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Effectiveness of PBL Model Based on Local Wisdom on Children's Scientific Thinking Skills

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Abstract
This study aims to determine the effectiveness of the problem-based learning model based on local wisdom on scientific thinking skills in children. This research is a type of quantitative research with a meta-analysis approach. This meta-analysis analyzed 23 effect sizes obtained through Google Scholar; Mendeley; ERIC issued in 2022-2025 with 1054 children. Data analysis with the help of the JASP application. Effect size is calculated with a 95% confidence level. The results of the data analysis concluded that the summary effect size value obtained through the random effect model was 1,072 (very high effect size category). These findings show that on average, children who use the problem-based learning model based on local wisdom can improve scientific thinking skills in children compared to conventional learning models.

Keywords: *PBL model; Local Wisdom; Scientific Thinking; Meta-analysis*

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Introduction

[21]st century education emphasizes the need to equip children with higher-order *thinking skills* to face increasingly complex global challenges (Zulyusri et al., 2023; Asnur et al., 2024). One of the essential components of this skill is scientific thinking, which involves the ability to analyze, evaluate, and create evidence-based solutions (Darmawati et al., 2024). At a child's age, scientific thinking skills are essential because they are the basis for the development of logic, problem-solving skills, and rational decision-making. By thinking scientifically, children are not only invited to understand academic concepts in depth, but also learn how to apply them to solve the daily problems they face (Mar'atussolichah et al., 2024; Sary et al., 2023).

Scientific thinking skills in children include several cognitive dimensions, such as the ability to observe phenomena, formulate questions, make hypotheses, and test ideas through simple experiments (Rahmasari & Kuswanto, 2023; Dewi, 2020). This process not only trains reasoning, but also encourages children to think critically and creatively. In the context of education, approaches such as *inquiry-based learning* or project-based learning can be used to develop these skills (Kundariati et al., 2022). For example, children are invited to identify environmental problems around them, design solutions, and evaluate the results. With this kind of learning, children not only understand the scientific process, but also learn to collaborate, communicate, and be responsible for the environment and society (Lubis et al., 2022; Tohri et al., 2022).

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Developing scientific thinking skills from an early age has a significant impact on children's future in facing the digital era and the Industrial Revolution 4.0 (Ali et al., 2024; Wantu et al., 2022). This ability helps children to understand complex information, solve data-driven problems, and make fact-based decisions in the midst of an abundant flow of information. In addition, scientific thinking skills are also relevant to equip children with adaptive and innovative attitudes, which are the main needs in the dynamic future world of work. By building these skills, children are not only prepared to succeed academically, but also become critical, creative individuals, and able to contribute to building a *knowledge-based society* (Sari et al., 2021; Uluk et al., 2024; Jumadi et al., 2021).

Scientific thinking skills in children in Indonesia are still relatively low, as reflected in the results of international surveys such as *the Programme for International Student Assessment* (PISA) and *Trends in International Mathematics and Science Study* (TIMSS) in 2022. Data from PISA shows that most students in Indonesia are still at a basic level in understanding scientific concepts and applying them to solve real-world problems(Ichsan et al., 2023; Luciana et al., 2024). This indicates that critical and analytical thinking skills, which are at the core of scientific thinking, have not been fully developed in the national education system. Factors such as learning approaches that place less emphasis on exploration, experimentation, and logical reasoning contribute to this condition, so students are more focused on memorization and outcomes than the learning process itself (Dakabesi & Luoise, 2019).

One of the causes of low scientific thinking skills is the lack of implementation of relevant and contextual learning models. Many learning methods in Indonesia are still conventional, with the dominance of lectures and practice questions, so that students are less actively involved in the critical and scientific thinking process. In addition, learning is often not associated with the local cultural context which should be able to motivate students to better understand the material (Maskur et al., 2020). In fact, Indonesia's rich local culture can be a source of inspiration for scientific learning, such as linking science lessons with traditional practices or natural phenomena that are familiar to students. The absence of this culture-based approach causes students to be less emotionally and intellectually engaged, making learning less meaningful (Uge et al., 2019). Furthermore, the lack of scientific thinking skills and local culture-based learning models has a long-term impact on the Indonesian education system. In the era of globalization and the Industrial Revolution 4.0, scientific thinking skills are very important to equip the younger generation to face technological, economic, and environmental challenges. Without relevant learning, Indonesian students risk falling behind in global competition, especially in innovation and mastery of science (Dedios et al., 2024). Therefore, there needs to be a systematic effort to integrate local culture-based approaches into learning models that promote scientific thinking. Education policies, teacher training, and the provision of learning resources that support cultural-based exploration and collaboration are key to addressing these challenges and improving the quality of national education. Therefore, one of the learning models that can encourage scientific thinking skills in students is problem-based learning(Asmayawati et al., 2024; Pujiastuti & Haryadi, 2024).

Problem-Based Learning (PBL) is a learning model that emphasizes solving real problems as the core of the learning process. In this model, students are faced with situations or problems that are relevant to daily life to be analyzed, solved, and used as a learning medium. PBL encourages students to develop critical, creative, and collaborative thinking skills (Pritchett, 2024), as they not only learn to understand concepts but also apply them to find solutions. The model is also oriented towards self-paced learning, where students actively seek information, ask questions, and build their knowledge through exploration and discussion. In addition, PBL creates a meaningful learning environment, as students feel directly involved with the material being taught (Daniel Shuttleworth, 2023). This approach has proven effective in improving higher-order thinking skills, including analysis, evaluation, and synthesis, which are critical to facing the challenges of the ^{21}st century(Zainil et al., 2023; Hidayah et al., 2023). Furthermore, The use of local wisdom in learning not only provides a

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contextual learning experience, but also helps students understand the importance of preserving cultural heritage while mastering modern scientific concepts (Net et al., 2024). With this approach, students are not only trained in scientific thinking, but also invited to appreciate and integrate cultural values in problem-solving, so as to create holistic and character building-oriented learning (Widiana et al., 2024; Nurtamam et al., 2023).

Although many studies have proven the effectiveness of *Problem-Based Learning* (PBL) in improving scientific thinking skills, most of these studies focus on the application of PBL in a global context or based on international standards (Mustofa & Hidayah, 2020; Farizi et al., 2019). Lack of attention is paid to the integration of local wisdom in the PBL model, which can increase the relevance of learning while preserving cultural values. In addition, research that examines the effectiveness of PBL based on local wisdom is generally limited to the level of case studies or small experiments in one specific region, so the results are less generalizable (Yustina et al., 2022). Until now, there have not been many meta-analyses that comprehensively examine the effectiveness of PBL based on local wisdom on scientific thinking skills in children, especially in the context of Indonesian education which has high cultural diversity. This creates a research gap in understanding how PBL based on local wisdom can be applied widely and effectively to develop scientific thinking skills (Ningsih et al., 2023; Fajri et al., 2023).

Through a meta-analysis approach, this study not only collects empirical evidence from various studies, but also evaluates the effectiveness of this model comprehensively and systematically. This research provides new insights by identifying patterns, contextual factors, and optimal conditions that affect the success of PBL based on local wisdom. In addition, this research also contributes to the scientific literature by showing how local culture-based education can bridge the needs of 21st-century skill development while strengthening students' cultural identities in the era of globalization. As such, the research is academically relevant and provides practical guidance for educators and education policymakers. Therefore, this study aims to determine the effectiveness of the problem-based learning model based on local wisdom on scientific thinking skills in children by meta-analysis.

Methodology

This study uses a meta-analysis approach to determine the problem-based learning model based on local wisdom on scientific thinking skills in children. Meta-analysis is a research approach that evaluates previous research statistically to reach a conclusion (Tamur et al., 2020; Badawi et al., 2023; Nurtamam et al., 2023; Zulyusri et al., 2023). The meta-analysis research procedure can be seen in Figure 1.

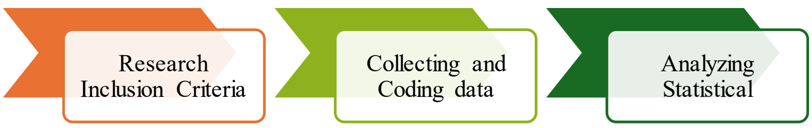

Figure 1. Stages in Meta-analysis ((Borenstein et al., 2007)

Eligibility Criteria

In the process of searching for data through the Google Scholar, ScienceDirect, Wiley, ERIC, ProQuest, Fronteins and Web of Science databases, the research must meet several inclusion criteria, namely a) the research must be published in 2021-2025; b) this research was obtained through the Google Scholar database; Mendeley; ScienceDirect; and Wiley; c) the research must be relevant; d) the research must have complete data to calculate the effect size value; and the sample size > 30 participants.. From the data search, 23 studies were obtained

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that met the inclusion criteria published in 2021-2025 which can be seen in Table 2. Proses peneyeleksian data menggunakan PRISMA 2020 dapat dilihat pada gambar 1.

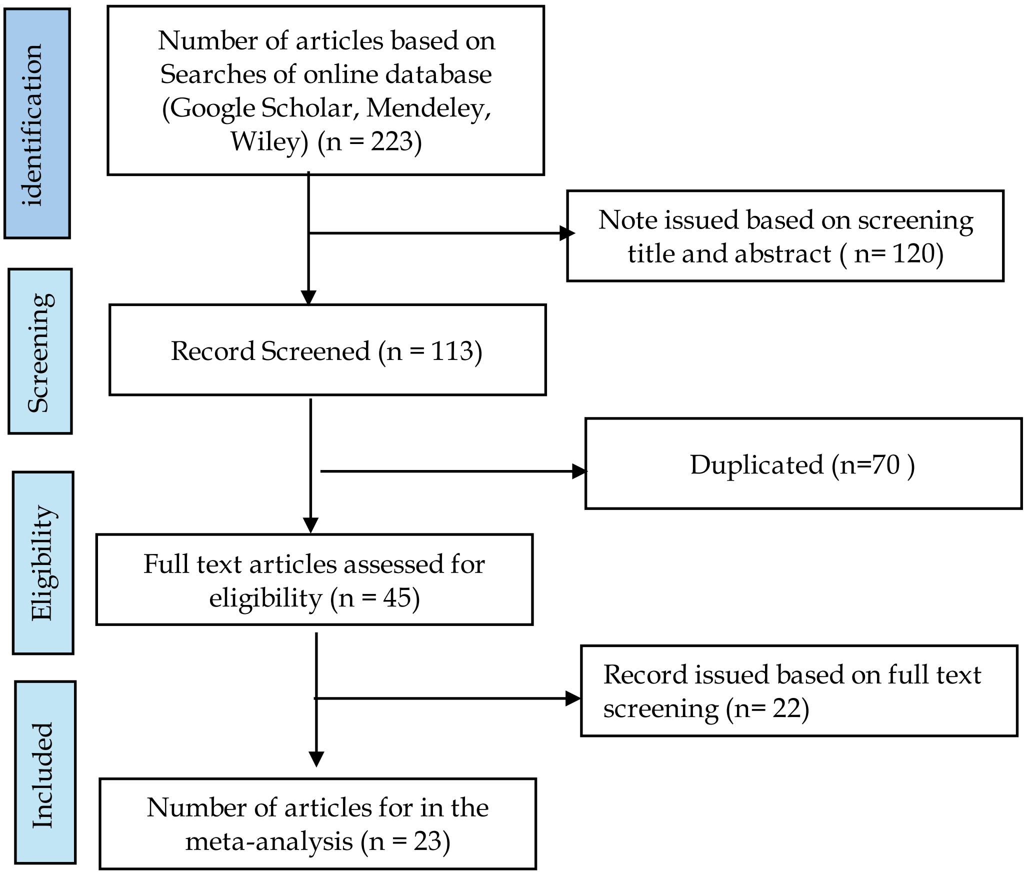

Figure 1. Data Selection Process Through PRISMA

Statistical Analysis

Data analysis in this study calculates the effect size value of each study analyzed. The effect size value in this study is to calculate the effect of the to the effectiveness of . the problem-based learning model based on local wisdom on scientific thinking skills in children. According to (Borenstein et al., 2007) The stages of data analysis in the meta-analysis can be seen in (Figure 1.). Furthermore, the criteria for the effect size value in the study can be seen in Table 1.

Table 1. Category Effect Size Value

Effect Size	Category
0.0≤ES≤ 0.2	Low
0.2≤ES≤ 0.8	Medium
ES≥ 0.8	High

Source: (Borenstein et al., 2007; Bachtiar et al., 2023; Tamur et al., 2020)

Publication Bias

In the research, publication bias checking was carried out through funnel plot analysis and Egger's test. Publication bias checks to find out whether or not there was research discarded in this study.

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Result and Discussion

Based on the results of data search through the database, 23 studies/articles met the inclusion criteria. The effect size and error standard can be seen in Table 2.

Table 2. Effect Size and Standard Error Every Research

Code Journal	Years	Effect Size	Standard Error	Variable	Index-Journal
LP 1	2021	1.45	0.32	Scientific Thinking	Sinta
LP 2	2021	0.62	0.30	Scientific Thinking	Sinta
LP 3	2022	0.76	0.25	Scientific Thinking	Scopus
LP 4	2024	0.33	0.16	Scientific Thinking	Scopus
LP 5	2021	0.79	0.30	Scientific Thinking	Scopus
LP 6	2024	1.56	0.34	Scientific Thinking	Sinta
LP 7	2024	1.98	0.40	Scientific Thinking	WOS
LP 8	2024	1.62	0.45	Scientific Thinking	Scopus
LP 9	2025	0.84	0.29	Scientific Thinking	Sinta
LP 10	2023	0.75	0.23	Scientific Thinking	Sinta
LP 11	2022	2.09	0.24	Scientific Thinking	Sinta
LP 12	2024	1.90	0.40	Scientific Thinking	Scopus
LP 13	2024	1.51	0.44	Scientific Thinking	Scopus
LP 14	2024	0.77	0.30	Scientific Thinking	Sinta
LP 15	2021	0.56	0.18	Scientific Thinking	Scopus
LP 16	2024	0.81	0.33	Scientific Thinking	Scopus
LP 17	2023	0.55	0.20	Scientific Thinking	Sinta
LP 18	2023	0.73	0.23	Scientific Thinking	Sinta
LP 19	2023	1.70	0.38	Scientific Thinking	Sinta
LP 20	2023	0.94	0.41	Scientific Thinking	Scopus
LP 21	2024	1.07	0.32	Scientific Thinking	Scopus
LP 22	2024	0.52	0.22	Scientific Thinking	Scopus
LP 23	2025	1.25	0.40	Scientific Thinking	Scopus

Based on Table 2, the effect size value of the 23 studies ranged from 0.33 to 2.09. According to Borenstein et al., (2007) Of the 23 effect sizes, 10 studies had medium criteria effect sizes and 13 studies had high criteria effect size values. Furthermore, 23 studies were analyzed to determine an estimation model to calculate the mean effect size. The analysis of the fixed and random effect model estimation models can be seen in Table 3.

Table 3. Fixed and Random effect

	Q	df	p
Omnibus test of Coefficients Model	86.834	1	< 0.001
Test of Residual Heterogeneity	142.872	22	< 0.001

Based on Table 3, a Q value of 142.872 was obtained higher than the value of 86. 834 with a coefficient interval of 95% and a p value of 0.001 <. The findings can be concluded that the value of 24 effect sizes analyzed is heterogeneously distributed. Therefore, the model used to calculate the mean effect size is a random effect model. Furthermore, checking publication bias through funnel plot analysis and Rosenthal fail safe N (FSN) test (Tamur et al., 2020; Badawi et al., 2022; Ichsan et al., 2023b; Borenstein et al., 2007; Abdullah et al., 2024). The results of checking publication bias with funnel plot can be seen in Figure 1 and 2.

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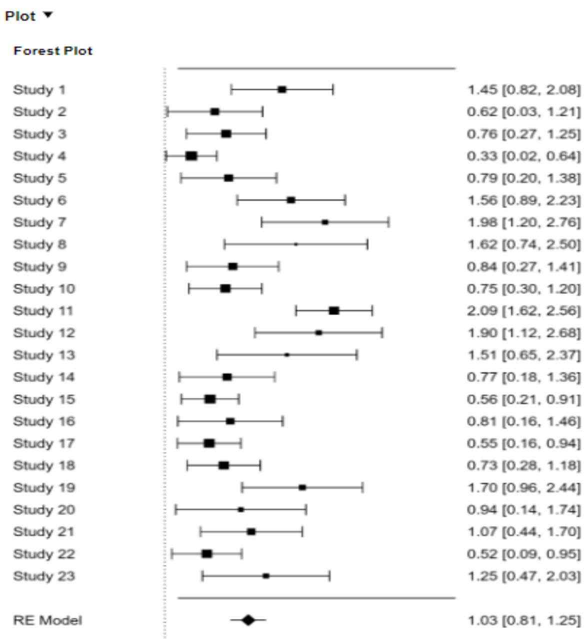

Figure 1. Forest Flot

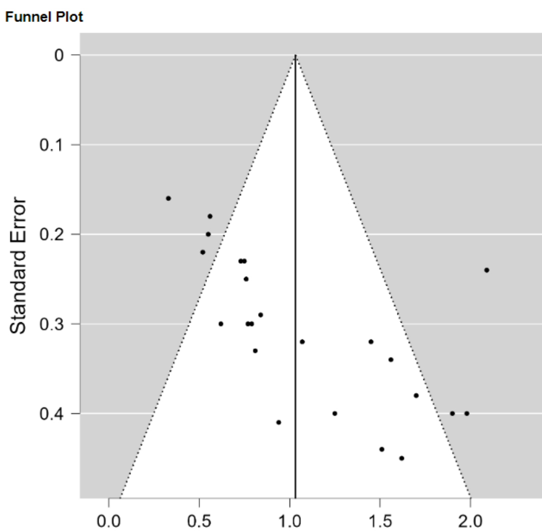

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Figure 2. **Funnel Plot**

Based on Figure 2, the analysis of the funnel plot is not yet known whether it is symmetrical or asymmetrical, so it is necessary to conduct a Rosenthal Fail Safe N (FSN) test. The results of the Rosenthal Fail Safe N calculation can be seen in Table 4.

Tabel 4. Fail Safe N

File Drawer Analysis			
	Fail Safe N	Target Significance	Observed Significance
Rosenthal	2353	0.050	< 0.001

Based on Table 4, the Fail Safe N value of 2353 is greater than the value of 5k + 10 = 5(23) + 10 = 125, so it can be concluded that the analysis of 19 effect sizes in this data is not biased by publication and can be scientifically accounted for. Next, calculate the p-value to test the hypothesis through the random effect model. The results of the summary effect model analysis with the random effect model can be seen in Table 5.

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Tabel 5. Summary/ Mean Effect Size

Coefficient						
	Effect Size	Standard Error	z	p	95 % Coefficient Interval	
					Lower	Upper
Intercept	1.03	0.11	9.242	< 0.01	0.815	1.375

Based on Table 5, the results of the analysis with the random effect model obtained a lower limit value of 0.815 and an upper limit of 1.375 and a mean effect size value of 1.11. The effect size category in this study is included in the high category. Furthermore, the results of the Z test to determine the significance were obtained 9.242 and the p value < 0.01, so it can be concluded that the application of problem-based learningmodel based on local wisdom can improve scientific thinking skills in children compared to conventional learning models. The Problem-based learning(PBL) model has been recognized as an effective approach in improving critical thinking and problem-solving skills in students (Darmawati et al., 2024). This model prioritizes real problem solving as the main context in the teaching and learning process, which requires students to actively think and find solutions. One of the latest developments in PBL is the incorporation of elements of local wisdom in learning materials (Lubis et al., 2022; Tohri et al., 2022). Local wisdom as a source of knowledge that grows in the culture and traditions of the community can be a very useful resource in shaping students' scientific mindset. This study aims to explore the effectiveness of the PBL model based on local wisdom in improving scientific thinking skills in children.

PBL focuses on giving students challenges to solve problems that are relevant to their lives. This model supports the development of scientific thinking skills by encouraging students to identify problems, formulate hypotheses, collect data, and draw conclusions (Niatin et al., 2022). Previous research has shown that PBL can improve critical thinking and analytical skills. Adding an element of local wisdom in PBL provides more value because it helps students to relate learning materials to their cultural experiences, which increases a sense of ownership of the learning process (Sari et al., 2021). Local wisdom can also build respect for tradition and the surrounding environment, which enriches the student's learning experience. In its application, the PBL model based on local wisdom suggests that students are given the task of solving problems related to their daily lives, using concepts derived from local wisdom. For example, in the context of science education, students may be required to solve environmental problems such as sustainable management of natural resources, by referring to existing local traditions (Jumadi et al., 2021; Dakabesi & Luoise, 2019). This approach not only improves scientific thinking skills, but also introduces students to the perspective of local communities towards nature and their natural resources. As time goes by, students learn to relate scientific theories to practices that exist in their daily lives.

Local wisdom makes a great contribution in building students' character. By utilizing local wisdom, PBL not only teaches scientific skills, but also forms positive values contained in local traditions and culture (Maskur et al., 2020). For example, wisdom in terms of waste management or sustainable agriculture can be integrated in science learning, teaching students to think holistically and respect the surrounding environment. This is not only beneficial for the development of their scientific skills, but also provides them with a deeper understanding of how science can be used to solve real problems in society (Daniel Shuttleworth, 2023). By applying the PBL model based on local wisdom, it is hoped that students can not only improve their scientific thinking skills, but also be able to apply the knowledge they have gained to solve problems in their environment. Children will more easily understand scientific concepts when they see the direct connection between theory and practice in the real world (Fajri et al., 2023; Dedios et al., 2024). Therefore, this approach is expected to increase students' understanding of the importance of science in daily life and encourage them to think critically about various phenomena that exist around them.

Conclusion

From the results of this meta-analysis, it can be concluded that on average, children who use the problem-based learningmodel based on local wisdom can improve scientific thinking skills in children compared to conventional learning models. By integrating local wisdom in science learning, students not only acquire scientific knowledge, but are also able to relate scientific concepts to daily life practices that are relevant to their culture. This encourages students to think critically, creatively, and be able to apply the knowledge gained in solving real problems in their environment. The implication of this study is that educators should consider the application of the PBL model based on local wisdom as an approach that can enrich students' learning experience, as well as help them develop more applicable and contextual scientific thinking skills. This model also has the potential to build students' awareness of the importance of preserving traditions and the surrounding environment in the context of modern education. The Problem-Based Learning (PBL) model based on local wisdom can be an effective approach in improving children's scientific thinking skills by connecting science concepts with the cultural context and environment around them. To optimize its application, it is recommended that teachers design problem-based learning scenarios that are relevant to students' daily lives.

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References

Abdullah, A., Wijayanti, A., Suryono, W., Ika, M., Sarnoto, A. Z., Hiola, S. F., Ruchiat, A., Sari, W. D., & Santosa, T. A. (2024). Qualitative Study : Comparison of Implementation of The Effectiveness of the Ethno-Religious-Based SAVI Model in Improving Problem-Solving Skills in PAI Learning. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *8*(5), 1245–1256. https://doi.org/10.31004/obsesi.v8i5.6192

Ali, M., Nurhayati, R., Wantu, H. M., Amri, M., & Santosa, T. A. (2024). The Effectiveness of Jigsaw Model Based on Flipped Classroom to Improve Students ' Critical Thinking Ability in Islamic Religious Education Learning. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *8*(5), 1069–1078. https://doi.org/10.31004/obsesi.v8i5.6190

Aminatun, T., Subali, B., Yuningsih, Y., Dwiyani, A., Prihartina, I., & Meliana, D. (2022). Developing Android-Based Mobile through Local Ecosystem Materials to Improve Thinking Skills of High School Students. *Anatolian Journal of Education*, *7*(1), 73–82. https://doi.org/10.29333/aje.2022.716a

Asmayawati, Yufiarti, & Yetti, E. (2024). Pedagogical innovation and curricular adaptation in enhancing digital literacy: A local wisdom approach for sustainable development in Indonesia context. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(1), 100233. https://doi.org/10.1016/j.joitmc.2024.100233

Asnur, L., Jalinus, N., Faridah, A., Apra, T., Ambiyar, R. D., & Utami, F. (2024). *Video-blogs (Vlogs) -based Project : A Meta Analysis*. *14*(5), 1553–1557.

Badawi et al. (2023). Integration of Blended Learning and Project-Based Learning (BPjBL) on Achievement of Students' learning goals: A Meta-analysis study. *Pegem Journal of Education and Instruction*, *13*(4). https://doi.org/10.47750/pegegog.13.04.32

Borenstein, M., Hedges, L., & Rothstein, H. (2007). *Introduction to Meta-Analysis*. www.Meta-Analysis.com

Dakabesi, D., & Luoise, I. S. Y. (2019). The effectiveness of problem-based learning model to increase the students' critical thinking skills. *Journal of Education and Learning*

(EduLearn), *13*(4), 543–549. https://doi.org/10.11591/edulearn.v13i4.12940

Daniel Shuttleworth, P. (2023). What matters for child participation - The role of valuation-based dialogical participation for children living in kinship care in England. *Children and Youth Services Review*, *149*(March), 106959. https://doi.org/10.1016/j.childyouth.2023.106959

Darmawati, B., Winahyu, S. K., Lubis, R. H., Herianah, Nurhuda, P., & Purba, A. (2024). Indigenous Wisdom-Based Literature at Buru Island: Situation and Need Analysis for Developing Indonesian Teaching Materials. *International Journal of Language Education*, *8*(2), 419–437. https://doi.org/10.26858/ijole.v8i2.65002

Dedios, M. C., Fonseca, L., Burgess, R., Jovchelovitch, S., Vera San Juan, N., & González-Gort, M. (2024). *Resisting Epistemic Violence in Global Mental Health: Listening to Local understandings of Mental Health and Emotional Distress among Victims and Ex-Guerrilla Members in Southern Colombia*. *7*(August 2024). https://doi.org/10.1016/j.ssmmh.2024.100385

Dewi, H. K. (2020). The Effectiveness Of The Use Of Augmented Reality-Assisted Physics E-Module Based On Pedicab To Improve Mathematical Communication And Critical Thinking Abilities. *Journal of Technology and Science Education*, *5*(3), 184–193.

Edy Nurtamam, M., Apra Santosa, T., Aprilisia, S., Rahman, A., & Suharyat, Y. (2023). Meta-analysis: The Effectiveness of Iot-Based Flipped Learning to Improve Students' Problem Solving Abilities. *Jurnal Edumaspul*, *7*(1), 2023–1492.

Fajri, G., Ginting, E., & Simanjuntak, M. P. (2023). *The Effect of the Project Based Learning-STEM Model on Students Critical and Creative Thinking Skills*. *9*(3), 244–255. https://doi.org/10.4108/eai.19-9-2023.2340544

Farizi et al. (2019). The Effect of the Challenge Based Learning Model on Critical Thinking Skills and Learning Outcomes Shohib. *Anatolian Journal of Education*, *4*(1), 13–22. http://e-aje.net/images/dosyalar/aje_2019_1_2.pdf

Hidayah, R., Wangid, M. N., Wuryandani, W., & Salimi, M. (2023). The Influence of Teacher Efficacy on Education Quality: A Meta-Analysis. *International Journal of Educational Methodology*, *9*(2), 435–450. https://doi.org/10.12973/ijem.9.2.435

Ichsan, I., Suharyat, Y., Santosa, T. A., & Satria, E. (2023). Effectiveness of STEM-Based Learning in Teaching 21 st Century Skills in Generation Z Student in Science Learning: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 150–166. https://doi.org/10.29303/jppipa.v9i1.2517

Jumadi, J., Perdana, R., Riwayani, & Rosana, D. (2021). The impact of problem-based learning with argument mapping and online laboratory on scientific argumentation skill. *International Journal of Evaluation and Research in Education*, *10*(1), 16–23. https://doi.org/10.11591/ijere.v10i1.20593

Kundariati, M., Maghfiroh, L., Indriwati, S. E., Rohman, F., & Priambodo, B. (2022). Revealing the effect of local-based teaching materials toward scientific reasoning, argumentation, and problem-solving in biology classroom. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *8*(3), 287–295. https://doi.org/10.22219/jpbi.v8i3.21973

Lubis, S. P. W., Suryadarma, I. G. P., Paidi, & Yanto, B. E. (2022). The Effectiveness of Problem-based learning with Local Wisdom oriented to Socio-Scientific Issues. *International Journal of Instruction*, *15*(2), 455–472. https://doi.org/10.29333/iji.2022.15225a

Luciana, O., Sjoraida, D. F., Santosa, T. A., Nugraha, A. R., & Zain, A. (2024). The Effect of Technology-Based Management Learning on Children ' s Organizational Skills Development : A Meta-Analysis Approach. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *8*(6), 1777–1786. https://doi.org/10.31004/obsesi.v8i6.6593

Mar'atussolichah, Ibda, H., Al-Hakim, M. F., Faizah, F., Aniqoh, A., & Mahsun, M. (2024). Benkangen game: Digital media in elementary school Indonesian language. *Journal of Education and Learning*, *18*(2), 480–488. https://doi.org/10.11591/edulearn.v18i2.21091

Maskur, R., Sumarno, Rahmawati, Y., Pradana, K., Syazali, M., Septian, A., & Palupi, E. K.

(2020). The effectiveness of problem-based learningand aptitude treatment interaction in improving mathematical creative thinking skills on curriculum 2013. *European Journal of Educational Research*, *9*(1), 375–383. https://doi.org/10.12973/eu-jer.9.1.375

Mustofa, R. F., & Hidayah, Y. R. (2020). The effect of problem-based learning on lateral thinking skills. *International Journal of Instruction*, *13*(1), 463–474. https://doi.org/10.29333/iji.2020.13130a

Net, W. W. W. P., Sumardi, L., & Herianto, E. (2024). The Effectiveness of Teaching Materials with TEE Patterns in Improving Students' Critical Thinking Skills and Scientific Attitudes. *Pegem Journal of Education and Instruction*, *14*(2), 184–191. https://doi.org/10.47750/pegegog.14.02.23

Ningsih, W., Prayitno, B. A., & Santosa, S. (2023). The effectiveness of environment-oriented e-books based on problem-based learning for problem-solving skills. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *9*(3), 511–520. https://doi.org/10.22219/jpbi.v9i3.25603

Pritchett, L. (2024). Investing in Human Capital in Africa: A framework for research. *International Journal of Educational Development*, *107*(April), 103048. https://doi.org/10.1016/j.ijedudev.2024.103048

Pujiastuti, H., & Haryadi, R. (2024). The Effectiveness of Using Augmented Reality on the Geometry Thinking Ability of Junior High School Students. *Procedia Computer Science*, *234*, 1738–1745. https://doi.org/10.1016/j.procs.2024.03.180

Rahmasari, A., & Kuswanto, H. (2023). The Effectiveness Of Problem-Based Learning Physics Local Wisdom Of Catapults In Improving Mathematical And. *Journal of Technology and Science Education, 13*(3), 886–900.

Sari, Y. I., Sumarmi, Utomo, D. H., & Astina, I. K. (2021). The Effect of Problem-based learningon Problem Solving and Scientific Writing Skills. *International Journal of Instruction*, *14*(2), 11–26. https://doi.org/10.29333/iji.2021.1422a

Sary, A. L., Isnawati, I., & Asri, M. T. (2023). Validity of teaching modules based on local wisdom of macroscopic fungi and PjBL-oriented to improve scientific attitudes and science literacy. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *9*(3), 256–270. https://doi.org/10.22219/jpbi.v9i3.28884

Tamur, M., Juandi, D., & Kusumah, Y. S. (2020). The effectiveness of the application of mathematical software in indonesia; a meta-analysis study. *International Journal of Instruction*, *13*(4), 867–884. https://doi.org/10.29333/iji.2020.13453a

Tohri, A., Rasyad, A., Sururuddin, M., & Istiqlal, L. M. (2022). The urgency of Sasak local wisdom-based character education for elementary school in East Lombok, Indonesia. *International Journal of Evaluation and Research in Education*, *11*(1), 333–344. https://doi.org/10.11591/ijere.v11i1.21869

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction*, *12*(3), 375–388. https://doi.org/10.29333/iji.2019.12323a

Uluk, E., Masruchiyah, N., Nurhayati, R., Agustina, I., Sari, W. D., Santosa, T. A., Widya, U., Klaten, D., & Yogyakarta, U. N. (2024). Effectiveness of Blended Learning Model Assisted By Scholoogy to Improve Language Skills of Early Childhood Education Teachers. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *8*(6), 1363–1374. https://doi.org/10.31004/obsesi.v8i6.6226

Widiana, L. V. W., Prayitno, B. A., & Sugiharto, B. (2024). Framework problem solving based augmented reality media to empower scientific explanation skill. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *10*(2), 631–639. https://doi.org/10.22219/jpbi.v10i2.32387

Youna Chatrine Bachtiar, Mohammad Edy Nurtamam, Tomi Apra Santosa, Unan Yasmaniar Oktiawati, & Abdul Rahman. (2023). the Effect of Problem-based learningModel Based on React Approach on Students' 21St Century Skills: Meta-Analysis. *International Journal of Educational Review, Law And Social Sciences (IJERLAS)*, *3*(5), 1576–1589. https://doi.org/10.54443/ijerlas.v3i5.1047

Yustina, Mahadi, I., Ariska, D., Arnentis, & Darmadi. (2022). The Effect of E-Learning Based on the Problem-Based Learning Model on Students' Creative Thinking Skills During the Covid-19 Pandemic. *International Journal of Instruction*, *15*(2), 329–348. https://doi.org/10.29333/iji.2022.15219a

Zainil, M., Kenedi, A. K., Rahmatina, Indrawati, T., & Handrianto, C. (2023). The influence of a STEM-based digital classroom learning model and high-order thinking skills on the 21st-century skills of elementary school students in Indonesia. *Journal of Education and E-Learning Research*, *10*(1), 29–35. https://doi.org/10.20448/jeelr.v10i1.4336

Zulyusri, Z., Santosa, T. A., Festiyed, F., Yerimadesi, Y., Yohandri, Y., Razak, A., & Sofianora, A. (2023). Effectiveness of STEM Learning Based on Design Thinking in Improving Critical Thinking Skills in Science Learning: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(6), 112–119. https://doi.org/10.29303/jppipa.v9i6.3709