant ideas integrating Ethno-STEAM. 33% proposed *Good* but conventional solutions, while 45% gave *Fair* responses that mirrored examples without modification. The 11% who *Needed Improvement* had difficulty generating ideas. These results point to a need for more activities encouraging divergent thinking, such as localized problem-solving challenges.
3. Planning & Designing: No student achieved *Excellent* mastery. While 11% reached the *Good* category with systematic planning, the majority (56%) had only *Fair* designs, often lacking depth. The 33% needing improvement struggled to construct logical plans. Guided templates or

planning frameworks that scaffold integration of STEAM components (e.g., a local mangrove restoration plan) could support student growth in this area.

4. Implementing: All students were assessed as *Fair*, suggesting that while they followed their plans, they relied heavily on teacher support. To foster independence, collaborative project-based tasks—such as building recycled models—can enhance execution skills and ownership of the learning process.
5. Evaluating: Only 11% demonstrated *Good* evaluation skills. The vast majority—89%—needed improvement, either omitting reflection or offering surface-level assessments. This highlights evaluation as the weakest phase. Teachers can support development through guided reflection prompts, such as linking solutions to cultural relevance (e.g., "How would your solution better reflect Surabaya's local wisdom?").

In summary, although students are developing foundational problem-solving skills, the results emphasize the need for further instructional interventions, particularly in the areas of planning, implementation, and especially evaluation. The Ethno-STEAM approach holds significant potential to enhance these competencies by situating learning within meaningful, culturally resonant contexts.

Discussion

The results of this study show that most of the students of the VB class of SDN Kendangsari IV Surabaya already have early ability in problem solving, especially in the context of Ethno-STEAM-based learning. This approach has proven to be able to integrate elements of local wisdom with elements of science, technology, engineering, art, and mathematics in the learning process. As many as 72% of students fall into the Developed Level category, indicating that they have been able to identify problems and offer basic solutions with the help of teachers. This is in line with the opinion of Chang et al. (2023) who stated that the STEAM approach can foster critical and creative thinking skills from an early age. However, none of the students achieved the Very Good level, which indicates that there is still a low level of student independence in solving complex problems. Lack of reflective and evaluative exercise may be the main causative factor in this case (Anggraeni, 2024). Therefore, learning strategies that involve more self-exploration and reflection need to be implemented. This is important to encourage students to achieve a higher level of mastery in problem solving.

According to Polya, the distribution of students' abilities in each stage of problem solving shows a tendency to decline in performance from the initial stage to the final stage (Purwanti et al., 2024). At the Problem Identification stage, more than half of the students were in the Good to Very Good category, which indicates that students are relatively able to recognize and explain the environmental problems around them. However, at the Evaluation stage, the majority of students (89%) were in the Need for Improvement category. This suggests that students' metacognitive abilities, such as evaluating the effectiveness of solutions and reflecting on processes, are still very limited (Rahayu et al., 2024). This ability is very important in 21st century learning because it relates to analysis-based decision-making. Without a good evaluation, students will find it difficult to develop sustainable solutions. Therefore, the evaluation stage needs to be strengthened with learning interventions based on triggering questions and reflective discussions. Teachers can also use evaluation rubrics as a tool for students to understand quality standards for problem-solving.

At the Finding Solutions stage, there are still many students who are in the Sufficient and Need Improvement categories. This reflects the low ability of students to produce creative solutions that are relevant to the local context. In fact, according to Sabella & Zannah (2024), the integration of local values in the Ethno-STEAM approach can increase students' reasoning power and meaningful learning. Solutions developed by students tend to be repetitive and simply imitate examples without any innovation. This can be due to the lack of student experience in divergent thinking activities, such as brainstorming or making alternative prototypes (Saputra, 2021). To overcome this, teachers can provide stimuli in the form of local case studies and challenge students to create diverse solutions. The application of techniques such as "thinking outside the box" can help increase students' thinking flexibility. Thus, creativity as an important part of STEAM can develop optimally.

The Planning and Design stage also shows the weakness of students' ability to formulate strategies or concrete steps to solve problems. As many as 56% of students are only in the Sufficient category, and the other 33% are in the Need for Improvement category. According to research by Nurhaliza et al. (2024), planning is an important element in building student independence in completing complex tasks. Students need explicit guidance to draw up a plan that is systematic and integrated with STEAM elements. One effective way is to use a project-based planning template that directs students to connect science with practical solutions (Ramadhana et al., 2022). Activities such as designing simple technology-based waste recycling tools can train students in integrating concepts and skills. The use of visual media or flowcharts can also help students map out their thought processes. In this way, planning skills can be improved gradually and systematically.

All students show the same ability at the Implement stage, which is in the Sufficient category. They are able to follow instructions and implement solutions as planned, but are still highly dependent on the teacher's direction. According to Prabawati et al. (2023), Project-Based Learning can improve students' ability to implement plans independently. Student dependence shows that independence and confidence in implementing solutions have not been optimally formed. Therefore, there needs to be an increase in practical and collaborative skills training. Teachers can organize small team projects where students share responsibility for completing problem-based assignments (Karo et al., 2023). Through teamwork, students can learn from each other and develop a sense of responsibility for the results of their joint work. This collaborative learning also strengthens social-emotional competencies that are important in the problem solving process.

The Evaluation Stage is the biggest challenge in developing students' problem-solving skills. Only 11% of students were able to evaluate the solution properly, while the rest were not able to assess the advantages, disadvantages, or effectiveness of the solution implemented. According to Fikrina et al. (2023), evaluation skills reflect high-order thinking skills that must be trained consistently in learning. The lack of reflective practice causes students to not be used to introspection on their own thought processes. Teachers can integrate metacognitive activities, such as reflective journals or peer-review, as strategies to build students' evaluative awareness. Guiding questions like "What can you improve from this solution?" can help students develop their critical thinking. Good evaluation also encourages continuous improvement in problem-solving strategies. Therefore, this stage needs to get a larger portion in the Ethno-STEAM-based learning process.

The overall Ethno-STEAM approach makes a positive contribution to improving students' problem-solving skills. By incorporating elements of local culture in the scientific thinking process, students can more easily understand the real problems that occur around them. According to Fikrina et al. (2023), ethnopedagogy-based contextual learning is able to increase student motivation and involvement in learning. However, the application of this approach still faces challenges in the aspects of evaluation and independent implementation. Improvement efforts are needed through the development of learning modules or tools that are more systematic and responsive to student needs. Teachers also need to receive training in integrating local wisdom with STEAM principles effectively. Local community involvement can also be a meaningful source of learning for students. Thus, the Ethno-STEAM approach can be a sustainable learning innovation and have a real impact.

Based on the results and analysis, it is concluded that students' problem-solving skills are still at a developing level and are not fully independent. Ethno-STEAM learning has great potential in strengthening students' critical and reflective thinking stages, especially in identifying and designing solutions based on local problems. For this reason, a more intensive approach is needed in guiding students towards more analytical and evaluative thinking. In the future, the development of learning programs must integrate evaluation aspects more explicitly and sustainably. In line with that, increasing the capacity of teachers in implementing Ethno-STEAM is a key factor in the successful implementation of this strategy (Rahma et al., 2024). Collaboration between schools, communities, and higher education institutions is also urgently needed to produce contextual and adaptive learning models. With a shared commitment, Ethno-STEAM can be a transformative approach in primary education. This is important in producing a generation of learners who are adaptive, creative, and solutive in facing global and local challenges.

CONCLUSION

This study shows that the application of the Ethno-STEAM approach in problem solving learning in the VB class of SDN Kendangsari IV Surabaya is able to encourage student involvement in understanding and solving problems based on local contexts. Most students are in the "Developmental Level" category, which reflects the basic critical and creative thinking skills, although they still rely on the guidance of teachers. Early stages such as identifying problems show fairly good results, but students' abilities decline significantly at the evaluation stage, which is an aspect of high-level thinking. This indicates that the learning process still needs to be strengthened in the metacognitive aspects and independent thinking. The Ethno-STEAM approach has proven to be relevant in linking scientific knowledge to local cultural realities, but its implementation requires systematic pedagogical support, including the use of scaffolding, assessment rubrics, and project-based learning. Teachers play an important role as facilitators who are able to guide students in every stage of problem solving. With the strengthening of this strategy, the Ethno-STEAM approach has the potential to become an effective learning innovation in developing the problem-solving skills of elementary school students as a whole.

Future research should explore the long-term effects of Ethno-STEAM integration across different grade levels and cultural settings, as well as its impact on other 21st-century skills such as collaboration, communication, and digital literacy. In addition, mixed-methods studies could provide deeper insights into the cognitive and affective changes experienced by students throughout the learning process.

REFERENCES

Anggraeni, P. N. (2024). Penyusunan Asesmen Siswa yang Menyenangkan dengan Pemanfaatan AI dalam Aplikasi Quizizz pada Guru SMAN 1 Kaliwiro. *Seminar Nasional Prodi Manajemen Pendidikan*, *2*(1).

Arista, G. A., Wibawa, K. A., & Payadnya, I. P. A. A. (2022). Analisis Kesalahan Siswa dalam Pemecahan Masalah Perbandingan dan Skala Berdasarkan Empat Langkah Polya di Kelas VII SMP TP 45 Denpasar. *Prisma, Prosiding Seminar Nasional Matematika*, *5*, 214–221.

Azcárate, A. L.-V., & Garcia, D. A. (2022). Sustainable Entrepreneurship in Higher Education: A Systemic STEAM Approach. *The International Journal of Humanities Education*, *20*(2), 1.

Aziz, M. T., Hasan, L. M. U., & Rido'i, M. (2024). Analisis Kurikulum Bahasa Arab Berbasis 4C (Critical Thinking, Communication, Collaboration, Creativity) untuk Pengembangan Kompetensi Abad 21 pada Siswa. *DAARUS TSAQOFAH Jurnal Pendidikan Pascasarjana Universitas Qomaruddin*, *2*(1), 216–222.

Chang, L., Wu, Z., & Ghadimi, N. (2023). A new biomass-based hybrid energy system integrated with a flue gas condensation process and energy storage option: An effort to mitigate environmental hazards. *Process Safety and Environmental Protection*, *177*, 959–975. https://doi.org/10.1016/j.psep.2023.07.045

Diva, D. F., Rizqi, N. R., Rahmawati, A., Rangkuti, S. A., Pulungan, F. K., Prasiska, M., & Fakhri, N. (2024). Pengembangan Aplikasi Geogebra Berbasis Budaya Batak Untuk Meningkatkan Kemampuan Visual Thinking Matematis Siswa. *FARABI: Jurnal Matematika dan Pendidikan Matematika*, *7*(2), 271–274.

Fikrina, Q. A., Sudarmin, S., & Priatmoko, S. (2023). Pengembangan E-LKPD Kesetimbangan Kuantitatif Asam Basa Terintegrasi PjBL Etno-STEAM Batik untuk Meningkatkan Literasi Numerasi dan Karakter Konservasi SiswaPengembangan E-LKPD Kesetimbangan Kuantitatif Asam Basa Terintegrasi PjBL Etno-STEAM Batik untuk M. *Prosiding Seminar Nasional Pascasarjana*, *6*(1), 623–629.

Fikrina, Q. A., Sudarmin, S., Sumarni, W., & Sumarti, S. S. (2023). Pengambangan E-Modul Kimia

Larutan Terintegrasi Etno-STEAM Bahan Kajian Batik Pekalongan. *Chemistry in education*, *12*(1), 17–24.

Karo, D. K., Waruwu, C. S. M., & Jarang, A. K. M. (2023). Desain Materi Pembelajaran Berbasis Proyek: Memotivasi Siswa Melalui Pembelajaran Aktif dalam Pelajaran Pendidikan Agama Kristen. *Inculco Journal of Christian Education*, *3*(3), 262–284.

Mariana, N., Julianto, J., Subrata, H., Balqis, K. I., Rachmadina, C. D., Anindya, V. H. K., & Sholihah, S. A. (2023). Desain pembelajaran STEAM dengan media Selasi untuk peserta didik kelas II SD. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *7*(1), 240–250.

Muhammad Rinov Cuhanazriansyah, M. R. C., Cahyaningrum, Y., & Kom, S. (2023). Peran Media Pembelajaran Berbasis Etno-Steam Pada Proses Pembelajaran di Sekolah Menengah Atas. *Journal Of Global Humanistic Studies*, *2*(1).

Nurhaliza, E., Indriyanti, N. Y., & Ariani, S. R. D. (2024). Literature Review: Pembelajaran IPA berbasis Pendekatan Etno-STEAM Untuk Mencapai Keterampilan Abad-21. *Seminar Nasional Pembelajaran Matematika, Sains Dan Teknologi*, *4*(1), 134–152.

Prabawati, M. A., Yamtinah, S., Bramastia, B., & Sidiq, A. S. (2023). Literature Review: Pembelajaran IPA Bermuatan Etno-STEAM sebagai Upaya Pemberdayaan Kemampuan Berpikir Kreatif Siswa Kurikulum Merdeka. *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*, 166–179.

Purwanti, E., Maisaroh, I., Studi, M. J.-K. J., & 2024, U. (2024). Penerapan Pembelajaran Tematik Integratif Berbasis Kontekstual dalam Meningkatkan Keterampilan Sosial Siswa Madrasah Ibtidaiyah. *Kartika: Jurnal Studi Keislaman*, *4*(2), 253–270. https://doi.org/10.17509/jsder.v2i1.12266

Rahayu, S., Wicaksono, V. D., & Budiyanto, S. (2024). PENINGKATAN PEMAHAMAN MATERI BANGUN RUANG MELALUI PENDEKATAN ETNO-STEAM PADA SISWA KELAS 2 SEKOLAH DASAR. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *9*(04), 387–401.

Rahma, R., Rizki, S., Saputra, R. J., Nazila, C. A., & Mulyana, I. (2024). PENDAMPINGAN GURU UPTD TK NEGERI PUTROE TI ZALIKHA DALAM MENDESAIN MODUL AJAR BERBASIS ETNO-STEAM PADA IMPLEMENTASIKURIKULUM MERDEKA. *PAKDEMAS: Jurnal Pengabdian Kepada Masyarakat*, *4*(1), 25–32.

Ramadhana, S. D., Norra, B. I., & Rasyida, N. (2022). KEEFEKTIFAN PERANGKAT PEMBELAJARAN DENGAN MODEL PjBL-STEAM PADA MATERI LINGKUNGAN UNTUK MENINGKATKAN LITERASI LINGKUNGAN. *Jurnal Pendidikan (Teori dan Praktik)*, *6*(2), 75–81. https://doi.org/10.26740/jp.v6n1.p75-81

Sabella, W., & Zannah, F. (2024). Ethno-STEAM Based E-Comic "Lilis Lamiang", is it Necessary to Use it on Science Learning in Elementary Schools? *Jurnal Penelitian Pendidikan IPA*, *10*(10), 7431–7436.

Salahuddin, M., & Ramdani, N. (2021). *Kemampuan Berpikir Kritis Siswa Dalam Memecahkan Masalah Matematika berdasarkan Tahapan Polya*. *8*(1), 37–48.

Saputra, A. (2021). *Kemampuan Representasi Matematis Siswa dalam Memecahkan Masalah Matematika Divergen Ditinjau dari Perbedaan Gender*. UIN Ar-Raniry Banda Aceh.

Solihin, A., & Rahmawati, I. (2024). Kartu Eksplorasi Etnomatematika-QR Pada Materi Bangun Datar Kelas IV Sekolah Dasar. *Jurnal Review Pendidikan Dasar : Jurnal Kajian Pendidikan dan Hasil Penelitian*, *10*(1), 64–79. https://doi.org/10.26740/jrpd.v10n1.p64-79

Subai, S., Hidayat, S., Jamaludin, U., & Leksono, S. M. (2023). Menggali Kearifan Lokal Untuk Meningkatkan Kualitas Pendidikan: Studi Etno-Pedagogi di Suku Baduy. *Al Qalam: Jurnal Ilmiah Keagamaan Dan Kemasyarakatan*, *17*(4). https://doi.org/10.35931/aq.v17i4.2323

Supiarmo, M. G., & Susanti, E. (2021). Proses berpikir komputasional siswa dalam menyelesaikan soal pisa konten change and relationship berdasarkan self-regulated learning. *Numeracy*, *8*(1), 58–72.

Supriyadi, E., Dahlan, J. A., & Juandi, D. (2023). Publication trends from STEAM in education from scopus database: Bibliometric analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 104–111.

Suryanti, S., Prahani, B. K., Widodo, W., Mintohari, M., Istianah, F., Julianto, J., & Yermiandhoko, Y. (2021). Ethnoscience-based science learning in elementary schools. *Journal of Physics: Conference Series*, *1987*(1). https://doi.org/10.1088/1742-6596/1987/1/012055