

## DAFTAR PUSTAKA

- Ananda, P. N., & Salamah, U. (2021). Meta Analisis Pengaruh Integrasi Pendekatan STEM Dalam Pembelajaran IPA Terhadap Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Penelitian Pembelajaran Fisika*, 7(1), 54–64.
- Andaresta, N., & Rachmadiarti, F. (2021). Pengembangan E-Book Berbasis STEM Pada Materi Ekosistem Untuk Melatihkan Kemampuan Literasi Sains Siswa. *BioEdu*, 10(1), 635–646.
- Asigigan, S. I., & Samur, Y. (2021). The Effect of Gamified STEM Practices on Students' Intrinsic Motivation, Critical Thinking Disposition Levels, and Perception of Problem-Solving Skills. *International Journal of Education in Mathematics, Science and Technology*, 9(2), 332–352.
- Atma, Y., Taufik, M., & Seftiono, H. (2018). Identifikasi Resiko Titik Kritis Kehalalan Produk Pangan: Studi Produk Bioteknologi. *Studi Produk Bioteknologi.*, 10(1), 59–66.
- Autenrieth, R. L., Lewis, C. W., & Butler-Purry, K. L. (2018). Enrichment Experiences in Engineering (E<sup>3</sup>) Summer Teacher Program: Analysis of Student Surveys Regarding Engineering Awareness. *Journal of STEM Education: Innovations and Research*, 19(4), 19–29.
- Azizah, M., Sulianto, J., & Cintang, N. (2018). Analisis Keterampilan Berpikir Kritis Siswa Sekolah Dasar pada Pembelajaran Matematika Kurikulum 2013. *Jurnal Penelitian Pendidikan*, 35(1), 61–70.
- Bronstein, M. V., Pennycook, G., Bear, A., Rand, D. G., & Cannon, T. D. (2019). Belief in Fake News is Associated with Delusionality, Dogmatism, Religious Fundamentalism, and Reduced Analytic Thinking. *Journal of Applied Research in Memory and Cognition*, 8(1), 108–117.
- Bustani, S., & Saleh, R. (2019). *Budaya hukum masyarakat dalam mengantisipasi dampak kerusakan lingkungan hidup akibat perkembangan bioteknologi pertanian*. 1–17.
- Bybee, R. W. (2013). *The Case for STEM Education Challenges and Opportunities*. National Science Teachers Association (NSTA Press).
- Campbell, R., MK, L., LA, R., & RJ, R. (2008). Biologi Jilid 1 Terj. dari Biology. 8th ed. Oleh Wulandari, D.T. In *The Biochemical journal* 414(2). Erlangga.
- Daud, K. M. (2019). Cabaran guru prasekolah dalam menerapkan Pendidikan STEM. *Jurnal Pendidikan Sains Dan Matematik Malaysia*, 9(2), 25–34.
- Dewi, E. R. S., Widyastuti, D. A., & Nurwahyunani, A. (2021). Buku Ajar: Bioktonologi. In *Universitas PGRI Semarang Press*. Lontar Media.
- Dywan, A. A., & Airlanda, G. S. (2020). Efektivitas Model Pembelajaran Project Based Learning Berbasis STEM dan Tidak Berbasis STEM terhadap Kemampuan Berpikir Kritis Siswa. *Jurnal Basicedu*, 4(2), 344–354.
- English, L. D. (2017). Advancing Elementary and Middle School STEM Education. *International Journal of Science and Mathematics Education*, 15(1), 5–24.

- Ennis, R. H. (1993). Critical thinking assessment. *Theory Into Practice*, 32(3), 179–186.
- Erdogan, F. (2019). Effect of Cooperative Learning Supported by Reflective Thinking Activities on Students' Critical Thinking Skills. *Eurasian Journal of Educational Research*, 2019(80), 89–112.
- Fahmeyzan, D., Soraya, S., & Etmy, D. (2018). Uji Normalitas Data Omzet Bulanan Pelaku Ekonomi Mikro Desa Senggigi dengan Menggunakan Skewness dan Kurtosi. *Jurnal Varian*, 2(1), 31–36.
- Fan, S. C., Yu, K. C., & Lou, S. J. (2017). Why do students present different design objectives in engineering design projects? *International Journal of Technology and Design Education*, 28(4), 1039–1060.
- Farell, G., Ambiyar, Simatupang, W., Giatman, M., & Syahril, S. (2021). Analisis Efektivitas Pembelajaran Daring Pada SMK Dengan Metode Asynchronous dan Synchronous. *Edukatif: Jurnal Ilmu Pendidikan*, 3(4), 1185–1190.
- Faridah, H. D., & Sari, S. K. (2019). Utilization of Microorganism on the Development of Halal Food Based on Biotechnology. *Journal of Halal Product and Research*, 2(1), 33.
- Fauziyah, N. E. H., & Anugraheni, I. (2020). Pengaruh Model Pembelajaran TGT (Teams Games Tournament) Ditinjau dari Kemampuan Berpikir Kritis Pada Pembelajaran Tematik di Sekolah Dasar. *Jurnal Basicedu*, 4(4), 850–860.
- Fitrianingsih, R., & Musdalifah. (2015). Efektivitas Penggunaan Media Video Pada Pembelajaran Pembuatan Strapless Siswa Kelas XII SMK Negeri 1 Jambu. *Fashion and Fashion Education Journal*, 4(1), 1–6.
- Foo, S. Y. (2021). Using EASY framework to facilitate economics students' critical thinking in asynchronous online discussions. *Asia Pacific Education Review*, 22(4), 637–654.
- Goodsett, M. (2020). Best practices for teaching and assessing critical thinking in information literacy online learning objects. *Journal of Academic Librarianship*, 46(5), 102163.
- Guzey, S. S., Ring-Whalen, E. A., Harwell, M., & Peralta, Y. (2019). Life STEM: A Case Study of Life Science Learning Through Engineering Design. *International Journal of Science and Mathematics Education*, 17(1), 23–42.
- Hachey, A. C. (2020). Success for all: fostering early childhood STEM identity. *Journal of Research in Innovative Teaching & Learning*, 13(1), 135–139.
- Haifaturrahmah, H., Hidayatullah, R., Maryani, S., Nurmiwati, N., & Azizah, A. (2020). Pengembangan Lembar Kerja Siswa Berbasis STEAM untuk Siswa Sekolah Dasar. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, 6(2), 310.
- Han, J., Kelley, T., & Knowles, J. G. (2021). Factors Influencing Student STEM Learning: Self-Efficacy and Outcome Expectancy, 21st Century Skills, and Career Awareness. *Journal for STEM Education Research*, 4(2), 117–137.

- Handriyan, A., Rosidi, I., & Subekti, H. (2018). Mengintegrasikan Literasi STEM dan Keterampilan Riset pada Berbasis Kearifan Lokal di Matakuliah Bioteknologi: Studi Pendahuluan. *Natural Science Education Research*, 1(2), 16–22.
- Hansen, L. M. (2018). Examining ways to meaningfully support students in STEM. *International Journal of STEM Education*, 5(1).
- Hermansyah. (2020). Pembelajaran IPA Berbasis STEM Berbantuan ICT dalam Meningkatkan Keterampilan Abad 21. *Jurnal Ilmiah Profesi Pendidikan*, 5(2), 129–132.
- Hidayati, N., Irmawati, F., & Prayitno, T. A. (2019). Peningkatan Keterampilan Berpikir Kritis Mahasiswa Biologi Melalui Multimedia STEM Education. *JPBIO (Jurnal Pendidikan Biologi)*, 4(2), 84–92.
- Hu, H. W., Chiu, C. H., & Chiou, G. F. (2019). Effects of question stem on pupils' online questioning, science learning, and critical thinking. *Journal of Educational Research*, 112(4), 564–573.
- Izzah, N., Asrizal, & Festiyed. (2021). Meta Analisis Effect Size Pengaruh Bahan Ajar Ipa Dan Fisika Berbasis Stem Terhadap Hasil Belajar Siswa. *Jpf (Jurnal Pendidikan Fisika)*, 9(1), 144–132.
- Jackson, C., Mohr-Schroeder, M. J., Bush, S. B., Maiorca, C., Roberts, T., Yost, C., & Fowler, A. (2021). Equity-Oriented Conceptual Framework for K-12 STEM Literacy. *International Journal of STEM Education*, 8(1), 1–16.
- Jolly, A. (2021). STEM by Design Strategies and Activities for Grades 4–8. In *Library of Congress Cataloging*. Routledge.
- Kelley, T. R., Geoff Knowles, J., Han, J., & Sung, E. (2019). Creating a 21st Century Skills Survey Instrument for High School Students. *American Journal of Educational Research*, 7(8), 583–590.
- Kelley, T. R., Knowles, J. G., Holland, J. D., & Han, J. (2020). Increasing High School Teachers Self-Efficacy for Integrated STEM Instruction Through a Collaborative Community of Practice. *International Journal of STEM Education*, 7(1), 1–13.
- Keulen, H. Van. (2018). STEM in Early Childhood Education. *European Journal of STEM Education*, 3(3), 1–24. 2.
- Khan, F. A. (2021). Biotechnology In Medical Sciences. In *Taylor & Francis Group*. CRC Press.
- Koszalka, T. A., Pavlov, Y., & Wu, Y. (2021). The informed use of pre-work activities in collaborative asynchronous online discussions: The exploration of idea exchange, content focus, and deep learning. *Computers and Education*, 104067.
- Kotijah, S., & Ventyrina, I. (2019). *Pengaturan Baku Mutu Bioteknologi (Dalam Baku Mutu Lingkungan Hidup Lain Sesuai Dengan Ilmu Pengetahuan Dan Teknologi)* (E. Suharti (ed.)). Lingkar Media.
- Kurniawan, S., Syarifuddin, A., Agusta, H. F., & Pradani, M. P. K. (2020).

- Optimasi Produksi Antibakteri Cairan Kultur Isolat Bakteri (Isolat Te234) Terhadap Bakteri *Escherichia Coli* Dan *Staphylococcus Aureus*. *Jurnal Ilmiah Ibnu Sina (JIIS) Ilmu Farmasi Dan Kesehatan*, 5(2), 211–219.
- Lamb, R., Hand, B., & Kavner, A. (2021). Computational Modeling of the Effects of the Science Writing Heuristic on Student Critical Thinking in Science Using Machine Learning. *Journal of Science Education and Technology*, 30(2), 283–297.
- Lin, K. Y., Hsiao, H. S., Williams, P. J., & Chen, Y. H. (2019). Effects of 6E-oriented STEM practical activities in cultivating middle school students' attitudes toward technology and technological inquiry ability. *Research in Science and Technological Education*, 38(1), 1–18.
- Loes, C. N., & Pascarella, E. T. (2017). Collaborative Learning and Critical Thinking: Testing the Link. *Journal of Higher Education*, 88(5), 726–753.
- Lou, S. J., Chou, Y. C., Shih, R. C., & Chung, C. C. (2017). A Study of Creativity in CaC2 Steamship-Derived STEM Project Based Learning. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(6), 2387–2404.
- Mahjatia, N., Susilowati, E., & Miriam, S. (2021). Pengembangan LKPD Berbasis STEM untuk Melatihkan Keterampilan Proses Sains Siswa Melalui Inkuiri Terbimbing. *Jurnal Ilmiah Pendidikan Fisika*, 4(3), 139.
- Margot, K. C., & Kettler, T. (2019). Teachers' Perception of STEM Integration and Education: A Systematic Literature Review. *International Journal of STEM Education*, 6(1), 1–16.
- Mohr-Schroeder, M. J., Bush, S. B., Maiorca, C., & Nickels, M. (2020). Moving Toward an Equity-Based Approach for STEM Literacy. In *Handbook of Research on STEM Education* (pp. 29–38). Routledge.
- Mufidah, I. A. (2019). The Implementation of Science, Technology, Engineering, and Mathematics (Stem) Learning To Improve Basic Asking Skills and Learning Achievements Students of Elementary School. *Al-Ishlah: Jurnal Pendidikan*, 11(2), 210.
- Oktavia, R. (2019). Bahan Ajar Berbasis Science, Technology, Engineering, Mathematics (Stem) untuk Mendukung Pembelajaran IPA Terpadu. *Jurnal Semesta Pendidikan IPA*, 2(1), 32–36.
- Prasadi, A. H., Wiyanto, W., & Suharini, E. (2020). The Implementation of Student Worksheet Based on STEM (Science, Technology, Engineering, Mathematics) and Local Wisdom to Improve of Critical Thinking Ability of Fourth Grade Students. *Journal of Primary Education*, 9(3), 227–237.
- Pratiwi, R. S., & Rachmadiarti, F. (2021). Pengembangan E-Book Berbasis Science, Technology, Engineering, and Mathematics (STEM) Materi Pertumbuhan Dan Perkembangan Tumbuhan Untuk Melatihkan Keterampilan Literasi Sains. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, 11(1), 165–178.
- Priyono. (2008). *Metode Penelitian Kuantitatif* (T. Chandra (ed.)). Zifatama Publishing.

- Raymond, C., Profetto-McGrath, J., Myrick, F., & Strean, W. B. (2018). Balancing the seen and unseen: Nurse educator as role model for critical thinking. *Nurse Education in Practice*, 31, 41–47.
- Reeve, E. . (2018). *Using Engineering Design Challenges to Promote Imagination and Innovation in Integrative STEM Education* (Issue June). Technology Education Research Group.
- Reynders, G., Lantz, J., Ruder, S. M., Stanford, C. L., & Cole, R. S. (2020). Rubrics to assess critical thinking and information processing in undergraduate STEM courses. *International Journal of STEM Education*, 7(1).
- Roehrig, G. H., Dare, E. A., Ring-Whalen, E., & Wieselmann, J. R. (2021). Understanding Coherence and Integration in Integrated STEM Curriculum. *International Journal of STEM Education*, 8(1), 1–21.
- Runisah, R., Herman, T., & Dahlan, J. A. (2017). Using the 5E Learning Cycle with Metacognitive Technique to Enhance Students' Mathematical Critical Thinking Skills. *International Journal on Emerging Mathematics Education*, 1(1), 87.
- Salonen, A., Kärkkäinen, S., & Keinonen, T. (2018). Career-related instruction promoting students' career awareness and interest towards science learning. *Chemistry Education Research and Practice*, 19(2), 474–483.
- Sembiring, O. B. I. O. K. I., Sidabutar, R., & Purba, Y. O. (2022). Pengaruh Pendekatan Science , Technology , Engineering , And Mathematics (STEM) Terhadap Kemampuan Literasi Matematis Siswa Kelas VIII Smp Negeri 4 Satu Atap Purba The Influence Of Science , Technology , Engineering , And Mathematics ( STEM ) Approaches On The Mathematical Literature Ability Of Students Of Class VIII Smp Negeri 4 Satuatap Purba. 8(2), 336–346.
- Septikasari, R., & Frasandy, R. N. (2018). Keterampilan 4C Abad 21 Dalam Pembelajaran Pendidikan Dasar. *Jurnal Tarbiyah Al Awwal*, 8(2), 107–117.
- Setiani, A., Hendri, M., & Rasmi, D. P. (2021). Persepsi Peserta Didik terhadap LKPD Terintegrasi STEM pada Materi Suhu dan Kalor. *Jurnal Penelitian Dan Pengembangan Pendidikan*, 5(2), 287–293.
- Setyawan, D. A. (2020). Petunjuk Praktikum Uji Normalitas & Uji Homogenitas Data dengan SPSS. In *Paper Knowledge . Toward a Media History of Documents*. Tahta Media Group.
- Shanta, S., & Wells, J. G. (2020). T/E design based learning: assessing student critical thinking and problem solving abilities. *International Journal of Technology and Design Education*, 1–19.
- Singer, A., Montgomery, G., & Schmoll, S. (2020). How to foster the formation of STEM identity: studying diversity in an authentic learning environment. *International Journal of STEM Education*, 7(1), 1–12.
- Siswanto, J. (2018). Keefektifan Pembelajaran Fisika dengan Pendekatan STEM untuk Meningkatkan Kreativitas Mahasiswa. *Jurnal Penelitian Pembelajaran Fisika*, 9(2), 133–137.

- Siyoto, S., & Sodik, A. (2015). *Dasar Metodologi Penelitian* (Ayup (ed.)). Literasi Media Publishing.
- Srilisnani, Amin, A., & Yolanda, Y. (2019). Penerapan Model Pembelajaran Contextual Teaching and Learning (Ctl) Terhadap Aktivitas Siswa Kelas X Di Sma Negeri 5 Model Lubuklinggau Tahun Pelajaran 2018/2019. *Silampari Jurnal Pendidikan Ilmu Fisika*, 1(1), 60–73.
- Sugiyono, P. D. (2015). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, R&D*. Alfabeta.
- Sukma, S. Y., Zulyusri, Z., Ardi, A., & Alberida, H. (2022). Implementasi Pendekatan Science, Technology, Engineering, Mathematics (STEM) dalam Pembelajaran dan Hubungannya dengan Kemampuan Berpikir Ilmiah Siswa. *As-Sabiqun*, 4(4), 786–799.
- Suwardi, S. (2021). Stem (Science, Technology, Engineering, and Mathematics) Inovasi Dalam Pembelajaran Vokasi Era Merdeka Belajar Abad 21. *Paedagogy: Jurnal Ilmu Pendidikan Dan Psikologi*, 1(1), 40–48.
- Taghinezhad, A., Riasati, M. J., & Behjat, F. (2019). The Effect of Teaching Critical Thinking Strategies on Students' Academic Writing, Critical Thinking Ability, and Critical Thinking Dispositions. *International Journal of Foreign Language Teaching and Research*, 7(28), 37–55.
- Thibaut, L., Knipprath, H., Dehaene, W., & Depaepe, F. (2018). How school context and personal factors relate to teachers' attitudes toward teaching integrated STEM. *International Journal of Technology and Design Education*, 28(3), 631–651.
- Ultay, E. (2017). Examination of Context- Based Problem-Solving Abilities of Pre-Service Physics Teachers. *Journal of Baltic Science Education*, 16(1), 113–122.
- Wati, M., & Anggraini, W. (2019). Strategi Pembelajaran Kooperatif Tipe Jigsaw: Pengaruhnya Terhadap Kemampuan Berpikir Kritis Fisika. *Indonesian Journal of Science and Mathematics Education*, 2(1), 98–106.
- Wechsler, S. M., Saiz, C., Rivas, S. F., Vendramini, C. M. M., Almeida, L. S., Mundim, M. C., & Franco, A. (2018). Creative and critical thinking: Independent or overlapping components? *Thinking Skills and Creativity*, 27(January 2017), 114–122.
- Winberg, C., Adendorff, H., Bozalek, V., Conana, H., Pallitt, N., Wolff, K., Olsson, T., & Roxå, T. (2018). Learning to teach STEM disciplines in higher education : a critical review of the literature. *Teaching in Higher Education*, 24(8), 930–947.
- Yuwono, T. (2006). *Bioteknologi Pertanian*. Gajah Mada University Press.
- Zulfiani, Juanengsih, N., & Noor, M. F. (2013). *Bioteknologi*. UIN Jakarta Press.
- Zuo, H., Ferris, K. A., & LaForce, M. (2019). Reducing Racial and Gender Gaps in Mathematics Attitudes: Investigating the Use of Instructional Strategies in Inclusive STEM High Schools. *Journal for STEM Education Research*, 3(1).