

DAFTAR PUSTAKA

- Aba-Oli, Z., Koyas, K., & Tulu, A. H. (2024). Higher-order thinking skills-oriented problem-based learning interventions in mathematics: A systematic literature review. *School Sci & Mathematics*, 125(3). <https://doi.org/https://doi.org/10.1111/ssm.12676>
- Abdullaeyvna, S. G. (2022). Formation of creative thinking in students under solving exercises and tasks on biology. *International Journal of Health Sciences*, 6(April), 3492–3496. <https://doi.org/10.53730/ijhs.v6ns5.9399>
- Abraham, Anna. (2024). Why the standard definition of creativity fails to capture the creative act. *Theory & Psychology*, 35(1), 40–60. <https://doi.org/10.1177/09593543241290232>
- Acar, S., Tadik, H., Myers, D., van der Sman, C., & Uysal, R. (2021). Creativity and well-being: A meta-analysis. *Journal of Creative Behavior*, 55(3), 738–751. <https://doi.org/10.1002/jocb.485>
- Adawiyah, R., & Wisudawati, W. A. (2017). Pengembangan instrumen tes berbasis literasi sains: Menilai pemahaman fenomena ilmiah mengenai energi. *Indonesian Journal of Curriculum and Educational Technology Studies*, 5(2), 112–121. <https://doi.org/http://dx.doi.org/10.15294/ijcets.v3i1.8675> Article
- Adnan, Mulbar, U., Sugiarti, & Bahri, A. (2021). Scientific literacy skills of students: Problem of biology teaching in junior high school in South Sulawesi, Indonesia. *International Journal of Instruction*, 14(3), 847–860. <https://doi.org/10.29333/iji.2021.14349a>
- Afandi, Sajidan, Akhyar, M., & Suryani, N. (2019). Development frameworks of the Indonesian partnership 21 st -century skills standards for prospective science teachers: A Delphi study. *Jurnal Pendidikan IPA Indonesia*, 8(1), 89–100. <https://doi.org/10.15294/jpii.v8i1.11647>
- Agüero Pérez, M. M., López Fraile, L. A., & Pérez Expósito, J. (2019). Challenge Based Learning como modelo de aprendizaje profesionalizante. Caso del programa Universidad Europea con Comunica +A. *Vivat Academia. Revista de Comunicación*, December 2019, 1–24. <https://doi.org/10.15178/va.2019.149.1-24>
- Aiken, L. R. (1980). Content validity and reliability of single items or questionnaires. *Educational and Psychological Measurement*, 40(4), 955–959. <https://doi.org/10.1177/001316448004000419>
- Aiman, U., Dantes, N., & Suma, K. (2019). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Literasi Sains Dan Berpikir Kritis Siswa Sekolah Dasar. *Jurnal Ilmiah Pendidikan Citra Bakti*, 6(2), 196–209. <https://doi.org/10.5281/zenodo.3551978>
- Ali, F., Wang, Y., Wang, S. J. W., & Zhu, G. (2025). Triggers of curiosity in social constructivist classroom discourse. *Npj Science of Learning*, 10(1), 1–9. <https://doi.org/10.1038/s41539-025-00330-5>

- Amijaya, D. T., Ibrahim, M., & Hawari, A. Al. (2024). The effectiveness of innovative blended learning through meaning (IBLTM) model to improve students' science literacy. *IJORER: International Journal of Recent Educational Research*, 5(6), 1396–1406. <https://doi.org/https://doi.org/10.46245/ijorer.v5i6.699>
- Anderson, L. W., Krathwohl Peter W Airasian, D. R., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *A Taxonomy for Learning, Teaching, and Assessing A Revision of Bloom's Taxonomy od Educational Objectives*. <https://www.uky.edu/~rsand1/china2018/texts/Anderson-Krathwohl - A taxonomy for learning teaching and assessing.pdf>
- Anggoro, S., Fitriati, A., Thoe, N. K., Talib, C. A., & Mareza, L. (2023). Differentiated instruction based on multiple intelligences as promising joyful and meaningful learning. *International Journal of Evaluation and Research in Education*, 13(2), 1194–1204. <https://doi.org/10.11591/ijere.v13i2.24791>
- Anjarsari, P. (2014). Literasi Sains Dalam Kurikulum Dan Pembelajaran Ipa Smp. *Prosiding Semnas Pensa VI "Peran Literasi Sains"*.
- Anwar, M. (2015). *Filsafat Pendidikan*. PT Aditya Andrebina Agung.
- Anwar, Z., & Sukiman, S. (2023). Literatur Review: Pembelajaran Berdiferensiasi dalam Kurikulum Merdeka di Madrasah Ibtidaiyah. *Mitra PGMI: Jurnal Kependidikan MI*, 9(2), 80–89. <https://doi.org/https://doi.org/10.46963/mpgmi.v9i2.1004>
- Arifin, U. H. B., Mohamed Mokmin, N. A. B., & Mohd Hamizi, M. A. A. Bin. (2022). Augmented Reality Technology in Physical Education : A Systematic Review in Instructional Design , and AR Implementation Option Over the Last 5 Years . *Advanced Journal of Technical and Vocational Education*, 6(1), 13–20. <https://doi.org/10.26666/rmp.ajtve.2022.1.3>
- Arniyawati, A., & Mulya, I. C. (2017). Analisis Kemampuan Berfikir Kritis Siswa yang Bergaya Kognitif Reflektif dan Impulsif pada Pembelajaran Biologi melalui Model SQ3R (Survey, Question, Read, Review, Recite) dengan Media Kartu Bergambar. *Bio-Pedagogi*, 6(2), 13. <https://doi.org/10.20961/bio-pedagogi.v6i2.20694>
- Arsad, N. M., Osman, K., & Soh, T. M. T. (2011). Instrument development for 21st century skills in Biology. *Procedia - Social and Behavioral Sciences*, 15, 1470–1474. <https://doi.org/10.1016/j.sbspro.2011.03.312>
- Asriadi, M., Hadi, S., Istiyono, E., & Retnawati, H. (2023). Does Differentiated Instruction Affect Learning Outcome Systematic Review and Meta-Analysis. *Journal of Pedagogical Research*. <https://doi.org/10.33902/jpr.202322021>
- Aulia, E. V. (2020). Improving science literacy skills for high school students through guided inquiry-based earning. *Mathematics, Informatics, Science, and Education International Conference (MISEIC 2019)*, 95(Miseic), 151–155. <https://doi.org/10.2991/miseic-19.2019.36>

- Bani, M., & Masruddin, M. (2021). Development of an android-based harmonic oscillation pocket book for senior high school students. *Journal of Technology and Science Education*, 11(1), 93–103. <https://doi.org/https://doi.org/10.3926/jotse.1051>
- Batubara, I. H., & Ammy, P. M. (2018). Pengaruh model pembelajaran berbasis masalah terhadap hasil belajar mahasiswa. *Biblio Couns: Jurnal Kajian Konseling Dan Pendidikan*, 1(2), 43–53. <https://doi.org/10.33507/cakrawala.v4i2.271>
- Bayraktar, B., Ragupathi, K., & Troyer, K. A. (2013). *Building Trust Through Feedback : A Conceptual Framework*. Carless.
- Besemer, S. P., & Treffinger, D. J. (1981). Analysis of Creative Products: Review and Synthesis. *The Journal of Creative Behavior*, 15(3), 158–178. <https://doi.org/10.1002/j.2162-6057.1981.tb00287.x>
- Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, 32. <https://link.springer.com/article/10.1007/BF00138871>
- Bilad, M. R., Zubaidah, S., & Prayogi, S. (2024). Addressing the PISA 2022 Results: A Call for Reinvigorating Indonesia's Education System. *International Journal of Essential Competencies in Education*, 3(1), 1–12. <https://doi.org/10.36312/ijece.v3i1.1935>
- Branch, R. M. (2009). Instructional Design: The ADDIE Approach. In *Encyclopedia of Evolutionary Psychological Science*. Springer Science+Business Media. https://doi.org/10.1007/978-3-319-19650-3_2438
- Bruthiaux, P. (1996). *Theoretical Issues*. 3–22. <https://doi.org/10.1093/oso/9780195100327.003.0001>
- Brydges, C. R. (2019). Effect Size Guidelines, Sample Size Calculations, and Statistical Power in Gerontology. *Innovation in Aging*, 3(4), 1–8. <https://doi.org/10.1093/geroni/igz036>
- Bujang, M. A., Omar, E. D., & Baharum, N. A. (2018). A review on sample size determination for cronbach's alpha test: A simple guide for researchers. *Malaysian Journal of Medical Sciences*, 25(6), 85–99. <https://doi.org/10.21315/mjms2018.25.6.9>
- Bustami, Y., Syafruddin, D., & Afriani, R. (2018). The implementation of contextual learning to enhance biology students' critical thinking skills. *Jurnal Pendidikan IPA Indonesia*, 7(4), 451–457. <https://doi.org/10.15294/jpii.v7i4.11721>
- Carless, D., & Boud, D. (2018). The Development of Student Feedback Literacy: Enabling Uptake of Feedback. *Assessment & Evaluation in Higher Education*, 43(8), 1315–1325. <https://doi.org/10.1080/02602938.2018.1463354>
- Carlos, J., & Luc, O. (2020). *Key Competences , Education for Sustainable Development and Strategies for the Development of 21st Century Skills . A Systematic Literature Review*. 1–17.

- Changwong, K., Sukkamart, A., & Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *Journal of International Studies*, *11*(2), 37–48. <https://doi.org/10.14254/2071-8330.2018/11-2/3>
- Chavarría, D. S., & Alquisira, J. P. (2021). Problem-Based Learning Approach to Review the Principles of Green Chemistry Applied to a Polycondensation Reaction. *Science Education International*, *32*(2), 107–113. <https://doi.org/10.33828/sei.v32.i2.3>
- Chen, O., Retnowati, E., Chan, B. B. K. Y., & Kalyuga, S. (2023). The effect of worked examples on learning solution steps and knowledge transfer. *Educational Psychology*, *43*(8), 914–928. <https://doi.org/10.1080/01443410.2023.2273762>
- Cheng, W. L. S. (2016). Application of Challenge-Based Learning in nursing education. *Nurse Education Today*, *44*, 130–132. <https://doi.org/10.1016/j.nedt.2016.05.026>
- Conde, M. Á., Rodríguez-Sedano, F., J. Fernández-Llamas, C., Gonçalves, J., Lima, J., & García-Peñalvo, F. J. (2020). Fostering STEAM through challenge-based learning, robotics, and physical devices: A systematic mapping literature review. *Computer Science, Interdisciplinary Applications*, 1–20. <https://doi.org/10.1002/cae.22354>
- Cremin, T., & Chappell, K. (2021). Creative pedagogies: a systematic review. *Research Papers in Education*, *36*(3), 299–331. <https://doi.org/10.1080/02671522.2019.1677757>
- Creswell, J. W. (2012). Educational research: : planning, conducting, and evaluating quantitative and qualitative research. In *Sustainability (Switzerland)* (Fourth Edi, Vol. 11, Issue 1). Pearson Education.Inc.
- Cuevas-Ortuno, J., & Huegel, J. C. (2020). Serious games or challenge-based learning - A comparative analysis of learning models in the teaching of lean manufacturing. *IEEE Global Engineering Education Conference, EDUCON, 2020-April*, 1542–1549. <https://doi.org/10.1109/EDUCON45650.2020.9125393>
- Da Costa, A. D., De Lucena, C. J. P., Coelho, H. L., Carvalho, G. R., Fuks, H., & Venieris, R. A. (2018). Multidisciplinary groups learning to develop mobile applications from the challenge based learning methodology. *ACM International Conference Proceeding Series*, 318–327. <https://doi.org/10.1145/3266237.3266256>
- Dangol, R., & Shrestha, M. (2020). Contribution of Gender on Learning Readiness Among School Students of Nepal. *Journal Of Curriculum Studies Research*. <https://doi.org/10.46303/jcsr.2020.2>
- Dawson, V., & Venville, G. J. (2009). High-school Students' Informal Reasoning and Argumentation about Biotechnology: An indicator of scientific literacy? *International Journal of Science Education*, *31*(11), 1421–1445.

<https://doi.org/10.1080/09500690801992870>

- Dewi, N., & Riandi, R. (2016). Analisis kemampuan berpikir kompleks siswa melalui pembelajaran berbasis masalah berbantuan mind mapping. *Edusains*, 8(1), 98-. <https://doi.org/http://dx.doi.org/10.15408/es.v8i1.1805>
- Dieck-Assad, G., Ávila-Ortega, A., & González Peña, O. I. (2021). Comparing Competency Assessment in Electronics Engineering Education with and without Industry Training Partner by Challenge-Based Learning Oriented to Sustainable Development Goals. *Sustainability*, 13(19), 10721. <https://doi.org/10.3390/su131910721>
- Draper, J. T., Freeling, B. S., & Connell, S. D. (2021). Sparking Creativity in Science Education. *Journal of Creative Behavior*, 55(4), 893–898. <https://doi.org/10.1002/jocb.495>
- Dwi Lestari, H., & Putu Parmiti, D. P. P. (2020). Pengembangan E-Modul Ipa Bermuatan Tes Online Untuk Meningkatkan Hasil Belajar. *Journal of Education Technology*, 4(1), 73. <https://doi.org/10.23887/jet.v4i1.24095>
- Efgivia, M. G., Adora Rinanda, R. ., Suriyani, Hidayat, A., Maulana, I., & Budiarjo, A. (2021). Analysis of Constructivism Learning Theory. *Proceedings of the 1st UMGESHIC International Seminar on Health, Social Science and Humanities (UMGESHIC-ISHSSH 2020)*, 585, 208–212. <https://doi.org/10.2991/assehr.k.211020.032>
- Ennis, R. H. (2011). *The Nature of Critical Thinking: An Outline of Critical Thinking Dispositions*. 1–8.
- Ennis, R. H. (2016). Critical Thinking Across the Curriculum : A Vision. *Topoi*. <https://doi.org/10.1007/s11245-016-9401-4>
- Ennis, R. H. (2018). Critical Thinking Across the Curriculum: A Vision. *Topoi*, 37(1), 165–184. <https://doi.org/10.1007/s11245-016-9401-4>
- Eraña-Rojas, I. E., López Cabrera, M. V., Ríos Barrientos, E., & Membrillo-Hernández, J. (2019). A challenge based learning experience in forensic medicine. *Journal of Forensic and Legal Medicine*, 68(April). <https://doi.org/10.1016/j.jflm.2019.101873>
- Ernawati, E. (2022). Fashion Design Education Students Learning Readiness; Increase or Decrease. *International Journal of Research in Counseling and Education*, 6(1), 45. <https://doi.org/10.24036/00497za0002>
- Estaiteyeh, M., & DeCoito, I. (2024). Differentiated instruction in digital video games: STEM teacher candidates using technology to meet learners' needs. *Interactive Learning Environments*, 32(7), 3768–3782. <https://doi.org/10.1080/10494820.2023.2190360>
- Facione, P. A. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction*. <https://philarchive.org/archive/faccta>

- Facione, P. A. (2011). *Critical Thinking : What It Is and Why It Counts*. Measured Reasons and The California Academic Press. <https://philarchive.org/archive/faccta>
- Fang, Z., Adams, B., Gresser, V., & Li, C. (2019). Developing Critical Literacy in Science Through an SFL-informed Pedagogical Heuristic. *English Teaching Practice & Critique*, 18(1), 4–17. <https://doi.org/10.1108/etpc-01-2018-0009>
- Fauziah, L., Rizkiyah, F., Miarsyah, M., & Ristanto, R. H. (2021). Pengembangan TTCT-V (Torrance Test Of Creative Thinking Verbal) berbasis lingkungan untuk tingkat SMA. *Bio-Lectura: Jurnal Pendidikan Biologi*, 1. <https://doi.org/https://doi.org/10.31849/bl.v8i1.4534>
- Félix-Herrán, L. C., Izaguirre-Espinosa, C., Parra-Vega, V., Sánchez-Orta, A., Benitez, V. H., & Lozoya-Santos, J. D. J. (2022). A Challenge-Based Learning Intensive Course for Competency Development in Undergraduate Engineering Students: Case Study on UAVs. *Electronics (Switzerland)*, 11(9), 1–25. <https://doi.org/10.3390/electronics11091349>
- Félix-Herrán, L. C., Rendon-Nava, A. E., & Nieto Jalil, J. M. (2019). Challenge-based learning: an I-semester for experiential learning in Mechatronics Engineering. In *International Journal on Interactive Design and Manufacturing* (Vol. 13, Issue 4, pp. 1367–1383). <https://doi.org/10.1007/s12008-019-00602-6>
- Field, A. (2013). *Discovering Statistic Using IBM SPSS Statistic* (4'th Editi). SAGE Publications Ltd.
- Fitria, Y.-, Alfa, D. S., Irsyad, M., Anwar, M., Adisva, Q. N. F., & Abdullah, H. (2022). Student Literacy Competence in Science Learning in Junior High Schools with the Reading to Learn Model. *AL-ISHLAH: Jurnal Pendidikan*, 14(2), 1607–1616. <https://doi.org/10.35445/alishlah.v14i2.1321>
- Fitriani, H., Asy'ari, M., Zubaidah, S., & Mahanal, S. (2019). Exploring the prospective teachers' critical thinking and critical analysis skills. *Jurnal Pendidikan IPA Indonesia*, 8(3), 379–390. <https://doi.org/10.15294/jpii.v8i3.19434>
- Fitriyah, A., & Ramadani, S. D. (2021). Pengaruh Pembelajaran STEAM Berbasis PJBL (Project-Based Learning) terhadap Keterampilan Berpikir Kreatif dan Berpikir Kritis. *Jurnal Inspiratif Pendidikan*, 10(1). <https://doi.org/https://doi.org/10.24252/ip.v10i1.17642>
- Fives, H., Huebner, W., Birnbaum, A. S., & Nicolich, M. (2014). Developing a Measure of Scientific Literacy for Middle School Students. *Science Education*, 98(4), 549–580. <https://doi.org/10.1002/sce.21115>
- Fraenkel, jack R., & Wallen, N. E. (2009). *How to Design and Evaluate Research in Education* (Seventh Ed). McGraw-Hill.
- Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational Research: An Introduction*. Pearson Education.Inc.

- Gallagher, S. E., & Savage, T. (2020a). Challenge-based learning in higher education: an exploratory literature review. *Teaching in Higher Education*, 0(0), 1–23. <https://doi.org/10.1080/13562517.2020.1863354>
- Gallagher, S. E., & Savage, T. (2020b). Challenge-based learning in higher education: An exploratory literature review. *Teaching in Higher Education*, 0(0), 1–23. <https://doi.org/10.1080/13562517.2020.1863354>
- Georgiou, Y., & Kyza, E. A. (2023). Fostering Chemistry Students' Scientific Literacy for Responsible Citizenship Through Socio-Scientific Inquiry-Based Learning (SSIBL). *Sustainability*, 15(8), 6442. <https://doi.org/10.3390/su15086442>
- Ghani, M. T. A., & Daud, W. A. A. W. (2018). Adaptation of Addie Instructional Model in Developing Educational Website for Language Learning. *Global Journal Al-Thaqafah*, 8(2), 7–16. <https://doi.org/10.7187/GJAT122018-1>
- Gigante, M. E. (2014). Critical Science Literacy for Science Majors. *Bulletin of Science Technology & Society*, 34(3–4), 77–86. <https://doi.org/10.1177/0270467614556090>
- Gormally, C., Brickman, P., & Lut, M. (2012). Developing a test of scientific literacy skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. *CBE Life Sciences Education*, 11(4), 364–377. <https://doi.org/10.1187/cbe.12-03-0026>
- Gregory, R. J. (2015). *Psychological testing: history, principle, and applications* (Seventh ed). Pearson Education Limited. https://doi.org/10.5005/jp/books/11437_16
- Gu, X., Wang, C., & Lin, L. (2019). Examining scientific literacy through new media. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(12). <https://doi.org/10.29333/ejmste/109948>
- Gutiérrez-Martínez, Y., Bustamante-Bello, R., Navarro-Tuch, S. A., López-Aguilar, A. A., Molina, A., & Longoria, I. Á. I. (2021). A challenge-based learning experience in industrial engineering in the framework of education 4.0. *Sustainability (Switzerland)*, 13(17). <https://doi.org/10.3390/su13179867>
- Habib, S., Vogel, T., & Thorne, E. (2025). Student perspectives on creative pedagogy: Considerations for the Age of AI. *Thinking Skills and Creativity*, 56(January), 101767. <https://doi.org/10.1016/j.tsc.2025.101767>
- Hamid, M. A., Yuliawati, L., & Aribowo, D. (2020). Feasibility of electromechanical basic work e-module as a new learning media for vocational students. *Journal of Education and Learning (EduLearn)*, 14(2), 199–211. <https://doi.org/10.11591/edulearn.v14i2.15923>
- Handayani, A., & Koeswanti, H. D. (2021). Meta-Analysis Model Pembelajaran Problem Based Learning (PBL) Untuk Meningkatkan Kemampuan Berpikir Kreatif. *Jurnal Basicedu*, 5(3), 1349–1355. <https://jbasic.org/index.php/basicedu>

- Haristy, D. R., Enawaty, H., & Lestari, I. (2013). Pembelajaran Berbasis Literasi Sains pada Materi Larutan Elektrolit dan Non Elektrolit Di SMA Negeri 1 Pontianak. *Jurnal Pendidikan Dan Pembelajaran*, 2(12).
- Hattie, John, & Timperley, Helen. (2007). The Power of Feedback. *Review of Educational Research*, 77(1), 81–112. <https://doi.org/10.3102/003465430298487>
- Heard, J., Scoular, C., Duckworth, D., Ramalingam, D., & Teo, I. (2020). Critical Thinking: Skill Development Framework. In *Australian Council for Educational Research*. https://research.acer.edu.au/ar_misc/41/
- Hein, G. E. (1991). Constructivist Learning Theory. *CECA (International Committee of Museum Educators) Conference, October*. <https://doi.org/10.4324/9781315716831-5>
- Hernandez-de-Menendez, M., Escobar Díaz, C., & Morales-Menendez, R. (2020). Technologies for the future of learning: state of the art. *International Journal on Interactive Design and Manufacturing*, 14(2), 683–695. <https://doi.org/10.1007/s12008-019-00640-0>
- Hidayati, N., & Irmawati, F. (2021). A Survey on the SETS-Based Human Anatomy and Physiology Course: Analysis of Instruments for Assessing Critical Thinking Skills Using Multimedia. *Proceeding Biology Education Conference*, 17(1), 112–119.
- Hikmawan, F. (2017). Perspektif Filsafat Pendidikan Terhadap Psikologi Pendidikan Humanistik. *Jurnal Sains Psikologi*, 6(1), 31. <https://doi.org/10.17977/um023v6i12017p31-36>
- Hynes, Kristy, Gershwin, Tracy, Robinson, Jason, & Mitchell, Chrissa. (2025). Relationships Matter: The Art of Creating Meaningful Interactions With Students. *Beyond Behavior*, 34(1), 4–13. <https://doi.org/10.1177/10742956241313215>
- Hyytinen, H., Siven, M., Salminen, O., & Katajavuori, N. (2021). Argumentation and processing knowledge in open-ended assignment tasks: Challenges and accomplishments among pharmacy students. *Journal of University Teaching and Learning Practice*, 18(6), 37–53. <https://doi.org/10.53761/1.18.6.04>
- Inayah, N., Hidayat, M. T., & Nur, M. (2020). Efektivitas pembelajaran berorientasi pendekatan saintifik pada materi hereditas terhadap kreativitas ilmiah Siswa SMA. *Jurnal Penelitian Pendidikan Sains*, 10(01), 3–8. <https://journal.unesa.ac.id/index.php/jpps>
- Irasuti, I., Ruminda, R., & Bachtiar, B. (2024). From Text to Texture: Elevating English Teaching Through Visual Literacy Skills. *Jurnal Onoma Pendidikan Bahasa Dan Sastra*, 10(2), 1780–1787. <https://doi.org/10.30605/onoma.v10i2.3595>
- Ivancovsky, T., Shamay-Tsoory, S., Lee, J., Morio, H., & Kurman, J. (2021). A Multifaceted Approach to Measure Creativity across Cultures: The Role of the

- Centrality of Context in Divergent Thinking Tasks. *Journal of Creative Behavior*, 55(4), 1028–1046. <https://doi.org/10.1002/jocb.506>
- Jagantara, I. W. M., Adnyana, P. B., & Widiyanti, N. P. (2014). Pengaruh Model Pembelajaran Berbasis Proyek (Project Based Learning) Terhadap Hasil Belajar Biologi Ditinjau Dari Gaya Belajar Siswa SMA. *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha Program Studi IPA*, 4(1), 1–13. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/1300/1002
- Jones, J. C. (2010). *21st century skills Rethinking How Students Learn*. Solution Tree Press.
- Joyce, B. R., Weil, M., & Calhoun, E. (2000). *Models of Teaching* (6th ed.). Pearson Education Company.
- Juliani, E., Rusmono, & Winarsih, M. (2023). Measuring the Learning Model's Effectiveness in the Medical Surgical Nursing course. *Gaceta Medica de Caracas*, 131(Supl 1), S21–S26. <https://doi.org/10.47307/GMC.2023.131.s1.5>
- Kamii, C., & Ewing, J. K. (1996). Basing Teaching on Piaget's Constructivism. *Childhood Education*, 72(5), 260–264. <https://doi.org/10.1080/00094056.1996.10521862>
- Kaplan, D. E. (2019). Creativity in Education: Teaching for Creativity Development. *Psychology*, 10(02), 140–147. <https://doi.org/10.4236/psych.2019.102012>
- Karnowski, V., & Kümpel, A. S. (2015). *Diffusion of Innovations*. 97–107. https://doi.org/10.1007/978-3-658-09923-7_9
- Kartini, A., Husamah, H., Permana, F. H., & Mohd Shukri, A. A. Bin. (2023). PBL-based STEM: Its effect on the cognitive learning outcome of junior high school students. *Jurnal Biolokus*, 6(2), 187. <https://doi.org/10.30821/biolokus.v6i2.2673>
- Kasbary, N., & Haymour, A. (2024). Exploring Hungarian teachers' perceptions of project-based learning in science and math education. *Hungarian Educational Research Journal*, 15, 88–104. <https://doi.org/10.1556/063.2024.00301>
- Kelana, J. B., & Pratama, D. F. (2019). *Bahan Ajar IPA Berbasis Literasi Sains*. Lekkas.
- Kementerian Pendidikan, Kebudayaan, R. dan T. (2022). *Keputusan Kepala Badan Standar, Kurikulum, dan Asesmen Pendidikan Nomor 008/H/KR/2022 Tentang Capaian Pembelajaran pada Pendidikan Anak Usia Dini, Jenjang Pendidikan Dasar dan Jenjang Pendidikan Menengah pada Kurikulum Merdeka*. Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi. https://kurikulum.kemdikbud.go.id/wp-content/unduh/CP_2022.pdf
- Khatun, N. (2021). Applications of Normality Test in Statistical Analysis. *Open Journal of Statistics*, 11(01), 113–122.

<https://doi.org/10.4236/ojs.2021.111006>

- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, 41(2), 75–86. https://doi.org/10.1207/s15326985ep4102_1
- Kohn Rådberg, K., Lundqvist, U., Malmqvist, J., & Hagvall Svensson, O. (2020). From CDIO to challenge-based learning experiences—expanding student learning as well as societal impact? *European Journal of Engineering Education*, 45(1), 22–37. <https://doi.org/10.1080/03043797.2018.1441265>
- Komşu, U. C. (2021). Postgraduate Students' Perceptions of Research Self-Efficacy and Critical Thinking Disposition and their Impact on Academic Creativity: Case of Mersin University. *TOJET: The Turkish Online Journal of Educational Technology*, 20(4), 53–66. <https://orcid.org/0000-0002-8348-8747>
- Krathwohl, D. R. (2002). A revision of bloom's taxonomy: An overview. *Theory into Practice*, 41(4), 212–218. https://doi.org/http://dx.doi.org/10.1207/s15430421tip4104_2
- Krell, M., Redman, C., Mathesius, S., Krüger, D., & van Driel, J. (2018). Assessing Pre-Service Science Teachers' Scientific Reasoning Competencies. *Research in Science Education*, 50(6), 2305–2329. <https://doi.org/10.1007/s11165-018-9780-1>
- Kuglitsch, R. (2018). An Interlocking and Interdependent Ecology. *Reference Services Review*, 46(2), 294–302. <https://doi.org/10.1108/rsr-02-2018-0022>
- Kulgemeyer, C., & Geelan, D. (2024). Towards a constructivist view of instructional explanations as a core practice of science teachers. *Science Education*, 108(4), 1034–1050. <https://doi.org/10.1002/sce.21863>
- Laugksch, R. C. (2000). Achieving Wider Scientific Literacy. *John Wiley & Sons*, 84, 71–94.
- Leahy, K. (2016). Winning the Future: An Investigation into the Creativity Capacity Across the Levels of Education in Ireland. *Creativity Research Journal*, 28(2), 188–197. <https://doi.org/10.1080/10400419.2016.1162543>
- Legaki, N. Z., Xi, N., Hamari, J., Karpouzis, K., & Assimakopoulos, V. (2020). The effect of challenge-based gamification on learning: An experiment in the context of statistics education. *International Journal of Human Computer Studies*, 144, 102496. <https://doi.org/10.1016/j.ijhcs.2020.102496>
- Leijon, M., Gudmundsson, P., Staaf, P., & Christersson, C. (2022). Challenge based learning in higher education— A systematic literature review. *Innovations in Education and Teaching International*, 59(5), 609–618. <https://doi.org/10.1080/14703297.2021.1892503>
- Lestari, H., Sopandi, W., Sa'ud, U. S., Musthafa, B., Budimansyah, D., & Sukardi,

- R. R. (2021). The impact of online mentoring in implementing radec learning to the elementary school teachers' competence in training students' critical thinking skills: A case study during covid-19 pandemic. *Jurnal Pendidikan IPA Indonesia*, 10(3), 346–356. <https://doi.org/10.15294/JPII.V10I3.28655>
- Liou, S. R., Cheng, C. Y., Chu, T. P., Chang, C. H., & Liu, H. C. (2023). Effectiveness of differentiated instruction on learning outcomes and learning satisfaction in the evidence-based nursing course: Empirical research quantitative. *Nursing Open*, 10(10), 6794–6807. <https://doi.org/10.1002/nop2.1926>
- López-Fernández, D., Salgado Sánchez, P., Fernández, J., Tinao, I., & Lapuerta, V. (2020). Challenge-Based Learning in Aerospace Engineering Education: The ESA Concurrent Engineering Challenge at the Technical University of Madrid. *Acta Astronautica*, 171(March), 369–377. <https://doi.org/10.1016/j.actaastro.2020.03.027>
- Malahayati, E. N., Duran Corebima, A., & Zubaidah, S. (2015). Hubungan Keterampilan Metakognitif dan Kemampuan Berpikir Kritis dengan Hasil Belajar Biologi Siswa SMA dalam Pembelajaran Problem Based Learning (PBL). *Jurnal Pendidikan Sains*, 3(4), 178–185.
- Malmqvist, J. (2015). Comparative Analysis of Challenge-Based Learning Experiences. *Proceedings of the 11th International CDIO Conference*. https://publications.lib.chalmers.se/records/fulltext/218615/local_218615.pdf
- Marlina. (2019). *Panduan Pelaksanaan Model Pembelajaran Berdiferensiasi di Sekolah Inklusif*.
- Marwiyati, S., & Istiningsih, I. (2020). Pembelajaran Saintifik pada Anak Usia Dini dalam Pengembangan Kreativitas di Taman Kanak-Kanak. In *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini* (Vol. 5, Issue 1, p. 135). <https://doi.org/10.31004/obsesi.v5i1.508>
- McCaslin, M., & Hickey, D. T. (2001). Educational psychology, social constructivism, and educational practice: A case of emergent identity. *Educational Psychologist*, 36(2), 133–140. https://doi.org/10.1207/S15326985EP3602_8
- McQueen, H. A., Abou Jawad, F., Cullinane, A., & Darmon, E. (2025). Creativity embedded in the biology curriculum. *Journal of Perspectives in Applied Academic Practice*, 13(1), 130–148. <https://doi.org/10.56433/4h8jzk22>
- Melindayani, S. (2022). Pengaruh model pembelajaran berbasis proyek terhadap kemampuan literasi sains materi ipa siswa kelas v sd telkom makassar. *Jurnal Handayam PGSD UNIMED*, 13(1), 1–13.
- Membrillo-Hernández, J., J. Ramírez-Cadena, M., Martínez-Acosta, M., Cruz-Gómez, E., Muñoz-Díaz, E., & Elizalde, H. (2019). Challenge based learning: the importance of world-leading companies as training partners. *International Journal on Interactive Design and Manufacturing*, 13(3), 1103–1113. <https://doi.org/10.1007/s12008-019-00569-4>

- Mohd Hamizi, M. A. A., Mohamed Mokmin, N. A., & Ariffin, U. H. B. (2022). Virtual reality technology in physical education: A systematic review in instructional design & implementation. *Advanced Journal of Technical and Vocational Education*, 6(1), 6–12. <https://doi.org/10.26666/rmp.ajtve.2022.1.2>
- Muhali, M. (2019). Pembelajaran Inovatif Abad Ke-21. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, 3(2), 25. <https://doi.org/10.36312/e-saintika.v3i2.126>
- Mukarromah, M., Budijanto, B., & Utomo, D. H. (2020). Pengaruh Model Challenge Based Learning terhadap Kemampuan Berpikir Kritis Siswa SMA pada Materi Perubahan Iklim. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 5(2), 214. <https://doi.org/10.17977/jptpp.v5i2.13176>
- Mutakinati, L., Anwari, I., & Yoshisuke, K. (2018). Analysis of students' critical thinking skill of middle school through stem education project-based learning. *Jurnal Pendidikan IPA Indonesia*, 7(1), 54–65. <https://doi.org/10.15294/jpii.v7i1.10495>
- Naim, S. S., Ibnu, S., & Santoso, A. (2020). Model Challenge Based Learning terhadap Kemampuan Berpikir Kreatif Mahasiswa. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 5(4), 478. <https://doi.org/10.17977/jptpp.v5i4.13358>
- Nawawi, S. (2017). Developing of module challenge based learning in environmental material to empower the critical thinking ability. *Jurnal Inovasi Pendidikan IPA*, 3(2), 212. <https://doi.org/10.21831/jipi.v3i2.15988>
- Neck, M., Leuders, T., & Reinhold, F. (2025). Implementing the four-component instructional design model in professional development programs: A systematic review with a focus on teachers. *Frontiers in Education*, 10(September), 1–15. <https://doi.org/10.3389/educ.2025.1631375>
- Ngu, B. H., Phan, H. P., Usop, H., & Anding, P. N. (2024). Enhancing Problem-Solving Skills for Word Problems: Impact of Diagram and Learner Expertise. *Journal of Experimental Education*, 0(0), 1–18. <https://doi.org/10.1080/00220973.2024.2394956>
- Nichols, M., & Cator, K. (2008). *Challenge Based Learning - About CBL*. 2. <http://www.challengebasedlearning.org/pages/about-cbl>
- Nichols, M., Cator, K., & Torres, M. (2016). *Challenge Based Learning User Guide*. Digital Promise.
- Nur, T. D., Corebima, A. D., Zubaidah, S., Ibrohim, I., & Saefi, M. (2023). Learning Biology through Thinking Empowerment by Questioning: The Effect on Conceptual Knowledge and Critical Thinking. *Participatory Educational Research*, 10(1), 122–139. <https://doi.org/10.17275/per.23.7.10.1>
- Nurwidodo, N., Zaenab, S., Hindun, I., & Wahyuni, S. (2025). *Development of problem orientation model and work organization in problem-based learning*

at Muhammadiyah Senior High School of Batu city Abstract : 11(1), 424–437.
10.22219/jpbi.v11i1.40190

- O'Mahony, T. K., Vye, N. J., Bransford, J. D., Sanders, E. A., Stevens, R., Stephens, R. D., Richey, M. C., Lin, K. Y., & Soleiman, M. K. (2012). A Comparison of Lecture-Based and Challenge-Based Learning in a Workplace Setting: Course Designs, Patterns of Interactivity, and Learning Outcomes. *Journal of the Learning Sciences*, 21(1), 182–206. <https://doi.org/10.1080/10508406.2011.611775>
- OECD. (2017). *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving* (revised ed). PISA, OECD Publishing. <https://doi.org/http://dx.doi.org/10.1787/9789264281820-en>
- OECD. (2019). OECD future of education and skills 2030. In *OECD Learning Compass 2030* (pp. 1–146). https://www.oecd.org/education/2030-project/teaching-and-learning/learning/learning-compass-2030/OECD_Learning_Compass_2030_Concept_Note_Series.pdf
- OECD. (2023). PISA 2022 results (Volume I): The state of learning and equity in education. In *PISA: Vol. I*. OECD Publishing. <https://doi.org/https://doi.org/10.1787/53f23881-en>.
- Olusegun, B. S. (2015). Constructivism: A Paradigm for Teaching and Learning. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 5(6), 66–70. <https://doi.org/10.9790/7388-05616670>
- Ortiz, A., Alcides, C., Pérez de Almidón, C., Miriam, E., Mejía, O., Jesús, M., Almidón, & Angel, E. (2025). Instructional design : Integration of the Q10 platform into the ADDIE model. *Revista de Ciencias Sociales (RCS)*, XXXI(1). <https://dialnet.unirioja.es/servlet/articulo?codigo=10020878>
- P21. (2007). Framework for 21st century learning. In *P21 Partnership for 21st Century Learning* (p. 2). http://static.battelleforkids.org/documents/p21/P21_framework_0816_2pgs.pdf%0Ahttp://www.p21.org/our-work/p21-framework
- Palk, K. (2018). Middle School Teachers Attitudes Towards the Need for Student Feedback and Attitudes Towards the Impact of Feedback on Teachers Professional Development. *Nternational Technology, Education and Development Conference*. <https://doi.org/10.21125/inted.2018.0653>
- Palupi, M. T. (2020). Hoax: Pemanfaatannya Sebagai Bahan Edukasi Di Era Literasi Digital Dalam Pembentukan Karakter Generasi Muda. *Jurnal Skripta*, 6(1), 1–12. <https://doi.org/10.31316/skripta.v6i1.645>
- Paraniti, A. A. I., Redhana, I. W., Suardana, I. N., & Suma, K. (2024). A novel learning model, integration of challenge-based and differentiated learning: A preliminary study. *Jurnal Penelitian Pendidikan IPA*, 10(3). <https://doi.org/https://doi.org/10.29303/jppipa.v10i3.5245>

- Partnership for 21st Century Skills, & National Science Teacher Association. (2009). 21st Century Skills Map: Science. In *21stcenturyskills.org*.
- Paul, R., & Elder, L. (2008). Journal of Developmental Education. *Journal of Developmental Education*. <https://files.eric.ed.gov/fulltext/EJ832681.pdf>
- Pepin, B., & Kock, Z. jan. (2021). Students' Use of Resources in a Challenge-Based Learning Context Involving Mathematics. *International Journal of Research in Undergraduate Mathematics Education*, 7(2), 306–327. <https://doi.org/10.1007/s40753-021-00136-x>
- Pérez-Sánchez, E. O., Chavarro-Miranda, F., & Riano-Cruz, J. D. (2020). Challenge-based learning: A 'entrepreneurship-oriented' teaching experience. *Management in Education*. <https://doi.org/10.1177/0892020620969868>
- Peschl, H., Deng, C., & Larson, N. (2021). Entrepreneurial thinking: A signature pedagogy for an uncertain 21st century. *International Journal of Management Education*, 19(1), 100427. <https://doi.org/10.1016/j.ijme.2020.100427>
- Piaget, J. (1975). From noise to order: The psychological development of knowledge and phenocopy in biology. *The Urban Review*, 8(3), 209–218. <https://doi.org/10.1007/BF02177361>
- Pllana, D. (2019). Creativity in Modern Education. *World Journal of Education*, 9(2), 136. <https://doi.org/10.5430/wje.v9n2p136>
- Portuguez Castro, M., & Gómez Zermeño, M. G. (2020). Challenge based learning: Innovative pedagogy for sustainability through e-learning in higher education. *Sustainability (Switzerland)*, 12(10). <https://doi.org/10.3390/SU12104063>
- Prakash Chand, S. (2023). Constructivism in education: exploring the contributions of Piaget, Vygotsky, and Bruner. *International Journal of Science and Research (IJSR)*, 12(7), 274–278. <https://doi.org/10.21275/sr23630021800>
- Pritchard, A., & Woollard, J. (2010). *Psychology for the classroom: Constructivism and social learning*. Taylor & Francis.
- Pujawan, I. G. N., Rediani, N. N., Antara, I. G. W. S., Putri, N. N. C. A., & Bayu, G. W. (2022). Revised Bloom Taxonomy-Oriented Learning Activities To Develop Scientific Literacy and Creative Thinking Skills. *Jurnal Pendidikan IPA Indonesia*, 11(1), 47–60. <https://doi.org/10.15294/jpii.v11i1.34628>
- Purba, M., Purnamasari, N., Soeyanto, Sylvia, A., Suwarna, I. R., & Susanti, E. I. (2021). *Pembelajaran Berdiferensiasi (Differentiated Instruction)*. Pusat Kurikulum dan Pembelajaran.
- Qiang, R., Han, Q., Guo, Y., Bai, J., & Karwowski, M. (2020). Critical Thinking Disposition and Scientific Creativity: The Mediating Role of Creative Self-Efficacy. *Journal of Creative Behavior*, 54(1), 90–99. <https://doi.org/10.1002/jocb.347>
- Qomariyah, N. D., & Subekti, H. (2021). Analisis Kemampuan Berpikir Kreatif: Studi Eksplorasi Siswa Di Smpn 62 Surabaya. *Pensa E-Jurnal : Pendidikan*

- Sains*, 9(2), 242–246.
<https://ejournal.unesa.ac.id/index.php/pensa/article/view/38250>
- Rahayu, S., Setyosari, P., Hidayat, A., & Kuswandi, D. (2022). the Effectiveness of Creative Problem Solving-Flipped Classroom for Enhancing Students' Creative Thinking Skills in Online Physics Educational Learning. *JPII*, 11(4), 649–656. <https://doi.org/10.15294/jpii.v11i4.39709>
- Ramadhani. (2019). Metode Penerapan Model Problem Based Learning (PBL). *Lantanida Journal*, 7(1), 75–86. <https://doi.org/10.22373/lj.v7i1.4440>
- Ramírez-Montoya, M. S., Loaiza-Aguirre, M. I., Zúñiga-Ojeda, A., & Portuguez-Castro, M. (2021). Characterization of the teaching profile within the framework of education 4.0. *Future Internet*, 13(4), 1–17. <https://doi.org/10.3390/fi13040091>
- Redhana, I. W. (2013). Model Pembelajaran Berbasis Masalah Dan Pertanyaan Socratic Untuk Meningkatkan Keterampilan Berpikir Kritis Siswa. *Jurnal Cakrawala Pendidikan*, 3, 351–365. <https://doi.org/10.21831/cp.v0i3.1136>
- Redhana, I. W. (2015). Pengembangan Tes Keterampilan Berpikir Kreatif. *Jurnal Pendidikan Dan Pengajaran*, 48(1–3), 27–34. <https://doi.org/10.23887/jppundiksha.v48i1-3.6915>
- Redhana, I. W. (2019). Mengembangkan Keterampilan Abad Ke-21 Dalam Pembelajaran Kimia. *Jurnal Inovasi Pendidikan Kimia*, 113(1), 2239–2253.
- Redhana, I. W. (2024a). *Literasi Digital Pedoman Menghadapi Society 5.0*. Samudra Biru.
- Redhana, I. W. (2024b). *Pendidikan Inklusi*. PT. Adab Indonesia.
- Redhana, I. W., & Sudiana, I. K. (2015). Tes untuk mengukur keterampilan berpikir kritis [Test to measure critical thinking skills]. *Prosiding Seminar Nasional Riset Inovatif*.
- Redhana, I. W., Sudiarmika, R., & Artawan, I. K. (2009). Pengembangan Perangkat Pembelajaran Berbasis Masalah dan Pertanyaan Socratic untuk Meningkatkan Keterampilan Berpikir Kritis Siswa SMP. *Jurnal Pendidikan Dan Pengajaran*, 42(3), 151–159.
- Redhana, I. W., & Sya'ban, S. (2015). Tes keterampilan berpikir kreatif: Validitas dan reliabilitas. *Prosiding Seminar Nasional Riset Inovatif*.
- Reigeluth, C. M., Beatty, B. J., & Myers, R. D. (2017). Instructional-design Theories and Models. In *Instructional-Design Theories and Models: The Learner-Centered Paradigm of Education: Vol. IV*. Routledge. <https://doi.org/10.4324/9781315795478>
- Retnowati, R., Taufik, M., & Rahma, E. (2020). Developing an integrated biology module for students' environmental attitude instruments. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 6(2), 327–334. <https://doi.org/https://doi.org/10.22219/jpbi.v6i2.11163>

- Richardson, J. T. E. (2011). Eta squared and partial eta squared as measures of effect size in educational research. *Educational Research Review*, 6(2), 135–147. <https://doi.org/10.1016/j.edurev.2010.12.001>
- Rios, J. A., Ling, G., Pugh, R., Becker, D., & Bacall, A. (2020). Identifying Critical 21st-Century Skills for Workplace Success: A Content Analysis of Job Advertisements. *Educational Researcher*, 49(2), 80–89. <https://doi.org/10.3102/0013189X19890600>
- Rizal, R., Rusdiana, D., Setiawan, W., & Siahaan, P. (2021). Development of a problem-based learning management system-supported smartphone (PBLMS3) application using the ADDIE model to improve digital literacy. *International Journal of Learning, Teaching and Educational Research*, 20(11), 115–131. <https://doi.org/10.26803/ijlter.20.11.7>
- Rizal, R., Rusdiana, D., Setiawan, W., & Siahaan, P. (2022). Learning Management System Supported Smartphone (Lms3): Online Learning Application in Physics for School Course To Enhance Digital Literacy of Pre-Service Physics Teachers. *Journal of Technology and Science Education*, 12(1), 191–203. <https://doi.org/10.3926/JOTSE.1049>
- Rodríguez-Chueca, J., Molina-García, A., García-Aranda, C., Pérez, J., & Rodríguez, E. (2019). Understanding sustainability and the circular economy through flipped classroom and challenge-based learning: An innovative experience in engineering education in Spain. *Environmental Education Research*, 26(2), 238–252. <https://doi.org/10.1080/13504622.2019.1705965>
- Rosa, N. M., & Pujiati, A. (2016). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Kemampuan Berpikir Kritis dan Kemampuan Berpikir Kreatif. *Jurnal Formatif*, 6(3), 175–183. <https://doi.org/10.30998/formatif.v6i3.990>
- Rosalina, Y., Yustina, Y., & Suzanti, F. (2021). Constructivism-Based Learning Module for Middle School Students' Creative Thinking on the Interaction of Living Things and Their Environments. *Journal of Educational Sciences*, 5(4), 687. <https://doi.org/10.31258/jes.5.4.p.687-701>
- Rowe, C., & Klein, S. (2007). A study of challenge-based learning techniques in an introduction to engineering course. *ASEE Annual Conference and Exposition, Conference Proceedings*. <https://doi.org/10.18260/1-2--1520>
- Salas-Rueda, R. A., Salas-Rueda, É. P., & Salas-Rueda, R. D. (2020). Analysis and design of the web game on descriptive statistics through the addie model, data science and machine learning. *International Journal of Education in Mathematics, Science and Technology*, 8(3), 245–260. <https://doi.org/10.46328/IJEMST.V8I3.759>
- Saleem, A., Kausar, H., & Deeba, F. (2021). Social Constructivism: A New Paradigm in Teaching and Learning Environment. *Perennial Journal of History*, 2(2), 403–421. <https://doi.org/10.52700/pjh.v2i2.86>
- Santos, A., Sales, A., Fernandes, P., & Kroll, J. (2018). Poster: Challenge-based learning: A brazilian case study. *Proceedings - International Conference on*

- Software Engineering*, 155–156. <https://doi.org/10.1145/3183440.3195061>
- Sari, D. K., Permanasari, A., & Supriyanti, F. M. T. (2017). Profile of students' creative thinking skills on quantitative project-based protein testing using local materials. *Jurnal Pendidikan IPA Indonesia*, 6(1), 71–75. <https://doi.org/10.15294/jpii.v6i1.9516>
- Schunk, D. H. (2012). *Learning Theories an Educational Perspective* (Sixth). Pearson Education.Inc.
- Sebatana, M. J., & Dudu, W. T. (2022). Reality or Mirage: Enhancing 21st-Century Skills Through Problem-Based Learning While Teaching Particulate Nature of Matter. *International Journal of Science and Mathematics Education*, 20(5), 963–980. <https://doi.org/10.1007/s10763-021-10206-w>
- Seprianto, S., & Hasby, H. (2023). Analysis of Students' Scientific Literacy Ability by the Implementation of Case Method Learning. *Jurnal Penelitian Pendidikan Ipa*, 9(3), 1143–1148. <https://doi.org/10.29303/jppipa.v9i3.2250>
- Serevina, V., Sunaryo, Raihanati, Astra, I. M., & Sari, I. J. (2018). Development of E-Module Based on Problem Based Learning (PBL) on Heat and Temperature to Improve Student's Science Process Skill. *TOJET: The Turkish Online Journal of Educational Technology* -, 17(3), 26–36. <https://files.eric.ed.gov/fulltext/EJ1184205.pdf>
- Shaffer, J. F., Ferguson, J., & Denaro, K. (2019). Use of the test of scientific literacy skills reveals that fundamental literacy is an important contributor to scientific literacy. *CBE Life Sciences Education*, 18(3). <https://doi.org/10.1187/cbe.18-12-0238>
- Shaheen, R. (2010). Creativity and Education. *Creative Education*, 01(03), 166–169. <https://doi.org/10.4236/ce.2010.13026>
- Shamboul, H. A. E. (2022). The Importance of Critical Thinking on Teaching Learning Process. *Open Journal of Social Sciences*, 10(01), 29–35. <https://doi.org/10.4236/jss.2022.101003>
- Sholahuddin, A., Susilowati, E., Prahani, B. K., & Erman, E. (2021). Using a cognitive style-based learning strategy to improve students' environmental knowledge and scientific literacy. *International Journal of Instruction*, 14(4), 791–808. <https://doi.org/10.29333/iji.2021.14445a>
- Sianturi, R. (2022). Uji homogenitas sebagai syarat pengujian analisis. *Jurnal Pendidikan, Sains Sosial, Dan Agama*, 8(1), 386–397. <https://doi.org/10.53565/pssa.v8i1.507>
- Siburian, J., Corebima, A. D., Ibrohim, & Saptasari, M. (2019). The correlation between critical and creative thinking skills on cognitive learning results. *Eurasian Journal of Educational Research*, 2019(81), 99–114. <https://doi.org/10.14689/ejer.2019.81.6>
- Sidiq, Y., Ishartono, N., Desstya, A., Prayitno, H. J., Anif, S., & Hidayat, M. L. (2021). Improving elementary school students' critical thinking skill in science

- through hots-based science questions: A quasi-experimental study. *Jurnal Pendidikan IPA Indonesia*, 10(3), 378–386. <https://doi.org/10.15294/JPII.V10I3.30891>
- Sinaga, M., Situmorang, M., & Hutabarat, W. (2019). Implementation of Innovative Learning Material to Improve Students Competence on Chemistry. *Indian Journal of Pharmaceutical Education and Research*, 53(1), 28–41. <https://doi.org/10.5530/ijper.53.1.5>
- Smale-Jacobse, A., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated Instruction in Secondary Education: A Systematic Review of Research Evidence. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.02366>
- Smets, W., De Neve, D., & Struyven, K. (2022). Responding to students' learning needs: how secondary education teachers learn to implement differentiated instruction. *Educational Action Research*, 30(2), 243–260. <https://doi.org/10.1080/09650792.2020.1848604>
- Sofyan, H., Anggereini, E., & Saadiah, J. (2019). Development of E-Modules Based on Local Wisdom in Central Learning Model at Kindergartens in Jambi City. *European Journal of Educational Research*, 8(4), 1137–1143. <https://doi.org/10.12973/eu-jer.8.4.1137>
- Strogilos, V., Lim, L., & Buhari, N. B. M. (2023). *Differentiated instruction for students with SEN in mainstream classrooms contextual features and types of curriculum modifications.pdf*. <https://doi.org/10.1080/02188791.2021.1984873>
- Suardana, I. N., Redhana, I. W., Sudiarmika, A. A. I. A. R., & Selamat, I. N. (2018). Students' critical thinking skills in chemistry learning using local culture-based 7E learning cycle model. *International Journal of Instruction*, 11(2), 399–412. <https://doi.org/10.12973/iji.2018.11227a>
- Suardipa, P. (2019). Kajian Creative Thinking Matematis Dalam Inovasi Pembelajaran. *Purwadita: Jurnal Agama Dan Budaya*, 3(2), 15–22.
- Suastika, I. N., Suartama, I. K., Sanjaya, D. B., & Arta, K. S. (2021). Application of multicultural-based learning model syntax of social studies learning. *Cypriot Journal of Educational Sciences*, 16(4), 1660–1679. <https://doi.org/10.18844/cjes.v16i4.6030>
- Sulasmı, E. (2020). *Konsep Pendidikan Humanis dalam Pengelolaan Pendidikan di Indonesia*. Bildung.
- Sumardi, L. (2020). Pancasila: The Educational Philosophy Alternative from Indonesia for the World. *Journal of Education and Practice*, 11(11), 89–96. <https://doi.org/10.7176/jep/11-12-11>
- Sun, X. (2023). Differentiated instruction in L2 teaching: two extensive reading programmes conducted during COVID-19 pandemic. *Innovation in Language Learning and Teaching*, 17(2), 177–190.

<https://doi.org/10.1080/17501229.2021.1979985>

- Suprpto, N., Ibisono, H. S., & Mubarak, H. (2021). the Use of Physics Pocketbook Based on Augmented Reality on Planetary Motion To Improve Students' Learning Achievement. *Journal of Technology and Science Education*, 11(2), 526–540. <https://doi.org/10.3926/jotse.1167>
- Susanto, A. M., Epriliyana, N. N., & Utama, H. H. (2024). Implementation of Learning Innovations in Society 5.0 to Stimulate Creative Thinking Skills at Higher Education. *Jurnal Dimensi Pendidikan Dan Pembelajaran*, 12(1), 25–36. <https://doi.org/10.24269/dpp.v12i1.8282>
- Suwono, H., Maulidia, L., Saefi, M., Kusairi, S., & Yuenyong, C. (2022). The Development and Validation of an Instrument of Prospective Science Teachers' Perceptions of Scientific Literacy. *Eurasia Journal of Mathematics, Science and Technology Education*, 18(1). <https://doi.org/10.29333/EJMSTE/11505>
- Suwono, H., Permana, T., Saefi, M., & Fachrunnisa, R. (2021). The problem-based learning (PBL) of biology for promoting health literacy in secondary school students. *Journal of Biological Education*, 57(1), 230–244. <https://doi.org/10.1080/00219266.2021.1884586>
- Suwono, H., Saefi, M., & Susilo, H. (2019). Challenge based learning to improve scientific literacy of undergraduate biology students. *AIP Conference Proceedings*, 2081(March), 0–7. <https://doi.org/10.1063/1.5094018>
- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12, 257–285. [https://doi.org/https://doi.org/10.1016/0364-0213\(88\)90023-7](https://doi.org/https://doi.org/10.1016/0364-0213(88)90023-7)
- Sweller, J. (2011). Cognitive Load Theory. *Psychology of Learning and Motivation*, 55, 37–76. <https://doi.org/10.1016/B978-0-12-387691-1.00002-8>
- Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years ater. *Educational Psychology Review*, 31(2), 261–292. <https://doi.org/10.1007/s10648-019-09465-5>
- Szulewski, A., Howes, D., Van Merriënboer, J. J. G., & Sweller, J. (2021). From Theory to Practice: The Application of Cognitive Load Theory to the Practice of Medicine. *Academic Medicine*, 96(1), 24–30. <https://doi.org/10.1097/ACM.0000000000003524>
- Tamrin, A. G., Triyono, M. B., Saputro, I. N., Sucipto, T. L. A., & Asnur, L. (2025). Enhancing creative teaching behavior of vocational school teachers: structural equation modeling analysis. *Journal of Education and Learning*, 19(1), 221–231. <https://doi.org/10.11591/edulearn.v19i1.21812>
- Tang, A. C. Y., & Chow, M. C. M. (2020). To evaluate the effect of challenge-based learning on the approaches to learning of Chinese nursing students: A quasi-experimental study. *Nurse Education Today*, 85, 104293. <https://doi.org/10.1016/j.nedt.2019.104293>

- Tanti, Kurniawan, D. A., Kuswanto, Utami, W., & Wardhana, I. (2020). Science process skills and critical thinking in science: Urban and rural disparity. *Jurnal Pendidikan IPA Indonesia*, 9(4), 489–498. <https://doi.org/10.15294/jpii.v9i4.24139>
- Tomlinson, C. A. (2011). *Differentiate instruction in mixed-ability classrooms* (2nd). Association for Supervision and Curriculum Development.
- Trust, T., & Pektas, E. (2018). Using the ADDIE Model and Universal Design for Learning Principles to Develop an Open Online Course for Teacher Professional Development. *Journal of Digital Learning in Teacher Education*, 34(4), 219–233. <https://doi.org/10.1080/21532974.2018.1494521>
- Utami, L., Festiyed, Dian Purnama Ilahi, Arista Ratih, Elvi yenti, & Lazulva. (2024). Analisis Indeks Aiken Untuk Mengetahui Validitas Isi Instrumen Scinetific Habbits of Mind. *Journal of Research and Education Chemistry*, 6(1), 59. [https://doi.org/10.25299/jrec.2024.vol6\(1\).17430](https://doi.org/10.25299/jrec.2024.vol6(1).17430)
- van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2020). Determinants of 21st-Century Skills and 21st-Century Digital Skills for Workers: A Systematic Literature Review. *SAGE Open*, 10(1). <https://doi.org/10.1177/2158244019900176>
- van Merriënboer, J. J. G. (2013). Perspectives on problem solving and instruction. *Computers & Education*, 64, 153–160. <https://doi.org/10.1016/j.compedu.2012.11.025>
- Verburgh, A. (2019). Effectiveness of approaches to stimulate critical thinking in social work curricula. *Studies in Higher Education*, 44(5), 880–891. <https://doi.org/10.1080/03075079.2019.1586336>
- Vilalta-Perdomo, E., Michel-Villarreal, R., & Thierry-Aguilera, R. (2022). Integrating Industry 4.0 in Higher Education Using Challenge-Based Learning: An Intervention in Operations Management. *Education Sciences*, 12(10). <https://doi.org/10.3390/educsci12100663>
- Widiastuti, S. (2020). Deep Learning sebagai Kenormalan Baru dalam Pembelajaran. *Prosiding Seminar Nasional Kimia (SNK)*, 358–365. <https://kimia.fmipa.unesa.ac.id/wp-content/uploads/2021/01/358-365.pdf>
- Wijnen, F., Walma van der Molen, J., & Voogt, J. (2021). Measuring primary school teachers' attitudes towards stimulating higher-order thinking (SHOT) in students: Development and validation of the SHOT questionnaire. *Thinking Skills and Creativity*, 42(May). <https://doi.org/10.1016/j.tsc.2021.100954>
- Yang, L., Zhang, M., & Zhang, Z. (2022). The application of PBL in english teaching among middle schools of china. *The 3rd International Conference on Educational Innovation and Philosophical Inquiries (ICEIPI)*. <https://doi.org/10.54254/2753-7048/2/2022623>
- Yang, Z., Zhou, Y., Chung, J. W. Y., Tang, Q., Jiang, L., & Wong, T. K. S. (2018). Challenge based learning nurtures creative thinking: An evaluative study.

Nurse Education Today, 71(November 2016), 40–47.
<https://doi.org/10.1016/j.nedt.2018.09.004>

- Yuliana, I., Cahyono, M. E., Widodo, W., & Irwanto, I. (2021). The effect of ethnoscience-themed picture books embedded within contextbased learning on students' scientific literacy. *Eurasian Journal of Educational Research*, 2021(92), 317–334. <https://doi.org/10.14689/ejer.2021.92.16>
- Yunus, H. A. (2016). Telaah Aliran Pendidikan Progresivisme dan Esensialisme dalam Perspektif Filsafat Pendidikan. *Jurnal Cakrawala Pendas*, 2(1).
- 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>
- Yusuf, A. M., Hidayatullah, S., & Tauhidah, D. (2022). Hubungan Literasi Digital dan Saintifik dengan Hasil Belajar Kognitif Biologi Siswa SMA (The Relationship Between Digital and Scientific Literacy with Biology Cognitive Learning Outcomes of High School Students) ARTICLE HISTORY. *Assimilation: Indonesian Journal of Biology Education*, 5(1), 8–16. <https://doi.org/10.17509/aijbe.v5i1.43322>
- Zubaidah, S., Corebima, A. D., & Mistianah. (2015). Asesmen Berpikir Kritis Terintegrasi Tes Essay. *Symbion*, April 2015, 200–213. https://www.researchgate.net/publication/322315188_Asesmen_Berpikir_Kritis_Terintegrasi_Tes_Essay
- Zubaidah, S., Fuad, N. M., Mahanal, S., & Suarsini, E. (2017). Improving creative thinking skills of students through Differentiated Science Inquiry integrated with mind map. *Journal of Turkish Science Education*, 14(4), 77–91. <https://doi.org/10.12973/tused.10214a>