Digital Perspectives Journal on Education
Volume 1, Issue 1, pp. 29-39.
e_ISSN: ……
https://journal.dyoqu.com/index.php/dpj
DOI.

The Role of Teachers in the Implementation of Mathematics Learning Based on Sustainable Education: An Evaluative Study at the *"Sekolah Penggerak"*

Joko Sutrisno[1]*, Binti Khoiriyah[2], Fertika Dwi Hijayati[3], Nanda Kusuma Dewi[4]

[1] STKIP PGRI Bandar Lampung, Indonesia
[2] UNU Lampung, Indonesia
[3,4] UIN Raden Intan Lampung, Indonesia

*** Corresponding author:**
Joko Sutrisno, STKIP PGRI Bandar Lampung, Indonesia. jokosutrisnoab@gmail.com

Article Info

Article history:

Received: April 10, 2025
Revised: May14, 2025
Accepted: June 23, 2025

Keywords:

Teacher Role;
Sustainable Education
"Sekolah Penggerak" Program

Abstract

Background: Mathematics education in Indonesia still faces challenges in connecting theoretical concepts with practical skills that are relevant to real life. The low PISA results and the weak pedagogical competence of teachers are indicators of the need for new approaches to learning, one of which is through sustainable education. *Sekolah Penggerak* program that has been implemented is an important foothold in applying this principle.
Aims: This study aims to evaluate the role of teachers in implementing sustainable education-based mathematics learning in schools that have participated in the *Sekolah Penggerak* Program. The scope includes planning, implementation and challenges faced by teachers in integrating sustainability principles into mathematics learning.
Methods: This study uses a qualitative method with an evaluative literature review approach, which involves the systematic identification, assessment, and synthesis of existing studies to evaluate the implementation and challenges of mathematics learning based on continuing education. The steps used include formulating research questions, establishing inclusion criteria, identifying sources, and conducting thematic analysis. Comparative analysis was conducted using a matrix-based approach to compare themes among the selected studies.
Result: The majority of teachers have implemented contextual and project-based approaches in mathematics learning. There was an increase in competency in formative assessment and differentiated learning. However, most teachers have not received advanced training and face limitations in facilities and technology use. Teacher collaboration through learning communities is a significant supporting factor.
Conclusion: The role of teachers is crucial to the success of sustainable education-based mathematics learning. To improve the effectiveness of implementation, continuous support is needed through training, provision of facilities and collaboration between teachers, schools, government and communities. This approach is believed to be able to form students who are not only academically excellent, but also aware of sustainability issues and able to contribute to society.

To cite this article: Sutrisno-1, Joko-1., Khoiriyah-2, Binti-2., & Hijayati-3, Fertika Dwi-3. (2025). The Role of Teachers in the Implementation of Mathematics Learning Based on Sustainable Education: An Evaluative Study at the "Sekolah Penggerak". *Digital Perspectives Journal on Education*, *1*(1), 29-39.

Introduction

Based on the results of PISA 2018, Indonesia ranked 74th out of 79 participating countries, highlighting the persistent challenges in the nation's education system, particularly in mathematics learning (Anis Magfiroh, 2024; Solihin et al., 2024; Ortiz et al., 2024; Ridwan et al., 2025; Puad et al., 2023). Low performance in PISA indicates that Indonesian students scored an average of 379 compared to the OECD average of 487 in 2018, revealing more than just general weaknesses in mathematics; this poses a challenge for sustainability in the real life (Vásquez, Seckel, et al., 2023). One of the main causes is the suboptimal development of skills in the education system,

including in mathematics lessons that should train logical thinking and problemsolving skills. This can be seen in the following picture

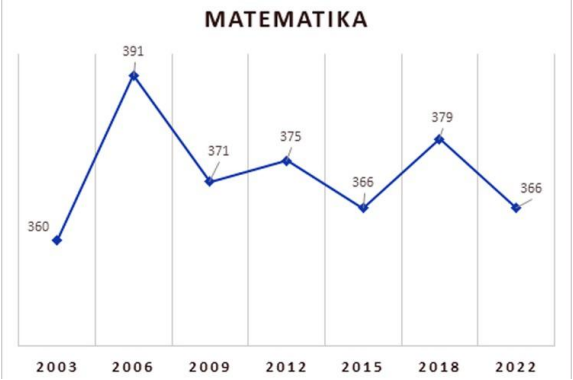

Figure 1. Score of PISA

Based on figure 1, the PISA results show a decline in Indonesian students' learning scores, indicating that the development of skills in mathematics learning has not been optimally implemented in the education system (Wijaya et al., 2024). However, mathematics is a strategic subject that can be used to develop students' sustainability literacy. As a foundational science for quantitative analysis, mathematics enables students to understand and evaluate various sustainability issues, such as carbon emissions calculations, energy use, water conservation, and environmental statistical data processing. Additionally, mathematics helps in developing critical and systematic thinking patterns when assessing the impact of human actions on the environment. This decline is related to the sustainable development goal of quality education in mathematics learning. Sustainable development emphasizes the importance of ensuring inclusive and quality education and promoting lifelong learning opportunities for all. In line with this, in today's modern era, education has become one of the factors contributing to unemployment due to the inability to balance skills and knowledge. (Aryanti & Sukardi, 2024). This occurs because of the mismatch between education graduates and labor market needs, with the open unemployment rate for high school and vocational school graduates reaching 8.89% in August 2022. Additionally, 5.34% of open unemployment in 2023 was experienced by university graduates, higher than the national average of 4.86% (Azzahra et al., 2024). In this context, improving the quality of education by focusing on the development of skills in mathematics education required for the future is a strategic step to ensure that students can significantly contribute to enhancing Indonesia's human resource competitiveness. Therefore, it is important to apply the principles of sustainable education that can support the future job market.

The implementation of sustainable education has become one of the main focuses in the development of the global education system. Education for Sustainable Development (ESD) has become a global focus and is now integrated into the Indonesian curriculum. Since the introduction of the *Merdeka* curriculum in 2021, project-based learning materials and aspects of the Sustainable Development Goals (SDGs) have begun to be implemented in secondary schools through science and STEM subjects to address issues such as climate change and environmental pollution(Anisa Sari et al., 2022). This approach aims to develop the potential of students, maintain environmental and social sustainability, and prepare students to be able to contribute to society and adapt to the ever-evolving world of work (Hakim & Muslimin, 2024). In line with the implementation of the Merdeka curriculum, this is realized through the School Movement Program, a strategic initiative that promotes holistic learning transformation and strengthens character and competencies through the Pancasila Student Profile (Darmayanti et al., 2024). The strengthening of the Pancasila Student Profile includes critical thinking and sustainability competencies, which are integrated into the Merdeka curriculum and implemented through character-building activities. *Sekolah Penggerak* program emphasizes contextual and student-centered learning, supported by instructional leadership from school principals and teachers (Khofifah & Syaifudin, 2023).

In 21st century education, teachers act as agents of change, not only transferring academic content but also shaping a transformative and meaningful learning environment. Based on (Bandura in Guerra et al., 2024) agency theory, teachers carry out four main dimensions intentionality, forethought, self-reactiveness, and self-reflectiveness as the basis for designing and adapting teaching strategies that support students' holistic development and active engagement in sustainability issues. In this context, teachers play a strategic role as agents of change who not only transfer knowledge but also create a positive, enjoyable learning environment focused on the overall development of students (Jannati et al., 2023). However, several studies indicate that the implementation of sustainable education-based learning still faces various challenges, particularly related to teachers' pedagogical competencies. For example, Azmi in (Fauzi & Hamdu, 2021) emphasizes the need to enhance teachers' capacity in designing meaningful learning. Rahayu in (Novayanti et al., 2023) notes that low pedagogical competencies impact students' learning motivation. Other obstacles include the lack of training to support the implementation of contextual learning (Riess et al., 2022), low teacher creativity (Syair et al., 2023), and limited digital facilities (Nuraini & Purwanto, 2025).

Nevertheless, several studies also note the positive impact of the *Sekolah Penggerak* Program on improving learning quality, such as strengthening psychological, pedagogical, and school collaboration skills (Sinaga & Lian, 2025; Sudana, 2025). This aligns with data from the Ministry of Education, Culture, Research, and Technology (2023), which shows that over 80% of teachers participating in the Teacher Development Program experienced improvements in differentiated learning and formative assessment. Additionally, a collaborative and innovative school culture has also emerged (Aditiya & Fatonah, 2023; Puspeka, 2022). Therefore, in the context of mathematics learning based on sustainable education, teachers not only act as instructors but also as facilitators who can create an active learning environment, empower students, and instill values of sustainability.

Many previous studies have explicitly examined the role of teachers in implementing sustainability principles through mathematics learning in the Sekolah Penggerak program. Previous studies have tended to focus on general program evaluation or improving teachers' pedagogical competencies, but have not specifically addressed the integration of mathematics content with sustainability principles. Therefore, this study is important as a scientific contribution in bridging this gap and providing practical direction for the development of contextual and environmentally conscious mathematics learning.

Method

Research Design

This research is a literature review, using qualitative methods through a comparative analysis approach. Qualitative methods are scientific investigations that emphasize depth and richness of context and voice in understanding social phenomena. This study uses a comparative analysis approach because it aims to gain a deep understanding of the role of teachers in the implementation of mathematics education based on sustainable education using evaluative studies in pilot schools. The data is sourced from relevant literature reviews, including peer-reviewed articles, academic books, and government regulations. The analysis and selection of literature were guided by the Education for Sustainable Development (ESD).

Participant

Participants in this research are non-human subjects, as the study is based on documentary and literature sources. The unit of analysis includes content from national journals, reports, and government documents regarding the role of teachers in implementing sustainable education.

Population and the Methods of Sampling (sample of questions, scoring method, and psychometric properties)

The population includes all literature sources discussing sustainable education and the *Sekolah Penggerak* program. The sampling technique used is purposive sampling, selecting documents that are directly relevant and recently. Selection criteria included thematic relevance, credibility of publication source, and research focus alignment.

Instrumentation

The instruments used in this study was document analysis, which served as a means of systematically organizing and analyzing selected literature by categorizing sources based on type of source, year of publication to ensure relevance and suitability, thematic relevance of source content, particularly related to the planning, implementation, and evaluation of mathematics learning based on sustainable education; and the presence of empirical findings or practical recommendations, which are essential for meaningful comparison and interpretation. This tool allows researchers to maintain consistency in data extraction and supports the credibility of the analytical process.

Procedures and if Relevant, the Time Frame

The procedure involved several stages: identifying and collecting literature based on inclusion criteria, screening and grouping documents based on thematic relevance, analyzing content using a comparative approach, and interpreting the results. The data collection and analysis process was carried out in the first half of 2025.

Analysis Plan

The analysis plan followed a comparative content analysis model, where the collected data were examined to identify patterns, similarities, and differences in how the role of teachers was portrayed in the context of sustainable mathematics education. No statistical tests were applied, as the research relied on qualitative interpretation. However, the analytical rigor was upheld by using triangulation, categorization, and thematic synthesis

Scope and/or Limitations of the Methodology Used

The scope of this study includes conceptual and policy discussions relevant to sustainable education and mathematics instruction in Indonesian educational settings. The limitations of the methodology lie in its dependence on secondary data, which may not fully capture the realities in classrooms or the diversity of school contexts. Furthermore, the findings are interpretative and may be influenced by the quality and availability of the literature reviewed.

Results and Discussion

Results

The results of the study obtains most teachers in schools that have participated in the *Sekolah Penggerak* Program have begun to implement the principles of sustainable education-based mathematics learning. Based on a synthesis of findings from empirical studies such as research by (Fathihatul Jannah et al., 2024; PSKP, 2023) which involved classroom observations, document analysis, and teacher interviews, it can be concluded that around 78% of teachers have integrated contextual and project-based approaches into mathematics learning. This approach is evident in learning activities that link mathematical concepts to environmental, social, and economic issues relevant to students lives. Additionally, there has been an improvement in teachers' pedagogical competencies in designing differentiated learning and formative assessment, in line with the achievements of the *Sekolah Penggerak* Program, which is part of the education transformation initiative. However, challenges remain significant. As many as 71% of teachers admit that they have not received further training on sustainable education after the program ended, and around 64% experience obstacles in utilizing learning technology to support contextual

activities. Uneven facilities and varying school leadership also affect the consistency of learning implementation. Nevertheless, this study also notes that collaboration among teachers is growing stronger through active learning community forums, which encourage the exchange of good practices in learning. A school culture that supports innovation and reflective learning is a key factor in maintaining the sustainability of relevant and meaningful mathematics learning practices.

Discussion

The relationship between the principles of sustainable learning, the role of teachers, and their implementation in mathematics learning at *Sekolah Penggerak* is greatly influenced by the extent to which teachers understand and apply the principles of sustainable education in classroom practice. The main principles of sustainable education include contextual relevance, participation, collaboration, and transformation. In this context, teachers act as planners of contextual learning, facilitators of project-based activities, connectors between stakeholders, and agents of change for students. For example, in the principle of contextual relevance, teachers begin to develop teaching modules based on environmental issues such as household waste or energy use, which are used in contextual mathematics problems. This indicates that teachers' understanding of the importance of linking mathematics material to real life is beginning to develop, although further training is still needed to strengthen the integrative framework in the curriculum.

These activities create contextual and applied learning experiences. This aligns with research conducted by (Vásquez, Alsina, et al 2023) showing that participatory approaches are beginning to be applied in sustainable mathematics learning practices, consistent with the P5 mathematics-based project model. However, regarding the collaborative principle, it was found that teacher collaboration with local communities and education stakeholders remains very limited. Only a few teachers involve external experts or collaborate with environmental communities. Regarding the transformational principle, a tangible impact is evident in changes in students' attitudes toward sustainability issues. Some students demonstrate greater concern for water consumption, waste reduction, and advocate for sustainability ideas in the classroom. This indicates that teachers have successfully fostered student critical awareness through a learning approach that emphasizes meaning and real-world action, rather than merely procedural or mathematical calculations.

Table 1. The correlation between principles, roles, and implementation Sustainable Education

Sustainable Education Principle	Teacher Role Indicator	Implementation
Contextual Relevance	Relating math concepts to real environmental issues	The teacher uses the ball pit model (cylindrical shape) to calculate space efficiency and estimate the number of balls based on volume connecting math to spatial logic and resource management.
Participatory	Engaging students in exploration and decision-making	Students are asked to analyze the image, estimate volume and number of balls, and explain their strategies encouraging active participation and critical thinking.
Transformational	Promoting a shift in students thinking about sustainability	Students begin to understand the importance of space and resource efficiency through the simulation of filling the ball pit fostering logical awareness of resource limitations.
Critical & Reflective	Developing open-ended questions and solution evaluation	The teacher uses open-ended problems, encouraging students to make assumptions, explain strategies, and evaluate possible solutions promoting reflective thinking.

To clarify the correlation between variables, the following table illustrates the connection between Sustainable Education principles, the role of teachers, and implementation

Implications

The Role of Teachers in Planning Sustainable Education

Teachers began integrating sustainability themes into lesson planning, primarily through contextual problems involving real-life environmental issues. The design of contextual modules, such as waste volume estimation and energy consumption charts, shows early implementation of ESD. However, these efforts lack a structured curriculum framework and teacher training (Fatmawati, 2021).

The Role of Teachers in Implementing Sustainable Education

The survey results show that teachers face various obstacles such as limited continuing education, a lack of interdisciplinary instructional resources, and pressure from high-stakes assessments, causing the implementation of sustainable learning to stagnate at the classroom level (Parry & Metzger, 2023). Therefore, the role of teachers in sustainable education needs to be improved through the following indicators.

1) Developing potential by improving skills through lesson study. Research conducted shows that lesson study was conducted in the classroom twice a week for one month with material on the human movement system and the circulatory system. This had a positive impact on teachers, especially in optimizing the learning process that leads to student potential (Artayasa et al., 2022).
2) Maintaining sustainability by improving teaching methods in the classroom. Research by (Aulia Dewi 2023) at SDN Petemon showed that the application of the syllabus method yielded maximum results in improving the reading skills of first-grade students, with adjustments made to the conditions on the ground. 3) Aligning oneself with the demands of the job market by transforming abilities culturally. Research conducted by(Syahputra, 2024) in vocational schools shows that teachers make students the subjects of learning, so that students can construct and develop their knowledge to the fullest.

Teachers practice activities such as P5-based mathematics projects. One example of a successful practical application is the ball pool project, in which students are asked to estimate the number of balls needed to fill a tube-shaped pool. This activity not only teaches the concept of volume but also instills awareness of space efficiency and responsible use of resources. A study by (Manunure & Leung 2024) supports this approach as part of a model or representation of a real-world system, created for the purpose of understanding, analysis, or design that emphasizes meaningful and contextual learning. Technological support remains a significant challenge. Many teachers still face limitations in designing digital media that supports contextual learning. Lack of training and technological infrastructure are major obstacles to optimizing sustainability-based mathematics learning. (Octasyavira & Nurlizawati, 2022) state that without innovation in digital learning media, the ESD approach is difficult to implement comprehensively. By paying attention to these indicators, it is hoped that the role of teachers in sustainable education can be improved, so that the learning process becomes more effective and relevant to the needs of students and society.

In terms of contextual approaches, teachers are increasingly using local environmental data in math assignments, such as rainfall graphs or plastic waste volume estimates. The use of open-ended questions based on real data helps students understand the connection between mathematical concepts and everyday sustainability issues. Vasquez, Alsina, et al (2023) emphasize that the success of Sustainable Education in mathematics depends on relevant contextual approaches.

Regarding collaboration, internal teacher learning communities are developing well, but external collaboration with environmental communities, industry, or universities remains very limited. highlights the importance of cross-sector partnerships in supporting holistic and sustainable project-based learning

Sustainable Education-based Mathematics Learning

In the context of sustainable education-based learning, there is a gap between theory and practice in teaching math and science concepts. As an example of applying sustainable education in mathematics lessons, practical activities such as filling a tube pool with balls can be developed into interdisciplinary case studies that link the concept of volume to environmental issues. Through this approach, students not only understand spatial dimensions, but also learn about systems thinking, responsible decision-making, and the relationship between mathematics and everyday sustainability issues (Manunure & Leung, 2024). Although students can understand the formula for the volume of a tube, they often struggle to apply this knowledge in real situations, such as estimating the number of balls that can fill a pool.

A ball pool is a pool that is filled with small plastic balls until it fills the pool.

Figure 2. Ball Pool

As seen in the figure, the shape of the pool used is a tube without a lid. If the size of the pool is as shown below

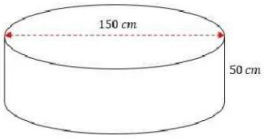

Figure 3. Shape of the Pool

What is the approximate number of balls used if the pool is filled to the brim? Explain your assumptions based on the picture given!

In the problem, we can know that the pool is tubular, therefore the number of balls that can be put into the pool can be calculated using the volume of the tube, namely

$$V_{pool} = \pi r^2 t$$
$$V_{pool} = 3{,}14(75 \times 75)50$$
$$V_{pool} = 883{,}125\ cm^3$$

From the calculation of the volume of the tube, the number of balls can be estimated by estimating the size and small balls used. Suppose the radius of the ball used is 4 cm, then

$$V_{pool} = \frac{4}{3}\pi r^3$$
$$V_{pool} = \frac{4}{3} \times 3{,}14 \times (4)^3 = 134{,}09\ cm^3$$

Then the number of balls can be found by

$$\frac{V_{pool}}{V_{balls}} = \frac{883{,}125}{134{,}09} = 6.586{,}06 \approx 1.586\ balls$$

Open-ended problems make the role of the teacher very important. In the context of continuing education, teachers not only teach theory, but also help connect lessons to relevant issues in life. By using examples such as filling a ball pond, teachers can show students how important efficiency and resource management are. This is a very valuable lesson, especially in this day and age when we are faced with various environmental challenges.

When teachers integrate project-based learning into the curriculum, they create a more engaging and meaningful learning experience. Education focuses not only on academic achievement, but also on character building and environmental awareness.

Implementation of Sustainable Education-based Learning for Driver Schools Towards Sustainable Education

Thus, the gap between Driver Schools can be understood as the result of a complex interaction between various factors. To create sustainable schools, it is imperative that teachers, principals, government and communities work together to address this challenge. This

collaborative effort will not only help reduce disparities between schools but also contribute to achieving the broader goal of sustainable education. By supporting and collaborating with each other, we can create a better educational environment for all students so that they can grow and develop optimally.

Research Contribution

This study offers several important contributions to the field of sustainable mathematics education, particularly within the context of the Sekolah Penggerak program in Indonesia. First, it provides a structured evaluative framework that aligns five core teacher roles (planner, implementer, assessor, collaborator, and professional developer) with the four foundational pillars of Education for Sustainable Development: contextual, participatory, collaborative, and transformative learning. This framework helps bridge the gap between policy discourse and classroom realities by offering measurable indicators to assess teachers' integration of sustainability in mathematics instruction.

Limitations

This study, which employs an evaluative literature review approach, is limited by its reliance on secondary data. Although thematic analysis and document comparisons have been carefully conducted, the absence of direct observation and field-based data collection may reduce the ability to capture the full complexity of teacher practices in real classroom settings. Additionally, the selected literature may not represent all regional variations, school contexts, or student demographics, particularly in remote or under-resourced schools. The interpretations are also constrained by the quality and completeness of the published sources, which may reflect publication bias or limited methodological rigor. Therefore, while the findings offer valuable insight, they must be interpreted with caution when applied to broader or diverse educational settings.

Suggestion

Future research should adopt a mixed-methods approach to complement the literature review with direct empirical data from classroom observations, interviews, and surveys with teachers and students. This would enrich understanding of how sustainable education principles are practically implemented and perceived. Additionally, there is a need for longitudinal studies that examine the sustained impact of teacher professional development in ESD-oriented mathematics instruction over time.

From a practical perspective, schools and policymakers should ensure continuous training programs focused on the integration of sustainability within STEM, especially in mathematics. Digital innovation and access to contextual teaching materials must be prioritized to overcome the technological barriers identified in this study. Furthermore, stronger school-community partnerships should be fostered to support collaborative and transformative learning projects. Encouraging teacher-led research and reflective practice would also enhance professional agency and support the long-term institutionalization of ESD values in daily teaching practices.

Conclusion

This study was designed to evaluate the role of teachers in implementing mathematics learning based on the principles of sustainable education within the *Sekolah Penggerak* program. The results of this study show a clear alignment between the research objectives and findings: teachers have begun integrating sustainability themes through contextual, participatory, and project-based approaches particularly in planning and instructional delivery. Activities such as the ball pit project serve as successful examples of integrating mathematical concepts with real-life sustainability challenges, highlighting teachers' potential as agents of transformative education.

However, this research also reveals that the implementation of sustainable education remains uneven. While internal collaboration among teachers has improved, external partnerships with environmental stakeholders are still limited. Technological support is another major challenge, as

many teachers lack the infrastructure and training needed to apply digital tools effectively in contextual learning. These issues indicate that although the foundation has been laid, further systemic and policy-level interventions are necessary to ensure consistent and comprehensive implementation of Sustainable Education.

The evaluation framework used in this study based on five core teacher roles (planner, implementer, assessor, collaborator, and professional developer) and four Sustainable Education pillars (contextual, participatory, collaborative, and transformative) demonstrates that current practices are strongest in contextual relevance and participatory learning, while collaborative and technological components require more support.

In terms of implications, this study contributes theoretically by reinforcing the concept of teacher agency in sustainability-based education. Practically, it provides a blueprint for school leaders and teacher trainers to develop Sustainable Education focused instructional models. From a policy perspective, the findings underscore the urgency of integrating sustainability indicators into teacher training programs, professional evaluations, and school accreditation systems.

Overall, this research affirms that mathematics, when taught through a sustainability lens, is not only a tool for quantitative reasoning but also a medium for shaping students' environmental awareness, critical thinking, and problem-solving capacities. To maximize this potential, continuous and multi-level support from policy to classroom practice is essential in advancing the goals of sustainable and inclusive education in Indonesia.

Acknowledgment

We would like to thank all those who contributed to the completion of this research. Our deepest gratitude goes to the scholars whose published works served as essential references and foundations for this study. We hope that the findings of this study will help in the planning and implementation efforts of all interested parties aimed at improving the role of teachers in the implementation of sustainable education-based mathematics learning using evaluative studies in driving schools.

Author Contribution Statement

JS was responsible for the conceptualization and design of the study. BK supported the manuscript by reviewing language clarity, editing grammar, and managing all references according to APA 7th Edition standards, contributed to data analysis, and interpretation of results. NKD data collection, initial drafting of the manuscript, organized the overall article structure, refined the presentation of results and conclusions, and ensured alignment with the JCSS formatting guidelines. FDH critical revision of the manuscript, also served as the correspondence author, handling all correspondence and revisions related to the publication. This collaboration reflects solid teamwork and shared responsibility in ensuring the quality and authenticity of research results.

References

Aditiya, N., & Fatonah, S. (2023). Upaya mengembangkan kompetensi guru penggerak di sekolah dasar pada kurikulum merdeka belajar. *Scholaria: jurnal pendidikan dan kebudayaan*, *2*, 108–116. https://doi.org/10.24246/j.js.2023.v13.i2.p108-116

Anis Magfiroh, N. N. (2024). *Analisis penerapan sustainable development goals (sdgs) dalam upaya peningkatan pendidikan berkualitas di indonesia*. https://doi.org/10.5281/zenodo.11127154

Anisa Sari, G. M., Antika, V. Y., Wisutama, R. A., Syiami, L. N., Sulaeman, N. F., Nuryadin, A., & Subagiyo, L. (2022). New indonesian science curriculum for junior high school: a content analysis to support stem sdgs. *Jurnal literasi pendidikan fisika (JLPF)*, *3*(2), 176–182. https://doi.org/10.30872/jlpf.v3i2.1555

Artayasa, I. P., Muhlis, Merta, I. W., & Hadiprayitno, G. (2022). Penyuluhan pelaksanaan lesson study di sma negeri 1 labuapi. *Jurnal pengabdian magister pendidikan IPA*, *5*(4), 217–222. https://doi.org/10.29303/jpmpi.v5i4.2525

Aryanti, E. D., & Sukardi, A. S. (2024). Pengangguran, pendidikan, kesehatan, dan ketimpangan pendapatan terhadap kemiskinan di Indonesia. *Journal of Economics Research and Policy Studies*, *4*(2), 117–133. https://doi.org/10.53088/jerps.v4i2.918

Aulia Dewi, Y., Larasati, D. A., & Yuliana, L. (2023). Pengaruh metode silaba terhadap kemampuan membaca permulaan siswa kelas i sdn petemon surabaya. *Jurnal peneroka*, *3*(2), 211–222. https://doi.org/10.30739/peneroka.v3i2.2372

Azzahra, A., Savandha, S. D., Bharoto, R. M. H., & Kevin, N. H. (2024). The impact of high job qualification standards on unemployment rates among fresh graduates in indonesia. *Journal transnational universal studies*, *2*(4), 244–255. https://doi.org/10.58631/jtus.v2i4.109

Darmayanti, A., Nugroho, D. Y., & Atikah, c. (2024). Penguatan profil pelajar pancasila dengan implementasi kebijakan merdeka belajar. *Journal of education research*, *5*(3), 2573–2581. https://doi.org/10.37985/jer.v5i3.1018

Fatmawati, I. (2021). Peran guru dalam pengembangan kurikulum dan pembelajaran. *Revorma: jurnal pendidikan dan pemikiran*, *1*(1), 20–37. https://doi.org/10.62825/revorma.v1i1.4

Fauzi, R., & Hamdu, G. (2021). Kompetensi guru: pelaksanaan pembelajaran berkelanjutan dan kreativitas berbasis esd di sekolah dasar. *Edukatif : jurnal ilmu pendidikan*, *3*(4), 1784–1797. https://doi.org/10.31004/edukatif.v3i4.675

Guerra, A., Chen, J., Du, X., Nielsen, H., & Kørnøv, L. (2024). Teacher's agency in education for sustainable development: an east-west collaborative erasmus programme using q methodology. *International journal of sustainability in higher education*, *25*(9), 155–176. https://doi.org/10.1108/IJSHE-05-2023-0155

Hakim, L., & Muslimin, A. I. (2024). Bibliometric insights into sustainable educational management practices in Indonesian Islamic universities. *Journal of Infrastructure, Policy and Development*, *8*(10), 7614. https://doi.org/10.24294/jipd.v8i10.7614

Jannati, P., Ramadhan, F. A., & Rohimawan, M. A. (2023). Peran guru penggerak dalam implementasi kurikulum merdeka di sekolah dasar. *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah*, *7*(1), 330. https://doi.org/10.35931/am.v7i1.1714

Khofifah, B., & Syaifudin, M. (2023). Analisis kebijakan pemerintah mengenai sekolah penggerak. Jurnal Inovasi Penelitian. *Jurnal Inovasi Penelitian*, *3*. https://doi.org/10.47492/jip.v3i8.2393

Manunure, K., & Leung, A. (2024a). Integrating inquiry and mathematical modeling when teaching a common topic in lower secondary school: An iSTEM approach. *Frontiers in Education*, *9*, 1376951. https://doi.org/10.3389/feduc.2024.1376951

Novayanti, N., Warman, W., & Dwiyono, Y. (2023). Implementasi program sekolah penggerak dalam kebijakan pendidikan merdeka belajar di sekolah dasar. *Jurnal ilmu manajemen dan pendidikan*, *3*, 151–160. https://doi.org/10.30872/jimpian.v3iSE.2965

Nuraini, B., & Purwanto, S. E. (2025). *Evaluasi implementasi program sekolah penggerak di sd negeri tamansari 03 jakarta*. *4*(2). https://doi.org/10.54259/diajar.v4i2.3413

Octasyavira, M., & Nurlizawati, N. (2022). Kesulitan guru dalam merancang media inovatif digital untuk pembelajaran sosiologi. *Naradidik: journal of education and pedagogy*, *1*(4), 437–445. https://doi.org/10.24036/nara.v1i4.87

Ortiz, Elena Arias, et al. "learning can't wait: lessons for latin america and the caribbean from pisa 2022." (2024). http://dx.doi.org/10.18235/0005671

Parry, S., & Metzger, E. (2023). Barriers to learning for sustainability: A teacher perspective. *Sustainable Earth Reviews*, *6*(1), 2. https://doi.org/10.1186/s42055-022-00050-3

Puad, Lalu Mohmmad Abid Zainul, and Karen Ashton. "A critical analysis of Indonesia's 2013 national curriculum: Tensions between global and local concerns." *The Curriculum Journal* 34.3 (2023): 521-535. https://doi.org/10.1002/curj.194

Ridwan, muhamad asep, and kusnandi kusnandi. "a systematic literature review: mathematical connection ability reviewed from self-efficacy." *research and development journal of education* 11.2 (2025): 844-854. http://dx.doi.org/10.30998/rdje.v11i2.21762

Riess, W., Martin, M., Mischo, C., Kotthoff, H.-G., & Waltner, E.-M. (2022). How can education for sustainable development (esd) be effectively implemented in teaching and learning? An analysis of educational science recommendations of methods and procedures to promote esd goals. *Sustainability*, *14*(7), 3708. https://doi.org/10.3390/su14073708

Sinaga, M., & Lian, B. (2025). *Implementasi program sekolah penggerak (psp) dalam meningkatkan karakter peserta dididik melalui projek penguatan profil palajar pancasila (p5) di sma negeri 18 palembang*. https://doi.org/10.30595/jkp.v18i2.22584

Solihin, Riza Ramadhani, et al. "the efforts of indonesian government in increasing teacher quality based on pisa result in 2022: a literature review." *Perspektif Ilmu Pendidikan* 38.1 (2024): 57-65. https://doi.org/10.21009/PIP.381.6

Syahputra, E. (2024). Pembelajaran abad 21 dan penerapannya di indonesia. *Journal of information system and education development*, *2*(4), 10–13. https://doi.org/10.62386/jised.v2i4.104

Syair, M., Murniati, N. A. N., & Soedjono, S. (2023). Analisis kesenjangan program p5 melalui risk manajemen worksheet analys di smp pgri candiroto dan SMP negeri 1 candiroto kabupaten temanggung. *Jurnal inovasi pembelajaran di sekolah*, *4*(2), 655–668. https://doi.org/10.51874/jips.v4i2.169

Vásquez, C., Alsina, Á., Seckel, M. J., & García-Alonso, I. (2023). Integrating sustainability in mathematics education and statistics education: A systematic review. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(11), em2357. https://doi.org/10.29333/ejmste/13809

Vásquez, C., Seckel, M. J., & Rojas, F. (2023). Connecting statistics education and sustainability: Beliefs of Primary Education teachers. *Avances de Investigación En Educación Matemática*, *23*, 127–146. https://doi.org/10.35763/aiem23.5415

Wijaya, T. T., Hidayat, W., Hermita, N., Alim, J. A., & Talib, C. A. (2024). Exploring contributing factors to PISA 2022 mathematics achievement: Insights from Indonesian teachers. *Infinity Journal*, *13*(1), 139–156. https://doi.org/10.22460/infinity.v13i1.p139-156