

## DAFTAR PUSTAKA

- Abdelghani, Rania & Sauz on, H l ne & Oudeyer, Pierre-Yves. (2023). Generative AI in the Classroom: Can Students Remain Active Learners?. 10.48550/arXiv.2310.03192.
- Agus, R. (2022). *Teknologi DNA rekombinan*. Literasi Nusantara Abadi.
- Akastangga, M. D. F., Harmonis, S., & Al Hafidz, R. A. (2023). The impact of ChatGPT on the critical thinking ability of UIN Sunan Kalijaga students. *Matrix : Jurnal Manajemen Teknologi Dan Informatika*, 13(3), 157–165. <https://doi.org/10.31940/matrix.v13i3.157-165>.
- Alhloul, A., & Kiss, E. (2022). *Industry 4.0 as a challenge for the skills and competencies of the labor force: A bibliometric review and a survey*. *Sci*, 4(3), 34. <https://doi.org/10.3390/sci4030034>
- Andriani, P. T., Sudatha, I. G. W., & Suartama, I. K. (2021). E-summary teaching materials with hannafin & peck models for training participants in the human resources development agency. *Indonesian Journal Of Educational Research and Review*, 4(3), 534. <https://doi.org/10.23887/ijerr.v4i3.40131>
- Aulia, A., & Andromeda, A. (2019). Pengembangan E-Modul Berbasis Inkuiri Terbimbing Terintegrasi Multirepresentasi dan Virtual Laboratory pada Materi Larutan Elektrolit dan Nonelektrolit untuk Kelas X SMA/MA. *Edukimia*, 1(1), 94–102. <https://doi.org/10.24036/ekj.v1.i1.a34bAHAN>
- Aulia Nur Hakim, & Leni Yulia. (2024). Dampak teknologi digital terhadap pendidikan saat ini. *Jurnal Pendidikan Sosial Dan Humaniora*, 3(1), 145–163. Retrieved from <https://publisherqu.com/index.php/pediaqu/article/view/800>
- Barbot, B., & Kaufman, J. C. (2025). PISA 2022 Creative Thinking Assessment: Opportunities, Challenges, and Cautions. *The Journal of Creative Behavior*, 59(1), e70003
- Chaeruman, U. (2019). *Instrumen Evaluasi Media Pembelajaran*. Jakarta: Pusat Teknologi Informasi dan Komunikasi Pendidikan.
- Creswell, J. W., & Guetterman, T. C. (2018). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson..
- Darejeh, A., Marcus, N., & Sweller, J. (2021). The effect of narrative-based E- 79 learning systems on novice users' cognitive load while learning software applications. *Educational Technology Research and Development*, 69(5), 2451–2473. <https://doi.org/10.1007/s11423-021-10024-5>
- Dewi, M. S. A., & Putri Lestari, N. A. (2020). E-Modul Interaktif Berbantuan Proyek Terhadap Hasil Belajar Peserta didik. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, 4(3), 433–441. <https://doi.org/10.23887/jipp.v4i3.28035>

- Divya s, Archana R, Nidhi S, Deepika J. Technology of Recombinant DNA. *Adv Biotech & Micro*. 2021; 16(5): 555947 DOI:[10.19080/AIBM.2021.16.555947](https://doi.org/10.19080/AIBM.2021.16.555947)
- Ennis, R. H. (2015). Critical Thinking: A Streamlined Conception. *The Palgrave Handbook of Critical Thinking in Higher Education*, 31–47. [https://doi.org/10.1057/9781137378057\\_2](https://doi.org/10.1057/9781137378057_2)
- Facione, P. A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction: The complete American Philosophical Association Delphi research report* (ERIC Doc. No. ED 315 423). The California Academic Press.
- Facione, P.A., Gittens, C.A., & Facione, N.C. (2016). Cultivating a critical thinking mindset 1. *Measured Reasons*, 1–9.
- Facione, P. A. (2011). Critical thinking: What it is and why it counts. *Insight assessment*, 1(1), 1-23.
- Feuerriegel, S., Hartmann, J., Janiesch, C., & Zschech, P. (2023). *Business & Information Systems Engineering*. <https://arxiv.org/abs/2309.07930>
- Fitri, S., Yuliani, L., & Laksono, B. A. (2023). Pengaruh motivasi belajar terhadap kemampuan berpikir kritis warga belajar pendidikan kesetaraan paket c di skb kuningan. *JoCE (Journal of Community Education)*, 3(1), 14-22.
- Ghozali, I. (2016). *Aplikasi Analisis Multivariate dengan Program IBM SPSS 23*. Semarang: Badan Penerbit Universitas Diponegoro.
- 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>
- Haleem, A., Javaid, M., & Pratap, R. (2023). An era of ChatGPT as a significant futuristic support tool: A study on features, abilities, and challenges. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 2(4), 100089. <https://doi.org/10.1016/j.tbench.2023.100089>
- Hannafin, M. J., & Peck, K. L. (1988). *The design, development, and evaluation of instructional software*. New York, NY: Macmillan
- Herawati, N. S., & Muhtadi, A. (2018). Pengembangan modul elektronik (e-modul) interaktif pada mata pelajaran Kimia kelas XI SMA. *Jurnal Ilmiah Pendidikan (JITP)*, 5(2), 15424. <https://doi.org/10.21831/jitp.v5i2.15424>.
- Holisoh, A., Pahamzah, J., & Hidayat, S. (2025). Literature Review on the Use of Electronic Modules in Independent Learning in Higher Education. *Journal of General Education and Humanities*, 4(1), 153–164. <https://doi.org/10.58421/gehu.v4i1.368>
- Hu, K. (2023). ChatGPT sets record for fastest-growing user base - analyst note. Reuters. <https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/>

- Janis, I. R., & Alias, M. (2018). A systematic literature review: Human roles, competencies and skills in Industry 4.0. *European Proceedings of Social and Behavioural Sciences*, 84, 851–858. <https://www.europeanproceedings.com/article/10.15405/epsbs.2018.05.84>
- Julianto, T. S., & Ratumanan, S. (2023). Pemanfaatan *Generative Artificial Intelligence* dalam pembelajaran bahasa untuk peserta didik SD: Pendekatan inovatif dalam meningkatkan kemampuan menulis. *Bima Journal of Elementary Education*, 1(2), 48–52. <https://doi.org/10.37630/bijee.v1i2.1224>
- Kasneji, 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., ... Kasneji, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103(March), 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
- Kawuryan, S. P., Sayuti, S. A., & Aman. (2022). Critical thinking among fourth grade elementary school students: A gender perspective. *Cakrawala Pendidikan*, 41(1), 211–224. [doi.org/10.21831/cp.v41i1.44322](https://doi.org/10.21831/cp.v41i1.44322)
- Kemdikbud. (2022). CP & ATP Biologi SD-SMA. retrieve from <https://guru.kemdikbud.go.id/kurikulum/referensi-penerapan/capaian-pembelajaran/sd-sma/biologi/>
- Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. (2022). *Keputusan Kepala Badan Standar, Kurikulum, dan Asesmen Pendidikan Nomor 009/H/KR/2022 tentang Dimensi, Elemen, dan Subelemen Profil Pelajar Pancasila pada Kurikulum Merdeka*. Jakarta: Badan Standar, Kurikulum, dan Asesmen Pendidikan.
- Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia. (2022). *Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia Nomor 25 Tahun 2022 tentang Penilaian Buku Pendidikan*.
- Khan, F. A., Pandey, A., Ahmad, A., & Raza, S. (2016). Role of recombinant DNA technology to improve life. *International Journal of Genomics*, 2016, Article ID 2405954. <https://doi.org/10.1155/2016/2405954>
- Kominfo. (2022). *Status Literasi Digital di Indonesia*. [aptika.kominfo.go.id](http://aptika.kominfo.go.id)
- Kotsis, K. T. (2024). Integration of artificial intelligence in science teaching in primary education: Applications for teachers. *European Journal of Contemporary Education and E-Learning*, 2(3), 27–43. [https://doi.org/10.59324/ejceel.2024.2\(3\).04](https://doi.org/10.59324/ejceel.2024.2(3).04)
- Kuncahyono, & Kumalasani, M. P. (2020). Digital Skill Guru melalui E-Modul sebagai Inovasi Bahan Ajar di Era Disrupsi 4.0. *Jurnal Pendidikan Dasar*, 1(1), 10–11. Retrieved from <https://jurnal.umpwr.ac.id/index.php/jpd/article/view/906>

- Mambu, J. G. Z., Pitra, D. H., Rizki, A., Ilmi, M., Nugroho, W., Leuwol, N. V., Muh, A., & Saputra, A. (2023). Pemanfaatan teknologi Generative Artificial Intelligence (AI) dalam menghadapi tantangan mengajar guru di era digital. *Journal on Education*, 06(01).
- Manurung, O., Destiani, A. C., Sugiarto, J., Lolo, A. T. A., & Chai, K. (2023). Identifikasi pengaruh penggunaan ChatGPT terhadap kemampuan berpikir peserta didik di Universitas Atma Jaya Yogyakarta Prodi Sistem Informasi Angkatan 2021. *Konvergensi Teknologi dan Sistem Informasi*, 3(2).
- McKenney, S., & Reeves, T. C. (2012). *Conducting Educational Design Research*. Routledge.
- McKenney, S., & Reeves, T. C. (2020). Educational design research: Portraying, conducting, and enhancing productive scholarship. *Medical Education*, 55(1), 82–92. <https://doi.org/10.1111/medu.14280>
- Moore, B. N., & Parker, R. (2019). *Critical Thinking*. McGraw-Hill Education.
- Najuah, M. Pd., Lukitoyo, P. S., & Wirianti, W. (2020). *Modul elektronik: Prosedur penyusunan dan aplikasinya*. Yayasan Kita Menulis.
- Nieveen, N. & Folmer, F. (2013). *Formative Evaluation in Educational Design Research* (pp. 152–169). Netherlands Institute for Curriculum Development (SLO).
- Ningsih, Sulistia & Shanie, Arsan. (2023). Pengaruh penggunaan gadget terhadap kemampuan berpikir kritis peserta didik sekolah dasar. *Muallimuna : Jurnal Madrasah Ibtidaiyah*. 8. 52. 10.31602/muallimuna.v8i2.10126.
- Nurhikmah, H., Tahmir, S., Junda, M., & Bena, B. A. N. (2018). Blended Learning Media in Biology Classroom. *Journal of Physics: Conference Series*, 1028(1). <https://doi.org/10.1088/1742-6596/1028/1/012027>
- Otto, S., Ejsing-Duun, S. & Lindsay, E. Disruptive tensions and emerging practices: an exploratory inquiry into student perspectives on generative Artificial Intelligence in a problem-based learning environment. *Educ Inf Technol* (2025). <https://doi.org/10.1007/s10639-025-13533-5>
- Park, I., & Michael, J. (1991). Empirically-Based Guidelines for the Design of Interactive Multimedia. *Educational Technology Research & Development*, 4(3), 63–85.
- Plomp, T. (2013). *Educational design research: An introduction* (pp. 10–51). Netherlands Institute for Curriculum Development (SLO).
- Plomp, T., & Nieveen, N. (2013). *Educational design research* (pp. 1–206). Netherlands Institute for Curriculum Development: SLO.
- Priadi, A., Aristina, T., Rachmawati, N., & Harigustian, Y. (2021). Literature Review: Pengaruh Penggunaan Gadget Berlebih Terhadap Kesehatan Mental Anak. *Jurnal Keperawatan AKPER YKY Yogyakarta*, 13(2), 75–82.

- Putri, H. S., Wahyuni, S., & Rusdianto. (2023). Pengembangan e-modul Berbantuan SETS (Science, Environment, Technology, and Society) Berbantuan Flip Pdf Professional untuk meningkatkan kemampuan berpikir kritis peserta didik SMP pada pembelajaran IPA. *Pendekar: Jurnal Pendidikan Berkarakter*, 6(2), 93-100. <https://doi.org/10.31764>
- Rabiman, R., Nurtanto, M., & Kholifah, N. (2020). Design and development E-learning system by learning management system (Lms) in vocational education. *International Journal of Scientific and Technology Research*.
- Rahmawati, Heni, & Pratiwi Pujiastuti, Andarini Permata Cahyaningtyas. (2023). Kategorisasi Kemampuan Berpikir Kritis Peserta didik Kelas Empat Sekolah Dasar di SD se-Gugus II Kapanewon Playen, Gunung Kidul. *Jurnal Pendidikan dan Kebudayaan*, Vol. 8, Nomor 1.
- Ray, P. P. (2023). ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations, and future scope. *Internet of Things and Cyber-Physical Systems*, 3, 121–154. <https://doi.org/10.1016/j.iotcps.2023.04.003>
- Regmi, K., & Jones, L. (2020). A systematic review of the factors – enablers and barriers – affecting e-learning in health sciences education. *BMC Medical Education*, 20, 91. <https://doi.org/10.1186/s12909-020-02007-6>
- Richey, R. C., Klein, J. D., & Nelson, W. A. (2004). *Developmental Research*. Lawrence Erlbaum Associates Publishers., 142–184.
- Rodrigues, R. (2020). Legal and human rights issues of AI: gaps, challenges and vulnerabilities. *Journal of Responsible Technology*, 100005. <https://doi.org/10.1016/j.jrt.2020.100005>
- Rupp, M., Schneckenburger, M., Merkel, M., Börret, R., & Harrison, D. K. (2021). Industry 4.0: A Technological-Oriented Definition Based on Bibliometric Analysis and Literature Review. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(1), 68. <https://doi.org/10.3390/joitmc7010068>
- Russell, S. J., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson Education.
- Sartika, I., Dafrita, I. E., & Nawaw. (2024). Pengembangan e-modul Berbantuan problem based learning (PBL) terhadap kemampuan berpikir kritis peserta didik pada materi sistem pencernaan manusia kelas XI SMAN 1 Samalantan. *Biodik: Jurnal Ilmiah Pendidikan Biologi*, 10(3), 311–320. <https://doi.org/10.22437/biodik.v10i3.30448>
- Smith, J. E. (2009). *Biotechnology* (5th ed.). Cambridge University Press.
- Sternberg, R. J. (1985). Teaching Critical Thinking, Part 2: Possible Solutions. *The Phi Delta Kappan*, 67(4), 277–280. <http://www.jstor.org/stable/20387615>
- Suarsana, I. M., & Mahayukti, G. A. (2013). Pengembangan e-modul berorientasi pemecahan masalah untuk meningkatkan Kemampuan berpikir kritis peserta

- didik. *Jurnal Pendidikan Indonesia*, 2(2), 264. <https://ejournal.undiksha.ac.id/index.php/JPI/article/viewFile/2171/1887>
- Sugiyono. (2013). *Statistika untuk Penelitian*. Bandung: Alfabeta.
- Sursala, L., Feuerriegel, S., Hartmann, J., Janiesch, C., & Zschech, P. (2024). *Electronic Markets*. <https://link.springer.com/article/10.1007/s12525-025-00754-2>
- Sutama, I. W., Astuti, W., & Anisa, N. (2021). E-modul strategi pembelajaran anak usia dini sebagai sumber belajar digital. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 9(3), 449–456. <https://ejournal.undiksha.ac.id/index.php/JJPAUD/index>
- Sweeney, S. (2023). Who wrote this? Essay mills and assessment considerations regarding contract cheating and AI in higher education. *The International Journal of Management Education*, 21(2), 100818. <https://doi.org/10.1016/j.ijme.2023.100818>
- Syafri, Fatrima Santri. (2018). *Pengembangan Modul Pembelajaran Aljabar Elementer di Program Studi Tadris Matematika IAIN Bengkulu*. Bengkulu: CV. Zigie Utama.
- Talan, D. F. E., & Widayati, A. (2023). Effectiveness of implementing e-module based on contextual teaching and learning to improve learning outcomes and class XI IPS in SMA Negeri 1 Soe. *Asian Journal of Social and Humanities*, 1(06), 279-287. <https://doi.org/10.59888/ajosh.v1i06.23>
- Thieman, W. J., & Palladino, M. A. (2014). *Introduction to biotechnology* (3rd ed.). Pearson Education Limited.
- Utami, B., Saputro, S., Ashadi, A., Masykuri, M., & Widoretno, S. (2017). Critical thinking skills profile of high school students in learning chemistry. *International Journal of Science and Applied Science: Conference Series*, 1(2), 124-130 [doi.org/10.20961/ijsascs.v1i2.5134](https://doi.org/10.20961/ijsascs.v1i2.5134).
- Van Den Akker, J. (1999) Principles and methods of development research. *Design Methodology and Developmental Research in Education and Training*, Kluwer Academic Publishers, The Netherlands, 1-14.
- Wang, Claudia, Monique Zhang, Ali Sesunan, Laurencia Yolanda. (2023). *Peran teknologi dalam transformasi pendidikan di indonesia Tinjauan dampak terkini gerakan Merdeka Belajar*. OliverWyman.
- Widyasari, N., & Nurcahyani, A. (2021). Development of E-comic-based mathematics teaching materials on the topic of multiplication and division with Realistic Mathematics Education (RME) approach. *Kreano: Jurnal Matematika Kreatif-Inovatif*, 12(2), 365–375. <https://doi.org/10.15294/kreano.v12i2.32482>
- Wisnuwati, D. (2018). *Modul pengembangan keprofesian berkelanjutan mata pelajaran biologi bidang perikanan dan kelautan sekolah menengah kejuruan (SMK)*. Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga

Kependidikan Pertanian, Direktorat Jenderal Guru dan Tenaga Kependidikan, Kementerian Pendidikan dan Kebudayaan.

Yosintha, R., & Arochman, T. (2020). Preparing English department students for industry 4.0 era through critical thinking skills development. In ICLLT 2019: Proceedings of the 1st International Conference on Language and Language Teaching, ICLLT 2019, 12 October, Magelang, Central Java, Indonesia (p. 159). *European Alliance for Innovation*. <https://eudl.eu/pdf/10.4108/eai.12-10-2019.2292229>

Yusuf, K., Sanely, D. P., & Maritska, Z. *A Recombinant DNA Technique in The Genetic Engineering of Insulin from Bacteria*. *Jurnal Riset Kedokteran*. <https://doi.org/10.29313/jrk.v3i2.2626>

Zhou, H. A., Wolfschläger, D., Florides, C., Werheid, J., Behnen, H., Woltersmann, J.-H., ... Schmitt, R. H. (2025). *Generative AI in industrial machine vision: A review*. *Journal of Intelligent Manufacturing*. <https://doi.org/10.1007/s10845-025-02604-6>

