

## REFERENCES

- Afifah, A.N., Ilmiyati, N., & Toto. (2019). Model Project Based Learning (PjBL) Berbasis Stem Untuk Meningkatkan Penguasaan Konsep Dan Keterampilan Berpikir Kritis Siswa. Quagga. *Jurnal Pendidikan dan Biologi*. 11(2): 73-78.
- Afriana, J., Permanasari, A., & Fitriani, A. (2016). Penerapan Project Based Learning terintegrasi STEM untuk meningkatkan literasi sains siswa ditinjau dari gender. *Jurnal Inovasi Pendidikan IPA*. 2(2): 202-212.
- Aini, M., Suratno & Asyiah, I. N. (2020). Analysis of Students Critical Thinking Skills in Junior High School on Natural Sciences based on the Difference of Learning Styles. *Jurnal of Physics: Conference Series*. 1465 012047.
- Aini, M., Ridianingsih, D.S., Yunitasari, I. (2022). The effectiveness of STEM-Based Project Based Learning (PjBL) Larning Model on Critical Thingking Skills of Students. *Jurnal Kiprah Pendidikan*. 1(4): 247-25.
- Allanta, T. R., & Puspita, L. (2021). Analisis keterampilan berpikir kritis dan self efficacy peserta didik: Dampak PjBL - STEM. *Jurnal Inovasi Pendidikan IPA*. 7(2): 158-170.
- Ardianto, D., Firman, H., Permanasari, A., & Ramalis, T. R. (2019). What is Science, Technology, Engineering, Mathematics (STEM) Literacy?. *Proceedings of the 3rd Asian Education Symposium (AES 2018)*. Bandung, Indonesia.
- Arifianti, U. (2020). Project Based Learning dalam Pembelajaran IPA. *SHEs: Conference Series*. 3(3): 2079- 2082.
- Arifin, Z. (2017). Kriteria instrumen dalam suatu penelitian. *Jurnal Theorems (the original research of mathematics)*, 2(1), 28-36.
- Arikunto, S. (2013). *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.

- Asri, Y., Mursyidah, D., & Rizqi, V. (2021). Application of Project-Based Learning through a STEM Approach to Improve Learning Outcomes during a Pandemic. *Jurnal Penelitian Pendidikan IPA*, 7(4): 2460-2582.
- Badriyah, N., Anekawati, A., & Azizah, L. (2020). Application of PjBL with Brain-based STEAM Approach to Improve Learning Achievement of Students. *Jurnal Inovasi Pendidikan IPA*, 6(1): 88-100.
- Beier, M. E., Kim, M. H., Saterbak, A., Leautaud, V., Bishnol. S., Gilberto, J. M. (2018). The Effect of Authentic Project-based Learning on Attitudes and Career Aspirations in STEM. *Journal of Research in Science Teaching*. 56(1): 3-23.
- Billah, A., Masykuri, M., Sarwanto., Sajidan. (2021). Analysis of Critical Thinking in Junior High School Students through Science Learning in Indonesia: A Systematic Review. *Journal of Physics: Conference Series*. 1796(012013): 1-9.
- Bybee, R. W. (2013). *The case for STEAM education: Challenges and Opportunity*. United States of America: National Science Teachers Association (NSTA) Press.
- Capraro, M. C. (2015). *STEM Project-Based Learning: An Integrated Science, Technology, Engineering, and Mathematics (STEM) Approach (second ed)*. Rotterdam: Sense Publishers.
- Daryanto & Rahardjo, M. (2012). *Model Pembelajaran Inovatif*. Yogyakarta: Gava Media
- Dywan, A. A., & Airlanda, G. S., (2020). Efektivitas Model Pembelajaran Project Based Learning Berbasis STEM dan Tidak Berbasis STEM Terhadap Keterampilan Berpikir Kritis Siswa. *Jurnal Basicedu*. 4(2): 344- 354.
- Ennis, R. H. (1985). *At Outline of Goals for A Critical Thingking Curriculum in Deveolping Mind: A Resource Book For Teaching Thinking. Revised Edition, Vol I*. California: ASCD.
- Ennis, R. H. (1996). *Critical Thinking*. USA: Prentice Hall, Inc.

- Facione, P. 2011. *Critical Thinking: What It Is and Why Its Counts*. Lillbrae, CA: The California Academic Press.
- Facione, P. A., Giancarlo, C. A., Facione, N. C., Gainen, J. (1995). The Disposition Toward Critical Thinking. *Journal of General Education*. 44(1):1-25.
- Febriani, H. I., Hastuti, S. P., & Keliat, N.R. (2017). Penerapan Model Project Based Learning Dipadukan dengan Sharing Gallery pada Sistem Ekskresi untuk Meningkatkan Hasil Belajar Biologi Siswa Kelas VIII F SMP Negeri 5 Salatiga Tahun Ajaran 2016/2017. *Prosiding Seminar Nasional Sains II: Inovasi dan Pengembangan Kualitas Pembelajaran Sains Berbasis Pendidikan Karakter dan Teknologi di Era MEA*, Salatiga, 22 April 2017. 333-342.
- Fisher, A. 2003. *Critical Thinking An Introduction*. London: Cambridge University Press.
- Fitriyani, A., Toto., Erlin, E. (2020). Implementasi Model PjBL-STEM untuk Meningkatkan Keterampilan Berpikir Tingkat Tinggi. *Jurnal Pendidikan Biologi* 8(2): 1-6.
- Gallant, D.J. (2010). *Science, Technology, Engineering, and Mathematics (STEM) Education*. Ohio State University
- George Lucas Educational Foundation. (2005). Instructional module project based learning. [Online]. Diakses dari <http://www.edutopia.org/modules/pbl/project-based-learning>.
- Glaser, M. E. (1941). *An Experiment in The Development of Critical Thinking, Teacher's College*. Columbia: Columbia University
- Hadi, S., & Novaliyosi. (2019). TIMSS Indonesia (Trend In International Mathematics And Science Study). *Prosiding Seminar Nasional & Call for Papers*. 562–569.

- Hamdani, M., Prayitno, B. A., & Karyanto, P. (2019). Meningkatkan Kemampuan Berpikir Kritis Melalui Metode Eksperimen. *Proceeding Biology Education Conference*. 16 (1): 139-145.
- Hartini, S., Mariani, I., Misbah, M., & Sulaeman, N. F. (2020). Developing of students worksheets through STEM approach to train critical thinking skills. *Journal of Physics: Conference Series*. 1567(4): 1-6.
- Haryadi, R. & Pujiastuti, H. (2021). Enhancing Pre-service Physics Teachers' Higher-Order Thinking Skills through STEM-PjBL Model. *International Journal of STEM Education for Sustainability*. 2(2): 156-171.
- Herak, R. (2021). Peningkatan Hasil Belajar IPA Peserta Didik Kelas VIII Materi Sistem Ekskresi melalui Pengaruh Model STEM. *Jurnal Studi Guru dan Pembelajaran*. 4(1): 127-134.
- Hidayah, R., Salimi, M., Susiani, T. S. (2017). Critical Thinking Skill: Konsep dan Indikator Penilaian. *Jurnal Taman Cendekia*. 1(2): 127-133.
- Jauhariyyah, F. R., Suwono, H., & Ibrohim. (2017). Science, Technology, Engineering and Mathematics Project Based Learning (STEM-PjBL) pada Pembelajaran Sains. *Pros. Seminar Pend. IPA Pascasarjana UM*. Vol(2): 432-436.
- Johnson, E. B. (2011). *Menjadikan Kegiatan Belajar-Mengajar Mengasyikan dan Bermakna*. (Alih Bahasa: Ibnu Setiawan). Bandung: Kaifa Learning.
- Kaleci, D., & Korkmaz, Ö. (2018). STEM Education Research: Content Analysis. *Universal Journal of Educational Research*, 6(11), 2404–2412.
- Kemendikbud. (2013). *Materi Pelatihan Guru Implementasi Kurikulum 2013*. Jakarta: Kemendikbud.
- Kemdikbud. (2014). *Materi Pelatihan Guru Implementasi Kurikulum 2013 Tahun Ajaran 2014/2015: Mata pelajaran IPA SMP/MTs*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

- Komariyah, S., Laili, A. F. N. (2018). Pengaruh Kemampuan Berpikir Kritis terhadap Hasil Belajar Matematika. *Jurnal Penelitian Pendidikan dan Pengajaran Matematika*. 4(2): 55–60.
- Laboy-Rush, D. (2010). Integrated STEM education through project-based learning. [online] tersedia di [www.learning.com/stem/whitepaper/integrated-STEM-throughProjectbased-Learning](http://www.learning.com/stem/whitepaper/integrated-STEM-throughProjectbased-Learning).
- Lasidos, P. A., Matondang, Z. (2015). Pendekatan Model Pembelajaran Kolaboratif untuk Meningkatkan Aktifitas dan Hasil Belajar Rencana Anggaran Biaya Siswa Kelas XII Kompetensi Keahlian Teknik Gambar Bangunan SMKN 2 Siatas Barita Tapanuli Utara. *Jurnal Educational Building*. 1(1): 13-22.
- Lutfi., Ismail., & Azis, A. A. (2018). Pengaruh Project Base Learning Terintegrasi Stem Terhadap Literasi Sains, Kreativitas dan Hasil Belajar Peserta Didik. *Prosiding Seminar Nasional Biologi dan Pembelajarannya*. 189-194.
- Madahae, S., Pisapak, P., & Thanyasirikul, C. (2021). Learning Design of STEM Education through Workshop Training for Thai Teachers. *Journal of Physics: Conference Series*. 1835(1): 012062.
- Mamahit, J.A., Aloysius, D.C., & Suwono, H. (2020). Efektivitas Model Project Based Learning Terintegrasi STEM Terhadap Keterampilan Berpikir Kreatif Siswa Kelas X. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*. 5(9): 1284-1289.
- Mubassyr, I., Rahayu, H. M., Muldayanti, N. D. (2021). The Impact of PjBL to Students' HOTS in Human Excretion System Material. *EPiC Series in Biological Sciences: Proceedings of KOBİ 2nd International Conference on Management of Tropical Biodiversity for Human Welfare*. 1(11): 79-85.
- Nosich, G. M. (2005). *Learning to Think Things Through: A Guide to Critical Thinking Across the Curriculum 2<sup>nd</sup> Edition*. Upper Saddle River: Pearson Prentice Hall.

- Nurbaiti, S., Kartijono, N. E., & Herlina, L. (2016). Pengaruh Pembelajaran Model Project Based Learning Materi Sistem Ekskresi Terhadap Hasil Belajar Siswa. *Unnes Journal of Biology Education*. 5(2): 214-221.
- Nuryanti, L., Zubaidah, S., & Diantoro, M. (2018). Analisis Kemampuan Berpikir Kritis Siswa SMP. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*. 3(2): 155-158.
- Organisation for Economic Co-operation and Development. (2019). PISA 2018 Results. <https://doi.org/10.1787/5f07c754-en>.
- Patton, A. (2012). *Work that Matters the Teacher's Guide to Project-based Learning*. London: Paul Hamlyn Foundation.
- Sayekti, A. M., & Suparman. (2020). Development of PJBL-Based LKPD With STEM Approach Design to Improve Critical Thinking Skills. *International Journal of Scientific & Technology Research*, 9(3): 3390-3394.
- Scriven, M. & Paul, R. (1987). Defining Critical Thinking. *8th Annual International Conference on Critical Thinking and Education Reform*. [online] tersedia di <http://www.criticalthinking.org/pages/defining-critical-thinking/766>
- Simatupang, H., & Purnama, D. (2019). *Handbook Best Practice Strategi Belajar*. Surabaya: Pustaka Media Guru.
- Sumaya, A. Israwaty, I. Ilmi, N. (2021). Penerapan Pendekatan STEM untuk Meningkatkan Hasil Belajar Siswa Sekolah Dasar Di Kabupaten Pinrang. *PENISI: Journal of Education*. 1(2): 217-223.
- Sunaryo, W. (2011). *Taksonomi Berpikir*. Bandung: Remaja Rosdakarya.
- Suprayitno, T. (2019). *Pendidikan di Indonesia: Belajar dari hasil PISA 2018*. Badan Penelitian dan Pengembangan Pendidikan: Kementerian Pendidikan dan Kebudayaan.
- Rahmania. I. (2021). Project Based Learning (PjBL) Learning Model with STEM Approach in Natural Science Learning for the 21<sup>st</sup> Century. *Institut Riset dan Kritik Internasional Budapest-Jurnal (BIRCI-Journal)*. 4(1): 1161-1167.

- Rahmawati, S., Masykuri, M., Sarwanto, S. (2019). Analisis Kemampuan Berfikir Kritis Topik Klasifikasi Materi dan Perubahannya Siswa SMP Negeri di Kabupaten Magetan. *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*.
- Ramadhan, I., Nugraha, T., Firmansyah, E., Alkahfy, R., & Rian, R. (2021). Perubahan Proses Pembelajaran Tatap Muka Pasca Pembelajaran Daring Pada Masa Pandemi Covid-19 Di MAN 2 Pontianak. *Jurnal Ilmiah Wahana Pendidikan*, 7(8), 86-93.
- Ramdani, A., Jufri, A. W., Jamaludin., Setiad, D. (2020). Kemampuan Berpikir Kritis dan Penguasaan Konsep Dasar IPA Peserta Didik. *Jurnal Penelitian Pendidikan IPA*. 6(1): 119-124.
- Ratnasari, N., Sugiyanto., Muhardjito. (2018). Pembelajaran IPA Model Project Based Learning pada Materi Sistem Ekskresi untuk Mengukur Kemampuan Berfikir Kritis Peserta Didik. *Prosiding Seminar Nasional Pembelajaran IPA ke-3*. [online] tersedia di <http://repository.um-palembang.ac.id/id/eprint/19069/1/Prosiding-Seminar-Nasional-Pembelajaran-IPA-Ke-3-UM%20LENGKAP.pdf>
- Shahali, E. H. M., Halim, L., Rasul, M. S., Osman, K., & Zulkifeli, M. A. (2017). STEM Learning through Engineering Design: Impact on Middle Secondary Students' Interest towards STEM. *Eurasia Journal of Mathematics, Science and Technology Education*. 13(5):1189-1211.
- Septiani, T., Prima, N., & Nisak, F. (2019). Meta-Analisis Model Inquiri Based Learning untuk Pembelajaran IPA dan Fisika pada Abad 21 Program Studi Magister Pendidikan Fisika UNP Guru MAN 3 Padang. *Pillar of Physics Education*, 12(4): 865–872.
- Sujana, H. A., & Sopandi, H. W. (2020). Model-model Pembelajaran Inovatif: Teori dan Implementasi. Depok: Rajawali Pers.
- Sujana, I. W. C. (2019). Fungsi dan Tujuan Pendidikan Indonesia. *Jurnal Pendidikan Dasar*. 4(1): 29-39.

- Syukri, M., Halim, L., & Meerah, T. S. M. (2013). Pendidikan STEM dalam Enterpreneurial Science Thinking Escit: Satu Perkongsian dari UKM Untuk Aceh. *Aceh Development International Conference*. 1(6): 105-112.
- Susilawati, A., Hernan, H., Sinaga, P. (2017). The application of Project-based Learning Using Mind Maps to Improve Students' Environmental Attitudes towards Waste Management in Junior High School. *International Journal of Education*. 9(2): 120-125.
- Thalheimer, W., & Cook, S. (2002). *How to calculate effect sizes from published research articles: A simplified methodology*. Retrieved November 31, 2002 from [http://work-learning.com/effect\\_sizes.htm](http://work-learning.com/effect_sizes.htm).
- Tiruneh, D. T., De Cock, M., & Elen, J. (2018). Designing Learning Environments for Critical Thinking: Examining Effective Instructional Approaches. *International Journal of Science and Mathematics Education*, 16(6), 1065–1089.
- Tipani, A., Toto., & Yulisma, L. (2019). Implementasi Model PjBL Berbasis STEM untuk Meningkatkan Penguasaan Konsep dan Kemampuan Berfikir Analitis Siswa. *Jurnal Bio Educatio*, 4(2): 70-76.
- Wahyuni. (2018). Analisis Kesulitan Belajar Siswa pada Mata Pelajaran IPA di Kelas VII SMP Negeri 4 Terbanggi Besar. *Jurnal Sains dan Teknologi*. 1(1): 19-26.
- Wahyunita, I., & Subroto, W. T. (2021). Efektivitas Model Pembelajaran dengan Pendekatan STEM Dalam Upaya Meningkatkan Kemampuan Berfikir Kritis Peserta Didik. *Jurnal Ilmu Pendidikan*. 3(3): 1010 – 1021.
- Widya., Rifandi, R., & Rahmi, Y. L. (2019). STEM Education to Fulfil the 21st Century Demand: A Literature Review. *Journal of Physics*. 1317(1): 1-7.
- Yustyan, S., Widodo, N., Pantiwati, Y. (2015). Peningkatan Kemampuan Berfikir Kritis dengan Pembelajaran Berbasis Scientific Approach Siswa Kelas X SA Panjura Malang. *Jurnal Pendidikan Biologi Indonesia*. 1(2): 240-254.



Zubaidah, Siti. (2019). Memberdayakan Keterampilan Abad Ke-21 Melalui Pembelajaran Berbasis Proyek. *Seminar Nasional*. FMIPA Universitas Negeri Malang.

Zamista, A. A. (2018). Increasing Persistence of Collage Students in Science Technology Engineering and Mathematic (STEM). *Curricula Journal of Teaching and Learning*. 3(1): 22–31.

