

DAFTAR PUSTAKA

- Alabbasi, A. M. A., Paek, S. H., Kim, D., & Cramond, B. (2022). What do educators need to know about the Torrance Tests of Creative Thinking: A comprehensive review. *Frontiers in Psychology*, 13, 1–14. <https://doi.org/10.3389/fpsyg.2022.1000385>
- Almasri, F. (2024). Exploring the Impact of Artificial Intelligence in Teaching and Learning of Science: A Systematic Review of Empirical Research. *Research in Science Education*, 54(5), 977–997. <https://doi.org/10.1007/s11165-024-10176-3>
- Baran, M., Baran, M., Karakoyun, F., & Maskan, A. (2021). The Influence of Project-Based STEM (PjBL-STEM) Applications on the Development of 21st-Century Skills. *Journal of Turkish Science Education*, 18(4), 798–815. <https://doi.org/10.36681/tused.2021.104>
- BMKG. (2026). *Buletin Informasi Iklim, Edisi 05 (Mei 2026)*. <https://www.bmkg.go.id/iklim/buletin-iklim>
- Campbell, D. T., & Stanley, J. C. (1963). Experimental and Quasi-Experimental Designs for Research. In N. L. Gage (Ed.), *Handbook of Research on Teaching* (pp. ix–84). Rand McNally.
- Capraro, R. Michael., Capraro, M. Margaret., & Morgan, J. R. . (2013). *STEM project-based learning : an integrated science, technology, engineering, and mathematics (STEM) approach* (2nd ed). SensePublishers.
- Chai, T., & Draxler, R. R. (2014). Root mean square error (RMSE) or mean absolute error (MAE)? -Arguments against avoiding RMSE in the literature. *Geoscientific Model Development*, 7(3), 1247–1250. <https://doi.org/10.5194/gmd-7-1247-2014>
- Chang, C.-C., & Chen, Y.-K. (2022). Educational values and challenges of i-STEM project-based learning: A mixed-methods study with data-transformation design. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.976724>
- Choi, S. H., & Manousiouthakis, V. I. (2022). Modeling the Carbon Cycle Dynamics and the Greenhouse Effect. *IFAC-PapersOnLine*, 55(7), 424–428. <https://doi.org/10.1016/j.ifacol.2022.07.480>
- Cohen, Jacob. (1988). *Statistical power analysis for the behavioral sciences*. Psychology Press, Taylor & Francis Group.
- Creswell, J. W. ., & Plano Clark, V. L. . (2011). *Designing and conducting mixed methods research* (2nd ed.). SAGE Publications.

- Dzulhijj M.R, & Albina M. (2025). Model Penelitian Campuran (Mixed Method). *Jurnal Arjuna : Publikasi Ilmu Pendidikan, Bahasa Dan Matematika*, 3(4), 80–91. <https://doi.org/10.61132/arjuna.v3i4.2187>
- Farahbakhsh, I., Bauch, C. T., & Anand, M. (2024). Tipping points in coupled human–environment system models: a review. *Earth System Dynamics*, 15(4), 947–967. <https://doi.org/10.5194/esd-15-947-2024>
- Fernández Villanueva, E., & Shaffer, G. (2025). Presentation, calibration and testing of the DCESS II Earth system model of intermediate complexity (version 1.0). *Geoscientific Model Development*, 18(7), 2161–2192. <https://doi.org/10.5194/gmd-18-2161-2025>
- Field, A. P. . (2013). *Discovering statistics using IBM SPSS statistics*. SAGE Publications.
- George, Darren., & Mallery, Paul. (2003). *SPSS for Windows step by step : a simple guide and reference, 11.0 update* (4th ed.). Allyn and Bacon.
- Hafitri, M. L., & Efwindi, S. (2024). Enhancing Students’ Learning Outcomes and Science Process Skills through STEM Project-Based Learning on Global Warming Topics. *Jurnal Penelitian Dan Pengembangan Pendidikan Fisika (JPPPF)*. <https://doi.org/10.21009/1.10113>
- Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64–74. <https://doi.org/10.1119/1.18809>
- Hetmaniok, E., & Pleszczyński, M. (2022). Comparison of the Selected Methods Used for Solving the Ordinary Differential Equations and Their Systems. *Mathematics*, 10(3). <https://doi.org/10.3390/math10030306>
- International Organization for Standardization. (2023). *ISO/IEC 25010:2023 Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Product quality model*. ISO. <https://www.iso.org/standard/78176.html>
- IPCC. (2021). *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. <https://doi.org/10.1017/9781009157896>
- Kamath, A., Poojari, S., & Varsha, K. (2025). Assessing the robustness of normality tests under varying skewness and kurtosis: a practical checklist for public health researchers. *BMC Medical Research Methodology*, 25(1). <https://doi.org/10.1186/s12874-025-02641-y>

- Kartono. (2012). *Persamaan Diferensial Biasa: Model Matematika Fenomena Perubahan* (1st ed.). Graha Ilmu.
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education. *Learning and Individual Differences*, 103. <https://doi.org/10.1016/j.lindif.2023.102274>
- Khalil, R. Y., Tairab, H., Qablan, A., Alarabi, K., & Mansour, Y. (2023). STEM-Based Curriculum and Creative Thinking in High School Students. *Education Sciences*, 13(12). <https://doi.org/10.3390/educsci13121195>
- Kwon, H., & Lee, Y. (2025). A meta-analysis of STEM project-based learning on creativity. *STEM Education*, 5(2), 275–290. <https://doi.org/10.3934/steme.2025014>
- Laboy-Rush, D. (2011). *Integrated STEM Education through Project-Based Learning*. <https://studentsatthecenterhub.org/resource/integrated-stem-education-through-project-based-learning/>
- Lan, X., Tans, P., & Thoning, K. W. (2026). *Trends in globally-averaged CO2 determined from NOAA Global Monitoring Laboratory measurements*. NOAA Global Monitoring Laboratory. <https://doi.org/10.15138/9N0H-ZH07>
- Lawshe, C. H. (1975). A Quantitative Approach to Content Validity. *Personnel Psychology*, 28, 563–575. <https://doi.org/10.1111/j.1744-6570.1975.tb01393.x>
- Lenton, T. M., Held, H., Kriegler, E., Hall, J. W., Lucht, W., Rahmstorf, S., & Schellnhuber, H. J. (2008). Tipping elements in the Earth's climate system. *Proceedings of the National Academy of Sciences*, 105(6), 1786–1793. <https://doi.org/10.1073/pnas.0705414105>
- Lewis, C. D. (1982). *Industrial and Business Forecasting Methods* (1st ed). Butterworth Scientific.
- Lin, K. Y., Wu, Y. T., Hsu, Y. T., & Williams, P. J. (2021). Effects of infusing the engineering design process into STEM project-based learning to develop preservice technology teachers' engineering design thinking. *International Journal of STEM Education*, 8(1). <https://doi.org/10.1186/s40594-020-00258-9>
- Mahombar, A., Padang, H.P, & Hutagalung, P. (2023). DAMPAK PENERAPAN MODEL PjBL DENGAN STEM PADA KEMAMPUAN BERPIKIR

- KREATIF DAN BERPIKIR KRITIS SISWA. *Journal of Physics and Science Learning*, 7(2). <https://doi.org/10.30743/pascal.v7i2.8172>
- Makridakis, S., Wheelwright, S. C., & Hyndman, R. J. (1998). *Forecasting: Methods and Applications* (3rd ed.). John Wiley & Sons.
- Maramba, I., Chatterjee, A., & Newman, C. (2019). Methods of usability testing in the development of eHealth applications: A scoping review. *International Journal of Medical Informatics*, 126, 95–104. <https://doi.org/10.1016/j.ijmedinf.2019.03.018>
- Maryati, I., & Nurkayati, N. (2021). Analisis kemampuan berpikir kreatif matematis siswa Sekolah Menengah Atas dalam materi Aljabar. *PYTHAGORAS Jurnal Pendidikan Matematika*, 16(2). <https://doi.org/10.21831/pythagoras.v16i2.40007>
- Mhlongo, H. R. (2024). Addressing Global Warming Issues In Schools Through Curriculum Integration. *International Journal of Innovative Technology and Interdisciplinary Sciences*, 7(3), 115–136. <https://doi.org/10.15157/ijitis.2024.7.3.115-136>
- Montgomery, D. C. ., Peck, E. A. ., & Vining, G. Geoffrey. (2021). *Introduction to linear regression analysis* (6th ed.). John Wiley & Sons, Inc.
- Munandar, Utami. (2014). *Pengembangan Kreativitas Anak Berbakat*. Rineka Cipta.
- Muzana, S. R., Jumadi, Wilujeng, I., Yanto, B. E., & Mustamin, A. A. (2021). E-STEM project-based learning in teaching science to increase ICT literacy and problem solving. *International Journal of Evaluation and Research in Education*, 10(4), 1386–1394. <https://doi.org/10.11591/IJERE.V10I4.21942>
- Myhre, G., Highwood, E. J., Shine, K. P., & Stordal, F. (1998). New estimates of radiative forcing due to well mixed greenhouse gases. *Geophysical Research Letters*, 25(14), 2715–2718. <https://doi.org/10.1029/98GL01908>
- OECD. (2024). *PISA 2022 Results Volume III: Creative Minds, Creative Schools - Factsheets: Indonesia*.
- Othman, O., Iksan, Z. H., & Yasin, R. M. (2022). Creative Teaching STEM Module: High School Students' Perception. *European Journal of Educational Research*, 11(4), 2127–2137. <https://doi.org/10.12973/eu-jer.11.4.2127>
- Qadafi. M, Jamaluddin, & Hastuti. A. (2022). Pengaruh Model Pembelajaran Project Based Learning (PjBL) Terintegrasi STEM Pada Mata Pelajaran Fisika Untuk Meningkatkan Kemampuan Berfikir Kreatif Peserta Didik SMA TGH Umar Kelayu Tahun Ajaran 2021/2022. *Jurnal Pengabdian Magister Pendidikan IPA*. <https://doi.org/10.29303/jpmipi.v5i2.1604>

- Rohman, M. H., Marwoto, P., Nugroho, S. E., & Supriyadi, S. (2024). Effectiveness of Ethnoecological-STEM Project-Based Learning Model to Improve Critical Thinking Skills, Creativity, and Science Concept Mastery. *International Journal of Cognitive Research in Science, Engineering and Education*, 12(3), 521–534. <https://doi.org/10.23947/2334-8496-2024-12-3-521-534>
- Roslina, Samsudin, A., & Liliawati, W. (2022). Effectiveness of Project Based Learning Integrated STEM in Physics Education (STEM-PJBL). *Phenomenon: Jurnal Pendidikan MIPA*, 12(1), 120–139. <https://doi.org/10.21580/phen.2022.12.1.11722>
- Septiadevana, R., & Abdullah, N. (2024). Developing STEM project-based learning module for primary school teachers: a need analysis. *International Journal of Evaluation and Research in Education*, 13(4), 2585–2593. <https://doi.org/10.11591/ijere.v13i4.28894>
- Setiawan, V. R., Situmorang, M., & Silaban, R. (2025). Project-based learning with STEM to promote higher order thinking skills as a strategy to improve high school chemistry learning outcomes. *Chemistry Teacher International*. <https://doi.org/10.1515/cti-2025-0025>
- Solihah, P. A., Kaniawati, I., Samsudin, A., & Riandi, R. (2024). DEVELOPMENT OF A TEXTBOOK GLOBAL WARMING (TGW) STEM WITH AN ESD APPROACH. *Journal of Engineering Science and Technology*, 19(Special Issue on ISCoE2023), 17–26.
- Sugiyono. (2023). *Metode Penelitian Kombinasi (Mixed Methods): Dengan 9 Desain* (2nd ed.). Alfabeta.
- Tomczak, M., & Tomczak, E. (2014). The Need to Report Effect Size Estimates Revisited: An Overview of Some Recommended Measures of Effect Size. *Trends in Sport Sciences*, 21(1), 19–25.
- Trott, C. D., Lam, S., Roncker, J., Gray, E. S., Courtney, R. H., & Even, T. L. (2023). Justice in climate change education: a systematic review. *Environmental Education Research*, 29(11), 1535–1572. <https://doi.org/10.1080/13504622.2023.2181265>
- Vistara, M. F., Rochmad., & Wijayanti, Kristina. (2022). Systematic Literature Review: STEM Approach through Engineering Design Process with Project Based Learning Model to Improve Mathematical Creative Thinking Skills. *Mathematics Education Journals*, 6(2). <https://doi.org/10.22219/mej.v6i2.21150>
- Wang, J., & Li, Y. (2026). AI and the future of educational technology: a systematic review of pedagogical innovations and challenges. *Cogent Education*, 13(1), 1–22. <https://doi.org/10.1080/2331186X.2026.2691562>

- Willmott, C. J., & Matsuura, Kenji. (2005). Advantages of the mean absolute error (MAE) over the root mean square error (RMSE) in assessing average model performance. *Climate Research*, 30(1), 79–82. <https://doi.org/10.3354/cr030079>
- Workineh, Y., Mekonnen, H., & Belew, B. (2024). Numerical methods for solving second-order initial value problems of ordinary differential equations with Euler and Runge-Kutta fourth-order methods. *Frontiers in Applied Mathematics and Statistics*, 10, 1–3. <https://doi.org/10.3389/fams.2024.1360628>
- Wu, B., Hu, Y., Yu, X., Sun, M., Xie, H., Li, Z., & Wang, M. (2023). How do secondary students engage in complex problem-solving processes in a STEM project? *Knowledge Management and E-Learning*, 15(4), 506–522. <https://doi.org/10.34105/j.kmel.2023.15.029>