



THE ROLE OF CULTURAL CONTEXT IN STEM LEARNING (SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS): PERSPECTIVE OF BASIC EDUCATION IN INDONESIA

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Abstract: *This study examines the integration of local cultural elements in STEM (Science, Technology, Engineering, and Mathematics) learning at the elementary school level in Jember Regency, Indonesia. The main objectives of this study were to identify relevant local cultural elements, understand teachers' and students' perceptions of culture-based STEM learning, and analyze challenges and opportunities in its implementation. The research method used was a qualitative approach with a case study, involving in-depth interviews, participant observation, and documentation analysis. The results showed that integrating local cultures, such as agricultural wisdom, art traditions, and the local environment, can increase the relevance and engagement of students in STEM learning. Teachers and students generally had positive perceptions of this approach, which was considered able to relate STEM concepts to their daily lives. However, challenges such as lack of teacher knowledge and limited resources need to be addressed to maximize the potential of cultural integration in STEM education. This study provides an important contribution to developing a more contextual and inclusive curriculum, as well as encouraging the preservation of local culture in the learning process.*

Keywords: *Culture-Based STEM, Basic Education, Local Cultural Integration, Contextual Learning, Character Education.*

1. Introduction

Integrating local cultural elements into STEM (Science, Technology, Engineering, and Mathematics) learning is a strategic approach to creating contextual and meaningful learning experiences.(Chen & Wu, 2024; Kamila et al., 2024). In the context of primary education, this approach not only serves to strengthen students' understanding of STEM concepts, but also to foster an appreciation of local cultural heritage.(Afkarina Izzata Dini & Febri Setiya Rini, 2024; Kusmawan, 2024). Local culture-based learning provides a foundation for students to understand how the concepts of science, technology, engineering, and mathematics can be applied in everyday life, while maintaining their cultural identity amidst the challenges of globalization.(Boz et al., 2024).

Indonesia is a country rich in cultural diversity, ranging from traditions, arts, to local wisdom that has been passed down from generation to generation.(Novikasari et al., 2024). This wealth is not only a national identity, but also a resource that can be optimized to support contextual education, including in STEM learning.(Susilawati et al., 2024). Elements such as batik patterns, traditional irrigation systems, and even traditional games can serve as inspiration to teach STEM concepts in a way that is relevant and interesting to students.(Setianingrum & Jumadi, 2023).

Although the potential of local culture as a source of learning is enormous, research that specifically explores the integration of local culture into the development of STEM materials is still limited, especially at the elementary education level. Most research on STEM in Indonesia focuses more on technological aspects and general pedagogical approaches without considering the local cultural context.(Alvidrez et al., 2024; Geng & Su, 2024; Tuyet et al., 2024). In fact, local cultural integration has the potential to increase student engagement, provide a more personal learning experience, and strengthen their conceptual understanding.(Fuad et al., 2024).

STEM (science, technology, engineering, and mathematics) education is a major focus in 21st century learning, especially in preparing students to face the era of globalization and the industrial revolution 4.0.(Afkarina Izzata Dini & Febri Setiya Rini, 2024; Chen & Wu, 2024). In Indonesia, the implementation of STEM at the elementary level aims to build critical thinking skills, problem solving, and creativity from an early age. Elementary education is seen as an important foundation because at this stage students begin to learn basic concepts relevant to STEM, which will then influence their interest in these fields at higher levels of education.(Kamila et al., 2024).

Culturally based contextual learning refers to an approach that relates learning materials to students' everyday lives, including their local culture. Based on situated learning theory(Jama & Alnefaie, 2023), learning rooted in local cultural contexts provides relevance and increases student engagement. In the context of STEM education, local cultures such as art, traditions, and traditional technologies can be a medium for explaining abstract concepts, making it easier for students to understand the material.(Luo et al., 2024). In addition, the integration of local culture also strengthens students' identity and builds appreciation for their cultural heritage.

Several previous studies have shown the potential for local cultural integration in STEM learning. International studies such as(Sharma (Gyawali), 2024)highlighting the importance of culture-based learning to improve student learning outcomes. In Indonesia, several studies have explored the use of local cultural elements such as batik and traditional irrigation systems in STEM education.(Setianingrum & Jumadi, 2023). However, these studies are generally limited to a specific area or only test the implementation in a small scope. The research gap lies in the lack of systematic reviews covering various cultural elements at the national level and a more in-depth analysis of the challenges and opportunities of local cultural integration in STEM education. This study aims to fill this gap by identifying relevant local cultural elements and examining their impact on STEM learning at the primary education level.

The research gap that this study fills is the lack of exploration of local cultural integration in STEM learning in Indonesia, especially at the elementary level. Most STEM

research in Indonesia focuses more on the technological or pedagogical aspects without linking them to the local context. In addition, previous studies tend to focus on secondary or higher education, thus paying less attention to STEM learning at the elementary level as the initial foundation for students' STEM understanding. This study also addresses the limitations in the literature related to teacher and student perceptions of culture-based STEM learning, which is an important component in its successful implementation. By filling this gap, this study can increase the relevance and effectiveness of STEM education while preserving local culture as part of the learning process. In addition, this study focuses on exploring teacher and student perceptions of the implementation of culture-based STEM, providing new insights that are rarely touched on in previous studies.

This study aims to identify local cultural elements relevant to STEM learning, understand teachers' and students' perceptions of culture-based STEM learning, and analyze the challenges and opportunities in integrating local cultural elements into STEM education. Thus, the results of this study are expected to provide new insights in the development of a more contextual and inclusive STEM curriculum.

2. Research Methods

This study uses a qualitative approach with a case study method to explore the integration of local culture in the development of STEM learning materials in elementary education. The location of the study was an elementary school in an area rich in local culture, namely Jember Regency, which has local traditions and wisdom relevant to contextual learning. This approach was chosen to understand the phenomenon in depth in a real context.

The subjects of the study included teachers who teach STEM, students involved in culture-based STEM learning, and local cultural experts. Data were collected through in-depth interviews, participant observation, and documentation of teaching materials, cultural notes, photographs, or videos. These techniques were designed to capture the perspectives of various parties and concrete evidence of the application of culture in STEM learning.

Data analysis was conducted using thematic analysis to identify key patterns or themes. Data triangulation was applied to increase validity by comparing the results of interviews, observations, and documentation. This process aims to produce credible and applicable findings for the development of culture-based STEM education in Indonesia.

3. Results and Discussion

3.1 Cultural elements integrated into STEM learning

This study identified several local cultural elements that were integrated into STEM learning. The integration of local cultural elements into STEM learning in Jember Regency was carried out by utilizing various cultural aspects in the area. The following are the findings of several integrated cultural elements:

1. Local Wisdom in Agriculture

Jember Regency is known for its superior agricultural sectors such as Arabica coffee, Na-Oogst tobacco, and highland vegetables. In STEM learning, students learn traditional and modern irrigation techniques, chemical analysis of organic fertilizers,

and local pest biology. They also model water use, calculate crop yields, and design sensor-based agricultural technology. This approach integrates science, technology, and mathematics in a local context.

In a culture-based learning approach, as expressed (Tuyet et al., 2024), the integration of traditional and modern practices in agriculture can increase the relevance of learning. For example, the use of traditional irrigation techniques involving water efficiency analysis or organic fertilization helps students understand plant biology, crop yield mathematics, and environmentally friendly technologies. With the CTL principle (Alvidrez et al., 2024), students learn through hands-on experiences, such as fieldwork on farmland, so that abstract concepts become more concrete. This approach also encourages students' problem-solving skills, for example through the design of simple technology-based tools to measure soil water content.

2. Arts and Crafts Traditions

Art traditions such as Lahbako Dance, Jember batik, and patrol music become STEM learning media. Students learn physics principles such as momentum and energy in dance, chemical reactions in batik coloring, and acoustics and design in making patrol musical instruments. These activities connect art with technology and science, creating meaningful and applicable learning.

According to (Kusmawan, 2024), culture-based learning strengthens students' identities and connects abstract concepts to their experiences. For example, Lahbako Dance not only teaches culture, but also involves physics principles such as momentum and balance in body movements. Likewise, batik crafts teach simple chemical reactions in the process of dyeing cloth. In constructivism theory (Toma et al., 2024), students collaborate to create traditional musical instruments such as angklung or patrol, which simultaneously trains the understanding of acoustic principles and engineering design. By using batik motifs as a learning context, students not only learn about geometry, but also gain insight into the cultural values contained in the motifs. This is in line with research stating that the use of cultural elements in mathematics teaching can provide deeper and more relevant meaning for students (Rohim, 2021; Zaky, 2024). With this activity, students not only learn STEM theoretically, but also through real applications.

In addition, introducing local arts and traditions can also be an important element in STEM learning. For example, introducing traditional musical instruments or regional dances can be integrated into science and technology learning. Through these activities, students can learn about the physics of sound in the context of musical instruments or understand the biological and environmental aspects related to certain traditions. (Kamila et al., 2024). Research shows that integrating local culture into the curriculum can enhance students' understanding and appreciation of their cultural heritage and local identity. (Cramer et al., 2024).

3. Local Languages and Literature

Jember's local language and literature are used to enrich STEM learning. Local terms such as "angin gending" facilitate understanding of science concepts, while folktales such as Dewi Rengganis train students in narrative analysis, data

interpretation, and scientific methods. This integration strengthens the connection between culture and science education.

The theory of cultural literacy from (Dicusara, 2024) stated that the use of local languages in learning can improve conceptual understanding because students feel closer to the context. For example, students learn scientific terms in local languages, such as "gending" for seasonal winds, which are then linked to meteorological concepts. Folklore-based projects also teach scientific methods through narrative analysis, data, and hypotheses. With the CTL approach, students are invited to conduct culture-based research, thereby improving their analytical skills while preserving the local language.

4. Local Environment and Ecosystems

Jember's biodiversity, including Meru Betiri National Park and Sukamade Beach, is the basis for STEM exploration. Students study the adaptation of flora and fauna, the impacts of climate change, and disaster mitigation such as landslides. Field projects encourage students to understand local ecosystems and develop technology-based solutions.

According to (Sung et al., 2023) Place-based education allows students to learn science through exploration of the local environment. For example, students observe flora and fauna in their natural habitat or study the impact of climate change on turtle conservation at Sukamade Beach. These field activities are in line with constructivism theory, where students actively construct knowledge through direct experience. In addition, disaster mitigation projects such as landslides or floods in mountainous areas provide real challenges for students to design STEM-based technological solutions.

5. Cultural Festivals and Traditions

Jember Fashion Carnaval (JFC) inspires STEM learning through costume design involving material structure engineering and aerodynamics. In addition, students analyze the social and economic impact of the festival, which teaches them the connection between art, technology, and tourism development.

Cultural festivals such as Jember Fashion Carnaval (JFC) provide opportunities to teach STEM concepts through design, engineering, and social analysis. In line with the theory of project-based learning (PBL), activities such as designing JFC costumes engage students in understanding material structures, aerodynamic principles, and design techniques. In addition, students can also analyze the social and economic impacts of the festival, which teaches analytical skills as well as interdisciplinary insights. With this approach, students not only understand STEM from a technical perspective, but also learn the role of STEM in society and the economy, as proposed by the theory of contextual education.

6. History and Cultural Heritage

Jember's history becomes a source of STEM learning through the study of local innovations such as tobacco storage techniques involving physics and biochemistry. In addition, the traditional architecture of stilt houses is studied to understand earthquake-friendly construction techniques, connecting scientific concepts with cultural heritage. Furthermore, learning media based on local culture can be designed

to stimulate students' literacy and numeracy skills. For example, the use of local folklore or legends in a learning context can help students understand STEM concepts in a more interesting and contextual way (Laksana, 2024). Research shows that learning media that integrates local cultural elements can improve students' understanding and enrich their learning experience. In the context of education in Jember Regency, it is important for educators to develop a curriculum that not only focuses on academic aspects, but also integrates local cultural values. This can be done through collaboration between teachers, the community, and other stakeholders to create a holistic and relevant learning environment. Thus, the integration of cultural elements in STEM learning can produce a generation that is not only academically intelligent but also has awareness and appreciation of their culture.

Jember's history and cultural heritage, such as tobacco storage techniques and traditional architecture, provide insight into how local innovations influenced the development of science and technology. According to (Sharma (Gyawali), 2024) Culture-based learning leverages students' "funds of knowledge," the knowledge inherited from their communities. For example, tobacco storage techniques involve principles of physics and biochemistry, which can be turned into research projects. In addition, the study of traditional stilt house architecture introduces the concept of engineering structures that are friendly to natural disasters such as earthquakes. Using constructivist theory, students learn about these technologies through historical analysis and practical simulations, which strengthens STEM understanding.

7. Use of Information and Communication Technology (ICT)

The integration of information and communication technology in Jember's local culture enriches STEM learning. ICT is utilized to document and promote local culture. Students learn programming to create cultural applications, graphic design for visualizing traditional architecture, and content analysis on social media. This approach combines technology with the preservation of local culture.

According to (Yopi Romafilani et al., 2024), the TPACK (Technological Pedagogical Content Knowledge) approach encourages the use of technology to enhance students' understanding. In this context, students can develop applications or websites that document Jember culture, such as interactive cultural maps or digital simulations of traditional dances. In addition, social media is used as a tool to promote local culture, involving graphic design, programming, and data analysis skills. Thus, students not only learn technology, but also use it to preserve culture, in line with the CTL theory that emphasizes the relationship between learning and real life.

The integration of Jember's local cultural elements in STEM learning not only provides a relevant learning context, but also encourages students to appreciate and preserve their cultural heritage. CTL theory provides a framework for connecting learning to real experiences, while CRT theory emphasizes the importance of culture in learning to increase student motivation and engagement. This approach is in line with the vision of 21st century education that emphasizes collaboration skills, creativity, and critical thinking. In addition, with constructivism theory, students actively construct their knowledge, so that learning becomes more meaningful and contextually relevant.

The application of local cultural elements in STEM learning has been found to be very effective in building deeper understanding. For example, batik patterns are used in math lessons to introduce the concepts of translation, rotation, and reflection, so that students can understand the theory of transformation in a concrete way. In science, traditional irrigation systems are taught to understand the principles of gravity, water pressure, and fluid flow, providing real-world context to theories that are often considered abstract. In technology, students are invited to create simple models of traditional musical instruments that utilize sound resonance as part of a collaborative learning project.

This application supports the view(Alves & Hostins, 2019)about the importance of scaffolding, where students are helped to understand new concepts through media they are already familiar with, such as local culture. By leveraging cultural elements, teachers can build a bridge between students' initial understanding and more complex STEM concepts. Furthermore, this approach supports STEM literacy by linking academic content to real-world applications, in line with the principles of project-based learning.

3.2 Teacher and Student Perceptions of Culture-Based STEM Learning

Teachers in Jember Regency generally welcomed the integration of local culture in STEM learning. They considered this approach to provide a learning context that is more relevant to students' daily lives. Through local cultural elements such as traditional irrigation practices, Jember's batik crafts, and the Lahbako Dance, teachers found it easier to explain STEM concepts, such as physics, biology, and mathematics. Teachers believe that this approach not only strengthens students' academic understanding but also instills local values that enrich students' characters. In addition, teachers feel that local culture-based learning can enhance students' creativity because it connects tradition and modern technology.

Students showed high enthusiasm for STEM learning integrated with local culture. Activities such as calculating geometric patterns on batik, learning the principle of gravity in Lahbako Dance movements, or analyzing biodiversity in Meru Betiri National Park made learning more interesting and easier to understand. They felt that this approach connected learning materials to real life, making it more relevant and meaningful. In addition, students felt more actively involved because culture-based activities often involved direct exploration, such as field observations or community-based projects.

Students also see local culture-based STEM learning as a way to understand the importance of their culture in modern life. They feel that this approach helps them relate school lessons to real challenges in society, such as how technology can be applied to improve local agriculture or preserve Jember's arts and culture. In addition, this learning gives them pride in their local identity while broadening their knowledge of science and technology. This makes them more enthusiastic about learning and thinking creatively in facing global challenges.

Teachers' and students' perceptions of culture-based STEM learning are important aspects that can influence the effectiveness of local cultural integration in education. Research shows that teachers tend to have positive views of STEM learning that integrates cultural elements, as they recognize that this approach can increase the

relevance of teaching materials and student engagement.(Junus et al., 2024). Teachers who understand the local cultural context can design more contextual learning experiences that not only teach STEM concepts but also strengthen students' cultural identities. This is in line with constructivism theory, which emphasizes the importance of experience and context in the learning process.

This perception is in line with the theory of Culturally Relevant Pedagogy (Boz et al., 2024), which emphasizes the importance of aligning learning with students' life experiences to increase engagement and learning outcomes. Teachers also noted that culture-based learning creates a sense of local pride, which supports the goals of character education. This is consistent with Dewey's (1938) view that learning must be experiential and relevant to create meaningful learning.

Culturally-based STEM learning materials have been shown to have a significant impact on student engagement and understanding. In classroom observations, students were seen to be more active in discussing and participating in project tasks such as modeling traditional musical instruments or analyzing batik patterns using mathematical concepts. Students also showed increased conceptual understanding, especially in topics that were previously considered difficult, such as geometric transformations and principles of fluid pressure. Research by(Chen & Wu, 2024)showed that students felt more interested and motivated when mathematics learning materials were presented with a local cultural context. This suggests that a culture-based approach can increase students' engagement in the learning process, which in turn can improve their learning outcomes.

These findings support the theory of contextual learning.(Hsu et al., 2019)which states that linking learning materials to cultural contexts or everyday life can increase students' motivation and understanding. In addition, these results also strengthen evidence from previous studies.(Kamila et al., 2024)that culture-based education has a significant impact on improving student learning outcomes, especially in multicultural environments. Thus, culture-based STEM learning is not only cognitively relevant but also builds social and cultural values.

3.3 Supporting and Inhibiting Factors in Integrating Local Culture

One of the main supporting factors in the integration of local culture into STEM learning is the richness of culture and local wisdom possessed by Jember Regency. Local culture such as traditional agricultural practices, dance, patrol music, and batik crafts provide a variety of relevant sources of inspiration to be used as learning media. Support from local communities, such as farmers, artists, and cultural figures, is also an important asset in providing direct knowledge about cultural practices to students. In addition, the flexible Merdeka-based curriculum allows teachers to explore and integrate local cultural elements into the learning process.

Teachers also have an important role in integrating local culture into STEM learning. Teachers' readiness and creativity in designing relevant learning are the keys to successful implementation. Many teachers in Jember Regency have shown enthusiasm for this approach because they realize the importance of connecting academic materials to students' real lives. In addition, support from the school, such as providing time for training and discussions between teachers, is also a significant supporting factor.

Schools that actively collaborate with local cultural communities also have easier access to relevant resources for learning.

Technology is also a key enabler in integrating local culture into STEM learning. The use of information and communication technologies (ICT) allows teachers and students to document, visualize, and disseminate local cultural elements through interactive applications, videos, or simulations. By utilizing graphic design software or STEM applications, students can develop projects based on local culture, such as creating visualizations of batik patterns or modeling traditional irrigation systems. This strengthens the connection between local culture and modern science and technology.

One of the main obstacles in the integration of local culture is the limited availability of adequate resources and references. Many teachers find it difficult to find appropriate learning materials to connect local culture with STEM concepts. In addition, the lack of special training for teachers makes them feel less confident in designing culture-based learning. On the other hand, there are still schools in remote areas that lack technological facilities, thus hampering the exploration and implementation of STEM-based learning.

Another obstacle that is often faced is the lack of collaboration between schools, cultural communities, and local government. Although local culture in Jember is very rich, not all cultural communities have access to schools or awareness of the importance of this collaboration. Policy support from local governments has also not been fully focused on the development of culture-based learning. The lack of official learning modules that integrate local culture with STEM is also a challenge that needs to be overcome. Therefore, synergistic efforts are needed between various parties to support the sustainability of the integration of local culture into STEM learning in Jember Regency.

Support from schools or government is essential in overcoming these barriers. Schools need to provide specific training for teachers in integrating local culture into STEM learning. This training can include the development of learning materials, the use of local cultural resources, and strategies for dealing with various challenges in the field. In addition, the government needs to provide support in the form of policies that support culture-based learning, such as allocating a budget for the development of a curriculum that integrates local culture. This support will help create a more inclusive and contextual learning environment, increasing student engagement and motivation.

The theory of policy enactment from (Bush, 2021) emphasizes the importance of education policies that enable teachers to develop innovative learning practices that are appropriate to the local context. If the government provides adequate support, both in the form of training and supportive policies, then the integration of local culture into STEM learning will be easier to implement. This support is also in line with the concept of adaptive teaching (Tomlinson & Imbeau, 2023) which emphasizes the importance of being responsive to students' needs and cultural contexts to create more relevant and effective learning.

There are several barriers to integrating local culture into STEM learning. One of the main challenges is teachers' lack of knowledge and understanding of local culture. Many teachers do not have an educational background in culture or are not skilled enough in linking STEM concepts to cultural elements. In addition, limited resources, such as

culturally-based learning materials and tools, are a serious obstacle to implementing culture-based STEM learning. Lack of training support for teachers is also a significant inhibiting factor. Without adequate training, teachers tend to have difficulty developing materials that are appropriate to the relevant local culture.

This is in accordance with the theory of cultural capital from (Sharma (Gyawali), 2024) which states that access to cultural resources can affect educational outcomes. If teachers do not have adequate access or understanding of local culture, they cannot effectively integrate these elements into STEM learning. In addition, situated learning theory emphasizes the importance of direct involvement in cultural communities to learn cultural practices. Therefore, this challenge requires intervention from schools or governments to provide adequate training and the necessary resources.

4. Conclusion

The integration of local cultural elements in STEM learning in Jember Regency shows that this approach has great potential to improve the relevance and effectiveness of education at the elementary level. The integration of local culture not only enriches students' learning experiences but also helps them understand STEM concepts in a more real and meaningful context. Through the use of cultural elements such as local wisdom in agriculture, art traditions, local languages and literature, and the environment and ecosystem, students can relate learning to their daily lives. Positive perceptions from teachers and students towards culture-based STEM learning indicate that this approach can increase student engagement and motivation. Teachers who understand the local cultural context can design more contextual learning experiences, while students feel more connected to the material being taught. However, challenges such as teachers' lack of knowledge and skills in integrating local culture and differences in students' cultural backgrounds need to be addressed through adequate training and support.

This study emphasizes the importance of developing an inclusive and contextual STEM curriculum, which not only focuses on academic aspects, but also appreciates and preserves local culture. Thus, STEM education in Jember Regency can produce a generation that is not only academically intelligent, but also has awareness and appreciation of their cultural heritage. Further research is needed to explore more deeply the challenges and opportunities in implementing culture-based STEM learning in various contexts and regions in Indonesia.

References

- Afkarina Izzata Dini, N., & Febri Setiya Rini, E. (2024). Integration of Local Potential in Science Learning to Improve 21st-Century Skills. *IJCER (International Journal of Chemistry Education Research)*, 156–165. <https://doi.org/10.20885/ijcer.vol8.iss2.art9>
- Alves, A.G., & Hostins, R.C.L. (2019). Conceptual elaboration through the collaborative and collective creation of digital games in the perspective of inclusive education. *Revista Brasileira de Educacao Especial*, 25(4), 657–674. <https://doi.org/10.1590/s1413-65382519000400011>

- Alvidrez, M., Rivera, J., & Diaz, M. (2024). The Role of Critical Pedagogies in Early Childhood Education to Create Pathways into STEM for Racially Minoritized Communities. *Education Sciences*, 14(11). <https://doi.org/10.3390/educsci14111208>
- Boz, T., Hammack, R., Lux, N., & Gannon, P. (2024). Technology-rich Engineering Experiences in Indigenous and Rural Schools. *International Journal of Education in Mathematics, Science and Technology*, 12(4), 1090–1108. <https://doi.org/10.46328/ijemst.4129>
- Bush, J. B. (2021). Software-based intervention with digital manipulatives to support student conceptual understanding of fractions. *British Journal of Educational Technology*, 52(6), 2299–2318. <https://doi.org/10.1111/bjet.13139>
- Chen, M.-K., & Wu, C.-C. (2024). Integrating Science, Technology, Engineering, and Mathematics (STEM) into Indigenous Education for Sustainability: The Development and Implementation of a Curriculum Based on Disaster Prevention for Young Children. *Sustainability*, 16(21), 9186. <https://doi.org/10.3390/su16219186>
- Cramer, J., Yazilitas, D., Bruynzeel, A., Romp, S., Smeets, I., & De Bruyckere, P. (2024). The effect of tutoring primary school pupils by university students on STEM interests: a pre-registered randomized controlled trial. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186X.2024.2408834>
- Dicusara, O. (2024). Cultural literacy, premised in the training of intercultural competence for future teachers. *Studia Universitatis Moldaviae. Seria Științe Ale Educației*, 9(169), 93–99. [https://doi.org/10.59295/sum9\(169\)2024_14](https://doi.org/10.59295/sum9(169)2024_14)
- Fuad, Z., Sholahuddin, A., & Mahardika, AI (2024). Integration of local wisdom of natural color sasirangan in project-based learning with steam approach to train science literacy. *JPPi (Jurnal Penelitian Pendidikan Indonesia)*, 10(4), 505. <https://doi.org/10.29210/020243295>
- Geng, X., & Su, Y.-S. (2024). Enhancing K-12 Students' STEM Learning Through the Integration of the Metaverse Into Online and Blended Environments: A Meta-Analysis. *International Journal of Science and Mathematics Education*. <https://doi.org/10.1007/s10763-024-10484-0>
- Hsu, H.-P., Wenting, Z., & Hughes, J. E. (2019). Developing Elementary Students' Digital Literacy Through Augmented Reality Creation: Insights From a Longitudinal Analysis of Questionnaires, Interviews, and Projects. *Journal of Educational Computing Research*, 57(6), 1400–1435. <https://doi.org/10.1177/0735633118794515>
- Jama, I., & Alnefaie, M. (2023). Situated Learning Theory: The Application of Grammatical Structure (Gerunds and Infinitives) in Developing EFL Students' Cover Letters. *World Journal of English Language*, 13(6), 314. <https://doi.org/10.5430/wjel.v13n6p314>
- Junus, F.B., Bennett, J.A., Green, T., Morphew, J., & Wertz, R. (2024). Visuospatial and Embodied Cognition in STEM Education: A Systematic Literature Review. *ASEE Annual Conference and Exposition, Conference Proceedings*. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85202055009&partnerID=40&md5=9c8a3626907373848d4e1ccbb2d17d1f>
- Kamila, K., Wilujeng, I., Jumadi, J., & Ungirwalu, SY (2024). Analysis of Integrating Local Potential in Science Learning and its Effect on 21st Century Skills and Student Cultural Awareness: Literature Review. *Journal of Science Education Research*, 10(5), 223–233. <https://doi.org/10.29303/jppipa.v10i5.6485>

- Kusmawan, U. (2024). Bridging Local Innovations and Global Challenges in STEM Education. *International Journal of Research in STEM Education*, 6(2), 98–102. <https://doi.org/10.33830/ijrse.v6i2.1757>
- Laksana, DNL (2024). Development of Literacy and Numeracy Learning Media Based on Local Culture for Lower Grade Elementary School Students. *JKTP Journal of Educational Technology Studies*, 7(1), 12. <https://doi.org/10.17977/um038v7i12024p012>
- Luo, T., Chen, Y., So, W.W.M., & Chiu, S.W.K. (2024). Exploring predictors of STEM aspirations from a STEM capital perspective. *Research in Science and Technological Education*. <https://doi.org/10.1080/02635143.2024.2320113>
- Novikasari, I., Muttaqin, A., & Elebiary, N. (2024). Teaching Mathematics and Preserving Culture: The Intersection of Values in Indonesian Pedagogy. In *Values and Valuing in Mathematics Education* (pp. 361–379). Springer Nature Singapore. https://doi.org/10.1007/978-981-99-9454-0_17
- Rohim, DC (2021). Exploration of Ethnomathematics on Troso Jepara Batik Motifs as Teaching Materials for Elementary School Students. *Journal of Elementary Education Review Journal of Educational Studies and Research Results*, 7(2), 98–104. <https://doi.org/10.26740/jrpd.v7n2.p98-104>
- Setianingrum, DA, & Jumadi, J. (2023). STEAM Study on Local Wisdom of Batik Tulis Yogyakarta to Develop Science Teaching Materials. *Journal of Science Education Research*, 9(9), 7390–7400. <https://doi.org/10.29303/jppipa.v9i9.5133>
- Sharma (Gyawali), B. (2024). Local Curriculum in Basic Level Education: Cultural Connection Versus Academic Coherence. *Praghyaratna प्रज्ञारत्न*, 6(2), 161–173. <https://doi.org/10.3126/praghyaratna.v6i2.70604>
- Sung, J., Lee, J. Y., & Chun, H. Y. (2023). Short-Term Effects of a Classroom-Based STEAM Program Using Robotic Kits on Children in South Korea. *International Journal of Stem Education*, 10(1). <https://doi.org/10.1186/s40594-023-00417-8>
- Susilawati, S., Sofyan, H., Ridha, S., Wahyuni, S., & Ilhamsyah, Y. (2024). Integrating STEM Education With Local Culture in Indonesia: Teachers' Perspective and Practice. 2035–2043. <https://doi.org/10.22492/issn.2186-5892.2024.173>
- Toma, R.B., Yáñez-Pérez, I., & Meneses-Villagrà, J. Á. (2024). Towards a Socio-Constructivist Didactic Model for Integrated STEM Education. *Interchange*, 55(1), 75–91. <https://doi.org/10.1007/s10780-024-09513-2>
- Tomlinson, C. A., & Imbeau, M. B. (2023). Leading and managing a differentiated classroom. Ascd.
- Tuyet, TLT, Thi, KN, Duc, HT, Giao, XTT, Thi, N. V, Tuong, VHK, Nhu, UDT, & Mai, ALT (2024). STEM education in primary schools of Southeast Asian countries: An analysis of scientific publications in the Scopus database from 2000 to 2022. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(4). <https://doi.org/10.29333/ejmste/14432>
- Yopi Romafilani, Nenden Wulan Lailasari, Neneng Aminah, & Laelasari Laelasari. (2024). Mathematics Professional Teacher Education (TPE) Participants Viewed From Technological Pedagogical Content Knowledge (TPACK). *International Journal Of Humanities Education and Social Sciences (IJHESS)*, 4(2). <https://doi.org/10.55227/ijhess.v4i2.1134>

- Zaky, HM (2024). Ethnomathematics: Introduction to Planar Shapes Through the Context of Jepara Troso Woven Fabric. *Cendekia Journal of Mathematics Education Journal*, 8(1), 441–453. <https://doi.org/10.31004/cendekia.v8i1.2369>
- Rofi'ah, S. H., & Fawaidi, B. (2023, March). Optimizing Early Childhood Sex Education To Prevent Sexual Abuse In Paud Al-Irsyad Al-Islamiyah Jember. In *International Conference on Humanity Education and Society (ICHES)* (Vol. 2, No. 1).
- Jannah, R., Sahlan, M., Mukaffan, M., & Rofi'ah, S. H. (2023). MADRASAH TEACHER PROFESSIONALISM DEVELOPMENT STRATEGY BASED ON SUPHISTIC HUMANISM IN THE AGE OF COMMUNITY 5.0. *EDURELIGIA: Jurnal Pendidikan Agama Islam*, 7(1), 37-46.
- Farikhin, F., Rofi'ah, S. H., Maghfirah, N. I., Subaidah, S., & Mufarohah, A. (2024, February). PERAN GURU PENDIDIKAN AGAMA ISLAM DALAM MEMBINA AKHLAKUL KARIMAH SISWA (Studi Kasus di Sekolah Dasar Negeri Kepatihan 06 Jember). In *International Conference on Humanity Education and Society (ICHES)* (Vol. 3, No. 1).
- Soleha, A. W., & Rofiah, S. H. (2024). Early childhood education nationalist exploration: Implementation of the project to strengthen the profile of Pancasila students (P5). *Edusoshum: Journal of Islamic Education and Social Humanities*, 4(1), 76-87.
- Ibad, T. N., Wahidah, F., Ansori, M., Rofi'ah, S. H., & Hanisy, A. (2024, July). Digital Literacy Management Based On Open Artificial Intelligence (Open AI) In PGMI Student Research Development. In *2nd Lawang Sewu International Symposium on Humanities and Social Sciences 2023 (LEWIS HUSO 2023)* (pp. 316-328). Atlantis Press.
- Subahiriyah, D. U., & Rofi'ah, S. H. (2024). Increasing Aud's Mathematical Logical Intelligence through the Use of Puzzle Pipe Media. *Al Yazidiy Jurnal Sosial Humaniora dan Pendidikan*, 6(2), 36-46.
- Habibah, J. N., Rofi'ah, S. H., & Arifin, Z. (2024, October). Budaya Wudhu dengan Cara Duduk sebagai Bagian dari Identitas Keislaman di Saiyid Wittaya Fondatun School, Songkhla–Thailand. In *Proceedings of Annual Conference for Muslim Scholars* (Vol. 8, No. 1, pp. 61-72).
- Rofiah, S. H. (2024). Model Pembelajaran Berdiferensiasi dalam Kurikulum Merdeka di Sekolah Dasar. *Mudarris: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, 1(1), 1-16.
- Rofi'ah, S. H., Munir, M. M., & Unsika, W. (2024, February). INTEGRATING THE MONOTHEISM VALUE IN SCIENCE LEARNING USING THE" SA'ADAH" METHOD IN MI UNGGULAN NURIS JEMBER. In *International Conference on Humanity Education and Society (ICHES)* (Vol. 3, No. 1).
- Habibah, J. N., Rofi'ah, S. H., & Arifin, Z. (2024, October). Budaya Wudhu dengan Cara Duduk sebagai Bagian dari Identitas Keislaman di Saiyid Wittaya Fondatun School, Songkhla–Thailand. In *Proceedings of Annual Conference for Muslim Scholars* (Vol. 8, No. 1, pp. 61-72).
- Subahiriyah, D. U., & Rofi'ah, S. H. (2024). Increasing Aud's Mathematical Logical Intelligence through the Use of Puzzle Pipe Media. *Al Yazidiy Jurnal Sosial Humaniora dan Pendidikan*, 6(2), 36-46.
- Ibad, T. N., Wahidah, F., Ansori, M., Rofi'ah, S. H., & Hanisy, A. (2024, July). Digital Literacy Management Based On Open Artificial Intelligence (Open AI) In PGMI Student Research Development. In *2nd Lawang Sewu International Symposium on Humanities and Social*



- Sciences 2023 (LEWIS HUSO 2023)* (pp. 316-328). Atlantis Press.
- Soleha, A. W., & Rofiah, S. H. (2024). Early childhood education nationalist exploration: Implementation of the project to strengthen the profile of Pancasila students (P5). *Edusoshum: Journal of Islamic Education and Social Humanities*, 4(1), 76-87.
- Farikhin, F., Rofi'ah, S. H., Maghfirah, N. I., Subaidah, S., & Mufarohah, A. (2024, February). PERAN GURU PENDIDIKAN AGAMA ISLAM DALAM MEMBINA AKHLAKUL KARIMAH SISWA (Studi Kasus di Sekolah Dasar Negeri Kapatihan 06 Jember). In *International Conference on Humanity Education and Society (ICHES)* (Vol. 3, No. 1).
- Jannah, R., Sahlan, M., Mukaffan, M., & Rofi'ah, S. H. (2023). MADRASAH TEACHER PROFESSIONALISM DEVELOPMENT STRATEGY BASED ON SUPHISTIC HUMANISM IN THE AGE OF COMMUNITY 5.0. *EDURELIGIA: Jurnal Pendidikan Agama Islam*, 7(1), 37-46.
- Rofi'ah, S. H., & Fawaidi, B. (2023, March). Optimizing Early Childhood Sex Education To Prevent Sexual Abuse In Paud Al-Irsyad Al-Islamiyah Jember. In *International Conference on Humanity Education and Society (ICHES)* (Vol. 2, No. 1).
- Farikhin, F., Faidah, H., & Rofi'ah, L. (2023). Stimulasi Kecerdasan Kinestetik Anak Usia Dini Melalui Metode Bermain Di Ra As-Siddiqi Baletbaru€Sukowono-Jember. *Childhood Education: Jurnal Pendidikan Anak Usia Dini*, 4(2), 179-190.
- Istiqomah, R., Fitriya, A., Wahidah, F., Rofi'ah, S. H., Amrela, U., Pratiwi, R. K., ... & Fawaidi, B. (2023, June). DISCIPLINE CHARACTER EDUCATION TO AVOID STUDENT MORAL DEGRADATION. In *International Conference on Humanity Education and Society (ICHES)* (Vol. 2, No. 1).
- Jannah, R., Sahlan, M., Mukaffan, M., & Rofi'ah, S. H. (2023). MADRASAH TEACHER PROFESSIONALISM DEVELOPMENT STRATEGY BASED ON SUPHISTIC HUMANISM IN THE AGE OF COMMUNITY 5.0. *EDURELIGIA: Jurnal Pendidikan Agama Islam*, 7(1), 37-46.
- Sofyan, A. S. S. (2024). Urgensi Nilai-nilai Moderasi Qur'ani dalam Pendidikan. *Al-Manar: Jurnal Kajian Alquran dan Hadis*, 10(1), 25-46.
- Fitriya, A., & Abdillah, F. (2024, February). THE EXISTENCE OF CAREER WOMEN IN INSTALLING RELIGIOUS AND MORAL VALUES IN EARLY CHILDREN IN THE COLLEGE ENVIRONMENT OF THE ISLAMIC RELIGIOUS INSTITUTE AL-QODIRI JEMBER. In *International Conference on Humanity Education and Society (ICHES)* (Vol. 3, No. 1).
- Abdillah, F. (2024). Pengembangan Strategi Pembelajaran Tahfidz Pada Anak Usia Dini Di Tahfidz Kids Club (TKC) Ar Raihan Sumber Sari Jember. *Childhood Education: Jurnal Pendidikan Anak Usia Dini*, 5(1), 86-125.
- Abdillah, F. (2023). Penerapan Nilai-Nilai Moderasi Beragama Pada Pembelajaran Anak Usia Dini Di Ra Al-Mukminin Sukowono Jember Tahun Pelajaran 2021/2022. *Childhood Education: Jurnal Pendidikan Anak Usia Dini*, 4(1), 166-193.