

## DAFTAR PUSTAKA

- Abdullah, N., Halim, L., & Zakaria, E. (2014). VStops: A thinking strategy and visual representation approach in mathematical word problem solving toward enhancing STEM literacy. *Eurasia Journal of Mathematics, Science and Technology Education*, 10(3), 165–174. <https://doi.org/10.12973/eurasia.2014.1073a>
- Abrouq, N. (2024). Understanding how Reflective Journal Writing Stimulates Reflective Reasoning: A Literature Review. *British Journal of Teacher Education and Pedagogy*, 1(1), 1–7. <https://doi.org/10.32996/bjtep>
- Adam, J. B. (2018). The Fourth Industrial Revolution and education. *South African Journal of Science*, 114(5/6), 17159. <https://doi.org/10.17159/sajs.2018/a0271>
- Akaygun, S., & Aslan-Tutak, F. (2016). STEM Images Revealing STEM Conceptions of Pre-Service Chemistry and Mathematics Teachers. *International Journal of Education in Mathematics, Science and Technology*, 4(1), 56. <https://doi.org/10.18404/ijemst.44833>
- Alex, S. (2003). *Psikologi Umum*. Pustaka Setia.
- Alfayez, M. Q. E. (2024). Availability of STEAM Approach Requirements among Intermediate-Stage Mathematics Teachers and Their Attitudes towards It. *International Journal of Instruction*, 17(1), 215–228. <https://doi.org/10.29333/iji.2024.17112a>
- Alhassan, R. (2016). Mobile Learning as a Method of Ubiquitous Learning: Students' Attitudes, Readiness, and Possible Barriers to Implementation in Higher Education. *Journal of Education and Learning*, 5(1), 176. <https://doi.org/10.5539/jel.v5n1p176>
- Aluko, R. (2017). Applying UNESCO guidelines on mobile learning in the South African context: Creating an enabling environment through policy. *International Review of Research in Open and Distance Learning*, 18(7), 24–44. <https://doi.org/10.19173/irrod1.v18i7.2702>
- Ananda, L. R., Rahmawati, Y., Khairi, F., & Irwanto. (2024). Developing the Computational Thinking Skills of Chemistry Students by Integrating Design Thinking with STEAM-PjBL. *AIP Conference Proceedings*, 2982(1). <https://doi.org/10.1063/5.0183005>
- Anita, N. (2016). Pengembangan Dan Peningkatan Kompetensi Guru Dalam Membuat Media Pembelajaran. *Seminar Hasil Penelitian Dan Pengabdian Masyarakat*, 164–167.
- Arnesen, K. K., & Rø, K. (2024). The complexity of supporting reasoning in a mathematics classroom of shared authority. *Mathematical Thinking and Learning*, 26(2), 159–184. <https://doi.org/10.1080/10986065.2022.2059628>
- Arsyad, A. (2014). *Media Pembelajaran*. Raja Grafindo Persada.

- Asih, B. A., Parwati, D. R., & Susilo, B. E. (2024). Literature Review: The Effect of STEAM-Based Learning on Students' Mathematical Learning Outcomes. *PRISMA, Prosiding ..., 7*, 554–558. <https://proceeding.unnes.ac.id/prisma/article/view/3004>
- Ayalon, M., & Even, R. (2008). Deductive reasoning : in the eye of the beholder. *Educ Stud Math*, 69, 235–247. <https://doi.org/10.1007/s10649-008-9136-2>
- Ayalon, M., & Even, R. (2010). Views of Mathematics Educators on the Role of Mathematics Learning in the Development of Deductive Reasoning. *International Journal of Science and Mathematics Education*, 8, 1131–1154.
- Azmi, M. (2016). Pengembangan Mobile Learning sebagai Alternatif Media Pembelajaran di Masa Depan. *Prosiding Seminar Nasional Teknologi Pendidikan*, 1–13.
- Baek, Y., Zhang, H., & Yun, S. (2017). Teachers' attitudes toward mobile learning in Korea. *Turkish Online Journal of Educational Technology*, 16(1), 154–163.
- Bain, E. (1992). *Introduction to probability and mathematical statistics*. Duxbury Prees.
- Baker, R., Ma, W., Zhao, Y., Wang, S., & Ma, Z. (2020). The results of zone of proximal development on learning outcome. *Proceedings of The 13th International Conference on Educational Data Mining (EDM 2020)*, 1(1), 749–749. <https://files.eric.ed.gov/fulltext/ED608058.pdf>
- Bakermans, M. H. (2018). Assessing information literacy instruction in interdisciplinary first year project-based courses with STEM students. *Library and Information Science Research*, 40, 98–105.
- Balacheff, N., Ludvigsen, S., De Jong, T., Lazonder, A., & Barnes, S. (2009). Technology-enhanced learning: Principles and products. *Technology-Enhanced Learning: Principles and Products*, 1–323. <https://doi.org/10.1007/978-1-4020-9827-7>
- Balasubramanian, K., Thamizoli, P., Umar, A., & Kanwar, A. (2010). Using mobile phones to promote lifelong learning among rural women in Southern India. *Distance Education*, 31(2), 193–209. <https://doi.org/10.1080/01587919.2010.502555>
- Bamford, A. (2001). The Grammar of Visual Literacy within the World of Interactive Media. *Education Research Network Conference on Learning (8th.,*
- Barkl, S., Porter, A. M. Y., & Ginns, P. (2012). Cognitive training for children: effects on inductive reasoning, deductive reasoning, and mathematics achievement in an australian school setting. *Psychology in the Schools*, 49(9), 828–842. <https://doi.org/10.1002/pits>
- Barreh, K. A. (2015). A framework for mobile leanring for enhancing learnign in higher education. *Malaysian Online Journal of Educational Technology*, 3(3), 1–9. <https://doi.org/10.1002/hed.23733>
- Barron, B., Schwartz, D., Vye, N., Moore, A., Petrosino, A., Zech, L., & Bransford, J.

- (2007). Doing With Understanding: Lessons From Research on Problem and Project-Based Learning. *Journal of the Learning Sciences*, 7(3), 271–311. [https://doi.org/10.1207/s15327809jls0703&4\\_2](https://doi.org/10.1207/s15327809jls0703&4_2)
- Beaudrie, B. (2007). *The Numeracy Action Plan: The Case for Quantitative Literacy in the State of New Hampshire* (New Hampsh). Plymouth State University.
- Bertens, K. (1975). *Sejarah Filsafat Yunani*. Kanisius.
- Bishop, J. (2015). *Partnership For 21st Century Skill*.
- Bjuland, R. (2007). Adult Students' Reasoning in Geometry: Teaching Mathematics through Collaborative Problem Solving in Teacher Education. *The Montana Mathematics Enthusiast*, 4(1), 1–30.
- Blackley, S., & Howell, J. (2015). A STEM Narrative: 15 Years in the Making. *Australian Journal of Teacher Education*, 40(40). <https://doi.org/10.14221/ajte.2015v40n7.8>
- Blum, W., & Ferri, R. B. (2009). Mathematical modelling: Can it be taught and learnt? *Journal of Mathematical Modelling and Application*, 1(1), 45–58. <http://proxy.furb.br/ojs/index.php/modelling/article/view/1620>
- Board, N. S. (2018). *Elementary and Secondary Mathematics and Science Education*.
- Boersma, S., Diefenderfer, C., Dingman, S., & Madison, B. (2011). Quantitative Reasoning in the Contemporary World, Assessing Student Learning. *Numeracy*, 4(2), 1–8. <https://doi.org/10.5038/1936-4660.4.2.8>
- Boud, D., & Bearman, M. (2024). The assessment challenge of social and collaborative learning in higher education. *Educational Philosophy and Theory*, 56(5), 459–468. <https://doi.org/10.1080/00131857.2022.2114346>
- Boulden, D. C. & M. A. E. (2017). Teaching an Online Graduate Multimedia Design Course Using Studio-Based Pedagogy. *International Journal for the Scholarship of Technology Enhanced Learning*, 1(2), 145–160.
- Brodie, K. (2009). *Teaching Mathematical Reasoning in Secondary School Classrooms* (Vol. 775). Springer Science & Business Media.
- Broggy, J., Reilly, J. O., & Erduran, S. (2017). Interdisciplinarity and Science Education. In *Science Education* (pp. 81–90). [https://doi.org/10.1007/978-94-6300-749-8\\_6](https://doi.org/10.1007/978-94-6300-749-8_6)
- Byiringiro, E. (2024). The Effect of Students Self-Confidence on Mathematics Achievement in High School in Korea. *East African Journal of Education Studies*, 7(1), 231–239. <https://doi.org/10.37284/eajes.7.1.1765>
- Caracelli, V. J. (1993). Data Analysis Strategies for Mixed-Method Evaluation Designs. *Educational Evaluation and Policy Analy*, 15(2), 195–207. <https://doi.org/10.3102/01623737015002195>

- Chafidah, N., Hayati, N., & Ika, M. B. (2024). Project-Based Learning Integrated with STEAM : A Study on Educational Pop-Up Books for Early Literacy. *Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini*, 9(March), 131–143.
- Chen, C. H., & Yang, Y. C. (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*, 26(October 2018), 71–81. <https://doi.org/10.1016/j.edurev.2018.11.001>
- Chen, C., & Lin, J. (2018). A Practical Action Research Study of the Impact of Maker-Centered STEM-PjBL on a Rural Middle School in Taiwan. *International Journal of Science and Mathematics Education*, 1–24. <https://doi.org/10.1007/s10763-019-09961-8>
- Chen, M.-R. A., & Lin, Y.-H. (2024). A reflective e-learning approach for reading, thinking, and behavioral engagement. *Language Learning & Technology*, 2024(1), 1–20. <https://hdl.handle.net/10125/73548>
- Chen, W., Tang, X., & Mou, T. (2019). Course design and teaching practice in STEAM education at distance via an interactive e-learning platform. *Asian Association of Open Universities Journal*, 14(2), 122–133. <https://doi.org/10.1108/aaouj-07-2019-0027>
- Cheng, R. W. Y., Lam, S. F., & Chan, J. C. Y. (2008). When high achievers and low achievers work in the same group: The roles of group heterogeneity and processes in project-based learning. *British Journal of Educational Psychology*, 78(2), 205–221. <https://doi.org/10.1348/000709907X218160>
- Cheon, J., Lee, S., Crooks, S. M., & Song, J. (2012). Computers & Education An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers & Education*, 59(3), 1054–1064. <https://doi.org/10.1016/j.compedu.2012.04.015>
- Chinofunga, M. D., Chigeza, P., & Taylor, S. (2024). How can procedural flowcharts support the development of mathematics problem-solving skills? In *Mathematics Education Research Journal* (Issue 0123456789). Springer Netherlands. <https://doi.org/10.1007/s13394-024-00483-3>
- Conner, A., Singletary, L. M., Smith, R. C., Wagner, A., & Francisco, R. T. (2014). Mathematical Thinking and Learning Identifying Kinds of Reasoning in Collective Argumentation. *Mathematical Thinking and Learning*, 16(2014), 181–200. <https://doi.org/10.1080/10986065.2014.921131>
- Creswell, & Clark, P. (2011). Designing and Conducting Mixed Methods Research. In *SAGE Publications* (2nd ed.). SAGE Publications. <http://journals.sagepub.com/doi/10.1177/1049731508318695>
- Crompton, H., & Burke, D. (2015). Research Trends in the Use of Mobile Learning in Mathematics. *International Journal of Mobile and Blended Learning*, 7(4), 1–15. <https://doi.org/10.4018/ijmbl.2015100101>

- Czerniak. (2007). *Interdisciplinary science teaching*. (Handbook o).
- Daghan, G. (2015). *Mixed Methods in Social & Behavioral Research* (2 nd Editi, Issue January). Elementary Education. <https://doi.org/10.17051/io.2015.07705>
- Dahlan, J. A., & Juandi, D. (2011). Analisis Representasi Matematik Siswa Sekolah Dasar Dalam Penyelesaian Masalah Matematika Kontekstual. *Jurnal Pengajaran Matematika Dan Ilmu Pengetahuan Alam*, 16(1), 128. <https://doi.org/10.18269/jpmipa.v16i1.273>
- Dai, G., Liu, Y., & Cui, S. (2018). A Study on the Mobile Learning of English and American Literature Based on Wechat Public Account. *English Language Teaching*, 11(6), 47. <https://doi.org/10.5539/elt.v11n6p47>
- Darmawijoyo, A. Z. &. (2013). Pengembangan Soal Matematika Model Pisa Pada Konten Quantity Untuk Mengukur kemampuan Penalaran Matematis Siswa Sekolah Menengah Pertama. *Jurnal Pendidikan Matematika*, 5(1), 14–26.
- Daşcioğlu, S., & Öğretmen, T. (2024). Detection of differential item functioning with latent class analysis: PISA 2018 mathematical literacy test. *International Journal of Assessment Tools in Education*, 11(2), 249–269. <https://doi.org/10.21449/ijate.1387041>
- DeJarnette, N. K. (2018). Implementing STEAM in the Early Childhood Classroom. *European Journal of STEM Education*, 3(3), 1–9. <https://doi.org/10.20897/ejsteme/3878>
- Demir, K., & Akpinar, E. (2018). The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning. *Malaysian Online Journal of Educational Technology*, 6(2), 48–59. <https://doi.org/10.17220/mojet.2018.02.004>
- Detel, W. (2015). Social Constructivism. In *International Encyclopedia of the Social & Behavioral Sciences: Second Edition* (Second Edi, Vol. 22). Elsevier. <https://doi.org/10.1016/B978-0-08-097086-8.63081-7>
- Dingman, S. W. (2011). *Twenty-First-Century Quantitative Education: Beyond Content* (Vol. 13, Issue 3).
- Domingo, M. G., & Garganté, A. B. (2016). Computers in Human Behavior Exploring the use of educational technology in primary education : Teachers ' perception of mobile technology learning impacts and applications ' use in the classroom. *Computers in Human Behavior*, 56, 21–28. <https://doi.org/10.1016/j.chb.2015.11.023>
- Driscoll, D. L., Salib, P., & Rupert, D. J. (2007). *Merging Qualitative and Quantitative Data in Mixed Methods Research : How To and Why Not*. 18–28.
- Druin, A. (2009). Mobile Technology for Children. In *Mobile Technology for Children*. <https://doi.org/10.1016/B978-0-12-374900-0.00010-7>

- Dwirahayu, G., Kustiawati, D., & Bidari, I. (2018). Pengaruh Habits of Mind Terhadap Kemampuan Generalisasi Matematis. *Jurnal Penelitian Dan Pembelajaran Matematika*, 11(2), 91–104. <https://doi.org/10.30870/jppm.v11i2.3757>
- Educating For The Fourth Industrial Revolution (2019). <https://www.stuff.co.nz/national/education/102229533/educating-for-the-fourth-industrial-revolution>
- Erdogan, N., Navruz, B., Younes, R., & Capraro, R. M. (2016). Viewing how STEM project-based learning influences students' science achievement through the implementation lens: A latent growth modeling. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(8), 2139–2154. <https://doi.org/10.12973/eurasia.2016.1294a>
- Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, Cognitivism, Constructivism: Comparing Critical Features From an Instructional Design Perspective. *Performance Improvement Quarterly*, 26(2), 43–71. <https://doi.org/10.1002/piq.21143>
- Evans, J. S. B. (2004). H. of the dual process theory of reasoning. I. P. of reasoning (pp. 251-276). P. P. (2004). History of the dual process theory of reasoning. In Psychology Press (Ed.), *In Psychology of reasoning* (pp. 251–276). Taylor & Francis.
- Fathani, A. H. (2016). Pengembangan literasi matematika sekolah Dalam Perspektif Multiple Intelligences. *Jurnal EduSains*, 4(2), 136–150.
- Febriyana Retno Putri, Sri Marmoah, S. (2023). Analyzing Students Mathematical Problem Solving Skills Through HOTS-Based Questions at the Elementary School Level. *Mini International Conference of Educational Research and Innovation (MICERI 2023) SHEs: Conference Series* 7 (1) (2024) 85 – 95 Analyzing, 7(Miceri 2023), 85–95.
- Ferrara, R. A. (2019). Children ' s Learning and Transfer of Inductive Reasoning Rules : Studies of Proximal Development. *Child Development*, 57(5), 1087–1099.
- Findsen, B., Golding, B., Krašovec, S. J., Schmidt-hertha, B., Dqg, N., Kdyh, Z., Ohduqw, Z. H., Olihorqj, D., Lq, O., Olih, O., Olih, O., Exw, O., Rq, D., Iurp, L., V, Q. N., Shuvshfwlyhv, V. F., Phwkrgv, D. Q. G., Gr, H. F., Uhjdug, Q. R. W., ... Olih, P. (2017). Through life there is learning. *Australian Journal of Adult Learning*, 57(3), 1–18.
- Foundation, N. S. (1992). *A Foundation for the 21 st Century*.
- Fukaya, T., Fukuda, M., & Suzuki, M. (2023). Relationship between mathematical pedagogical content knowledge, beliefs, and motivation of elementary school teachers. *Frontiers in Education*, 8(January), 1–11. <https://doi.org/10.3389/feduc.2023.1276439>
- Gardiner, V. (2017). More than Standardisation: Teacher's Professional Literacy Learning in Australia? *Australian Journal of Teacher Education*, 42(10), 93–107.

<https://doi.org/10.14221/ajte.2017v42n10.6>

- Goel, V. (2007). Anatomy of Deductive Reasoning. *Trends in Cognitive Sciences*, 11(10), 435–441. <https://doi.org/10.1016/j.tics.2007.09.003>
- Goel, V., & Dolan, R. J. (2004). Differential involvement of left prefrontal cortex in inductive and deductive reasoning. *Cognition*, 93. <https://doi.org/10.1016/j.cognition.2004.03.001>
- Goktas, Y. (2009). *Main Barriers and Possible Enablers of ICTs Integration into Pre-service Teacher Education Programs*. 12(1).
- Graham, K. J., & Fennell, F. S. (2001). Principles and Standards for School Mathematics and Teacher Education: Preparing and Empowering Teachers . *School Science and Mathematics*, 101(6), 319–327. <https://doi.org/10.1111/j.1949-8594.2001.tb17963.x>
- Greeno, J. G. (1996). *Cognition and learning*.
- Grimus, M., & Ebner, M. (2016). Mobile Learning and STEM - First Experiences in a Senior High School in Ghana. *Routledge, January*, 1–16.
- Groff, J. (2008). A Framework for Addressing Challenges to Classroom Technology Use. *AACE Journal*, 16, 21–46.
- Güler, H. K. (2019). Mathematical competencies required by Mathematical Literacy Problem. *Malaysian Online Journal of Educational Sciences*, 7(2), 57–70.
- Guo, J., & Woulfin, S. (2016). Twenty-First Century Creativity: An Investigation of How the Partnership for 21st Century Instructional Framework Reflects the Principles of Creativity. *Roeper Review*, 38(3), 153–161. <https://doi.org/10.1080/02783193.2016.1183741>
- Guthrie, W. K. C. (1962). *A History of Greek Philosophy* (Issue 2). Cambridge University Press.
- Hadinugrahaningsih, T., Rahmawati, Y., & Ridwan, A. (2017). Developing 21st century skills in chemistry classrooms: Opportunities and challenges of STEAM integration. *AIP Conference Proceedings*, 1868. <https://doi.org/10.1063/1.4995107>
- Hall, T. (2015). Special Issue on Mobile Learning in Teacher Education. In *Internasional Journal Mobile Learning* (pp. 5–6).
- Hamdi, M. N., Handayani, D., & Supriadi, B. (2024). *Student ' s perspective : Mathematical reasoning ability and correlations between mathematics and physics*. 2(1), 53–60. <https://doi.org/10.62672/joease.v2i1.31>
- Hamsa, V. (2009). Reasoning and Reflecting in Mathematical Literacy. *Learning and Teaching Mathematics*, 1(7), 47–52.
- Hamzah, A. M. (2023). Trends in International Mathematics and Science Study (TIMSS)

- as A Measurement for Student Mathematics Assessment Development. *12 Waiheru*, 9(2), 189–196. <https://doi.org/10.47655/12waiheru.v9i2.144>
- Han, S. Y. (2013). The Impact of Stem PBL Teacher Professional Development on Student Mathematics Achievement in High Schools. *ProQuest Dissertations and Theses*, August, 136. [http://search.proquest.com/docview/1508260347?accountid=11054%5Cnhttp://jj2ec6wc6q.search.serialssolutions.com/?ctx\\_ver=Z39.88-2004&ctx\\_enc=info:ofi/enc:UTF-8&rfr\\_id=info:sid/ProQuest+Dissertations+%2526+Theses+Global&rft\\_val\\_fmt=info:ofi/fmt:kev:mtx:diss](http://search.proquest.com/docview/1508260347?accountid=11054%5Cnhttp://jj2ec6wc6q.search.serialssolutions.com/?ctx_ver=Z39.88-2004&ctx_enc=info:ofi/enc:UTF-8&rfr_id=info:sid/ProQuest+Dissertations+%2526+Theses+Global&rft_val_fmt=info:ofi/fmt:kev:mtx:diss)
- Hansson, H., & Jonsson, B. (1994). A Logic for Reasoning about Time and Reliability. *Formal Aspects of Computing*, 6, 512–535. <https://doi.org/10.1007/BF01211866>
- Haryati, T., Nindiasari, H., & Sudiana, R. (2017). Analisis Kemampuan Dan Disposisi Berpikir Reflektif Matematis Siswa Ditinjau Dari Gaya Belajar. *Jurnal Penelitian Dan Pembelajaran Matematika*, 10(2), 146–158. <https://doi.org/10.30870/jppm.v10i2.2039>
- Hayati, T. R. (2019). Analysis of Mathematical Literacy Processes in High School Students. *International Journal of Trends in Mathematics Education Research*, 2(3), 116–119.
- Hayes, B. K. (2010). Inductive reasoning. *Inductive Reasoning. Wiley Interdisciplinary Reviews: Cognitive Science.*, 1(2), 278–292. <https://doi.org/10.1002/wcs.20>
- Hayun, M., & Hutami, Y. (2024). Realistic Mathematic Education (RME) Approach Assisted By Time Board Displays on The Mathematical Cognitive Abilities of Elementary School Students. *International Journal of Business, Law, and Education*, 5(1), 466–472. <https://doi.org/10.56442/ijble.v5i1.408>
- Holyoak, K. J., & Morrison, R. G. (2005). *The Cambridge Handbook of Thinking and Reasoning*. Cambridge University Press. <https://doi.org/10.1007/s13398-014-0173-7.2>
- Hulme, A. K. (2005). *A handbook for educators and trainers*. Routledge.
- Hussin, A. A. (2018). Education 4.0 Made Simple: Ideas For Teaching. *International Journal of Education and Literacy Studies*, 6(3), 92. <https://doi.org/10.7575/aiac.ijels.v.6n.3p.92>
- Hutagaol, K. (2013). Pembelajaran Kontekstual Untuk Meningkatkan Kemampuan Representasi Matematis Siswa Sekolah Menengah Pertama. *Infinit : Jurnal Ilmiah Program Studi Matematika*, 2(1), 85–99. <http://u.lipi.go.id/1418615137>
- Jabbour, K. K. (2014). An analysis of the effect of mobile learning on Lebanese higher education. *Informatics in Education-An International Journal*, 13(1), 53–67.
- Jablonka, E. (2003). Mathematical Literacy. *Second International Handbook of Mathematics Education*, January, 75–102. <https://doi.org/10.1007/978-94-010->

0273-8\_4

- Jamali, S. M. (2017). Self Efficacy, Scientific Reasoning, and Learning Achievement in the STEM PjBL Literature. *IPCoRe, August*.
- James, W., Oates, G., & Schonfeldt, N. (2024). Improving retention while enhancing student engagement and learning outcomes using gamified mobile technology. *Accounting Education*, 1–21. <https://doi.org/10.1080/09639284.2024.2326009>
- Jamieson, H. (2007). *Visual Communication, More Than Meets the Eye*. Intellect.
- Javed, J. W. & S. (1996). Science Technology and Mathematics (STEM) Adult Literacy project. *International Journal of Technology and Design Education*, 6(2), 173–175. <https://doi.org/10.1007/BF00419923>
- Jeon, M. (2017). Robot Opera: A modularized afterschool program for STEAM education at local elementary school. *2017 14th International Conference on Ubiquitous Robots and Ambient Intelligence, URAI 2017*, 935–936. <https://doi.org/10.1109/URAI.2017.7992869>
- Jiuan, T. Y. (2007). Amalan Pemikiran Reflektif Dalam Kalangan Guru Matematik Sekolah Menengah. In *Universiti Putra Malaysia* (Vol. 1, Issue 1).
- Johar, R. (2019). Tingkat Berpikir Kreatif Siswa dalam Pemecahan dan Pengajuan Masalah Matematika melalui Tipe Soal Open Ended di SMP. *Jurnal Peluang*, 7(1), 22–30. <https://doi.org/10.24815/jp.v7i1.13741>
- Johnson, R. B. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, 1(2), 112–133. <https://doi.org/10.1177/1558689806298224>
- Johnson, R. B. (2017). Dialectical Pluralism: A Metaparadigm Whose Time Has Come. *Journal of Mixed Methods Research*, 11(2), 156–173. <https://doi.org/10.1177/1558689815607692>
- Jou, E. (2016). Mathematical induction: deductive logic perspective. *European Journal of Science and Mathematics Education*, 4(3), 315–330.
- Jurado, E., Fonseca, D., Coderch, J., & Canaleta, X. (2020). Social steam learning at an early age with robotic platforms: A case study in four schools in Spain. *Sensors (Switzerland)*, 20(13), 1–23. <https://doi.org/10.3390/s20133698>
- Kaiser, G., Blum, W., Ferri, R. B., & Stillman, G. (2011). *Trends in Teaching and Learning of Mathematical Modelling – Preface*. 1–5. [https://doi.org/10.1007/978-94-007-0910-2\\_1](https://doi.org/10.1007/978-94-007-0910-2_1)
- Kamienski, N., & Radziwill, N. (2018). Design for STEAM: Creating Participatory Art with Purpose. *The STEAM Journal*, 3(2), 1–17. <https://doi.org/10.5642/steam.20180302.08>
- Kangas, K., Sormunen, K., & Korhonen, T. (2022). Creative Learning with Technologies

- in Young Students' STEAM Education. *Lecture Notes in Educational Technology*, 157–179. [https://doi.org/10.1007/978-981-19-0568-1\\_9](https://doi.org/10.1007/978-981-19-0568-1_9)
- Kariadinata, R. (2014). Desain Dan Pengembangan Perangkat Lunak ( Software ) Pembelajaran Matematika Berbasis. *Jurnal Pendidikan Matematika*, 1(2), 56–73.
- Karina, A., Oktariani, A. P., Anh, D., & Hong, C. (2024). *Improving Learning Outcomes Using Jigsaw Learning in High Class Elementary Schools*. 5(2). <https://doi.org/10.37251/jber.v5i2.747>
- Kay, R. (2018a). Examining Individual Differences in the Use of STEM-Based Mobile Apps. *EDULEARN18 Proceedings*, 1(July), 2069–2076. <https://doi.org/10.21125/edulearn.2018.0577>
- Kay, R. (2018b). *Understanding How Teachers Influence the Effectiveness of STEM-Based Mobile Understanding How Teachers Influence the Effectiveness of STEM-Based Mobile Apps*. October.
- Kearney, M. (2018). Mobile STEM Learning Scenarios. *Springer Nature*, 46(2016), 287–308. [https://doi.org/10.1007/978-981-10-8246-7\\_11](https://doi.org/10.1007/978-981-10-8246-7_11)
- Kelana, J. B., Wardani, D. S., Firdaus, A. R., Altaftazani, D. H., & Rahayu, G. D. S. (2020). The effect of STEM approach on the mathematics literacy ability of elementary school teacher education students. *Journal of Physics: Conference Series*, 1657(1). <https://doi.org/10.1088/1742-6596/1657/1/012006>
- Kemp, K., & Johnson, A. B. (2013). Spatial Literacy. In *Encyclopedia of Geographic Information Science* (1st ed.). Epifania Akosua Amoo-Adare. <https://doi.org/10.4135/9781412953962.n195>
- Kharisma, R. N. (2016). Pengaruh Metode Bercerita Menggunakan Papan Flanel Terhadap Kemampuan Mengenal Bilangan 1-20 Pada Anak. *Jurnal.Fkip.Uns.Ac.Id*.
- Kim, J., Sa, D., & Kim, J. (2016). Towards Higher Educational M-Learning Platform for Conceptual STEAM Environment. *International Journal of Multimedia and Ubiquitous Engineering*, 11(8), 93–98. <https://doi.org//dx.doi.org/10.14257/ijmue.2016.11.8.10>
- Klauer, K. J., & Phye, G. D. (2008). Inductive Reasoning: A Training Approach. *Review of Educational Research*, 78(1), 85–123. <https://doi.org/10.3102/0034654307313402>
- Kosko, K., & Wilkins, J. (2011). Communicating Quantitative Literacy: An Examination of Open-Ended Assessment Items in TIMSS, NALS, IALS, and PISA. *Numeracy*, 4(2). <https://doi.org/10.5038/1936-4660.4.2.3>
- Krajcik, J. S. (2014a). Promises and challenges of using learning technologies to promote student learning of science. In *Handbook of research on science education* (2nd ed., pp. 337–360).
- Krajcik, J. S. (2014b). *Teaching Science in Elementary and Middle School* (4th ed.).

Roultiedge.

- Krawec, J. L. (2014). Problem Representation and Mathematical Problem Solving of Students of Varying Math Ability. *Journal of Learning Disabilities*, 47(2), 103–115. <https://doi.org/10.1177/0022219412436976>
- Kristiawan, M. (2016). *Filsafat Pendidikan, The Choice is Yours*. Valia Pustaka Jogjakarta.
- Kunda, Z. (1990). The Case for Motivated Reasoning. *Psychological Bulletin*, 108(3), 480–498. <https://doi.org/10.1037/0033-2909.108.3.480>
- Kusmaryono, I., Jupriyanto, & Kusumaningsih, W. (2021). Construction of students' mathematical knowledge in the zone of proximal development and zone of potential construction. *European Journal of Educational Research*, 10(1), 341–351. <https://doi.org/10.12973/eu-jer.10.1.341>
- Laboy-Rush, D. (2011). Integrated STEM Education through Project-Based Learning. *Learning.Com*. <https://www.rondout.k12.ny.us/common/pages/DisplayFile.aspx?itemId=16466975>
- Laeli, S. I., & Purwoningsih, T. (2024). The Development of PJBL-STEAM Learning Design to Improve the Student Creativity in Handling Waste: Utilizing Used Cardboard in Making Simple Miniature ATMs. *International Journal of Current Science Research and Review*, 07(06), 3623–3635. <https://doi.org/10.47191/ijcsrr/V7-i6-11>
- Laird, J. (1999). Deductive reasoning. *Annual Review of Psychology*, 50, 109–135. [wos:000078701400006](https://doi.org/10.1146/annurev.psych.50.1.109)
- Lakshminarayanan, V., & McBride, A. C. (2015). The use of high technology in STEM education. *Education and Training in Optics and Photonics: ETOP 2015*, 9793(October), 97930C. <https://doi.org/10.1117/12.2223062>
- Land, M. H. (2013). Full STEAM ahead: The benefits of integrating the arts into STEM. *Procedia Computer Science*, 20, 547–552. <https://doi.org/10.1016/j.procs.2013.09.317>
- Lange, J. De. (2006). Mathematical literacy for living from OECD-PISA perspective. *Tsukuba Journal of Educational Study in Mathematics*, 25, 13–35. <http://www.human.tsukuba.ac.jp/~mathedu/2503.pdf>
- Laurens, T., Batlolona, F. A., Batlolona, J. R., & Leasa, M. (2018). How Does Realistic Mathematics Education (RME) Improve Students' Mathematics Cognitive Achievement? *EURASIA Journal of Mathematics, Science and Technology Education*, 14(2), 569–578. <https://doi.org/10.12973/ejmste/76959>
- Leavy, A., & Hourigan, M. (2024). Attending to task variables when engaging in group problem posing for elementary level mathematics. *Journal of Mathematical Behavior*, 73(January), 1–21. <https://doi.org/10.1016/j.jmathb.2024.101128>

- Lenhard, J., & Otte, M. (2018). The Applicability of Mathematics as a Philosophical Problem: Mathematization as Exploration. *Foundations of Science*, 23(4), 719–737. <https://doi.org/10.1007/s10699-018-9546-2>
- Leppma, M., & Darrah, M. (2022). Self-efficacy, mindfulness, and self-compassion as predictors of math anxiety in undergraduate student. *International Journal of Mathematical Education in Science and Technology*, 2(1), 0–16. <https://doi.org/doi.org/10.1080/0020739X.2022.2054740>
- Levy, Y. (2018). Why cognitivism? *Canadian Journal of Philosophy*, 48(2), 223–244. <https://doi.org/10.1080/00455091.2017.1345207>
- Lewis, A., & Smith, D. (1993). Defining Higher Order Thinking. *Theory Into Practice*, 32(3), 131–137. <https://doi.org/10.1080/00405849309543588>
- Listyorini, T., & Widodo, A. (2017). Perancangan Mobile Learning Mata Kuliah Sistem Operasi Berbasis Android. *Simetris : Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer*, 3(1), 25. <https://doi.org/10.24176/simet.v3i1.85>
- Lohman, D. F. (2018). Reasoning Abilities. In *Cognition and Intelligence* (Issue May, pp. 225–250). Cambridge University Press. <https://doi.org/10.1017/cbo9780511607073.013>
- M-Learning : Mobilising Learning in Higher Education (2010).
- Maia, F. J., & Machado, A. A. (2024). Active learning: new responsibilities for students and teachers. *Observatório De La Economía Latinoamericana*, 22(2), e3261. <https://doi.org/10.55905/oelv22n2-114>
- Malagrida, R., Klaassen, P., Ruiz-Mallén, I., & Broerse, J. E. W. (2022). Towards competencies and methods to support Responsible Research and Innovation within STEAM secondary education—the case of Spain. *Research in Science and Technological Education*, 00(00), 1–21. <https://doi.org/10.1080/02635143.2022.2123790>
- Mantere, S., & Ketokivi, M. (2010). Two Strategies for Inductive Reasoning in Organizational Research. *Academy of Management Review*, 35(2), 315–333. <https://doi.org/10.5465/AMR.2010.48463336>
- Mardiana, D., Mudrikah, A., Amna, N., Developing, N., Mardiana, D., Mudrikah, A., & Amna, N. (2016). Developing Kindergarten Children ' s Mathematical Abilities And Character By Using Area Instruction Model. *International Journal of Research in Education and Science Volume*, 3(1), 1–9.
- Martin, G. B. (2018). *Education & The Fourth Industrial Revolution*. 7270–7270. <https://doi.org/10.21125/iceri.2018.2771>
- Maznah, R., Hussain, R., & Naibi, I. Al. (2017). *21st Century Skills: A Pocket of Mobile Learning Tools for Language Teachers*.
- Meiliyasaari, M., Rahmawati, Y., Irwanto, Utami, A. D., Subekti, M., Permana, H., Nasbey,

- H., & Suryanda, A. (2024). Using a Dilemma-STEAM Teaching Model to Engage Students in 21st Century Learning. *AIP Conference Proceedings*, 2982(1). <https://doi.org/10.1063/5.0183689>
- Mercan, Z., & Kandır, A. (2024). The effect of the Early STEAM Education Program on the visual-spatial reasoning skills of children: research from Turkey. *Education 3-13*, 52(2), 123–153. <https://doi.org/10.1080/03004279.2022.2075906>
- Miller, H. B. and J. A. C. (2017). Mobile Learning and its Effects on Academic Achievement and Student Motivation in Middle Grades Students. *International Journal for the Scholarship of Technology Enhanced Learning*, 1(2), 91–110.
- Mira, M. (2024). Implementasi Pendekatan Contextual Teaching And Learning (CTL) untuk Meningkatkan Hasil Belajar Matematika Siswa Sekolah Dasar. *Jurnal Basicedu*, 8(1), 349–357. <https://doi.org/10.31004/basicedu.v8i1.7165>
- Mishra, P., & Mehta, R. (2017). What We Educators Get Wrong About 21st-Century Learning: Results of a Survey. *Journal of Digital Learning in Teacher Education*, 33(1), 6–19. <https://doi.org/10.1080/21532974.2016.1242392>
- Mou, T. Y. (2024). The practice of visual storytelling in STEM: Influence of creative thinking training on design students' creative self-efficacy and motivation. *Thinking Skills and Creativity*, 51(December 2023), 101459. <https://doi.org/10.1016/j.tsc.2023.101459>
- Mouhayar, R. (2018). Trends of progression of student level of reasoning and generalization in numerical and figural reasoning approaches in pattern generalization. *Educational Studies in Mathematics*, 99(1), 89–107. <https://doi.org/10.1007/s10649-018-9821-8>
- Mulyasa, E. (2013). *Pengembangan dan Implementasi Kurikulum 2013*. PT Remaja Rosdakarya.
- Muniroh, L., & Buchori, A. (2022). *Analisis Kemampuan Penalaran Matematis Peserta Didik Dalam Menyelesaikan Masalah Kontekstual Pada Materi Sistem Persamaan Linear Tiga Variabel ( SPLTV )*. 49–58.
- Muratovich, M. E., Kurbon, O., & Mamararhimovna, A. D. (2024). The Formation of Mathematical Representations in Preschoolers in the Process of Familiarizing them with the Concepts of Quantities and Numbers. *Middle European Scientific Bulletin*, 22(4), 63–67. <https://cejsr.academicjournal.io/index.php/journal/article/view/1187>
- Nasution, D. M., Nasution, I., & Sari, S. (2024). Students' Collaborative Skills with an Approach Ethno-Steam Project Otok-Otok Game Context In Mathematics Learning. *Jurnal Tarbiyah*, 31(1), 17–31.
- National Council of Teachers of Mathematics (NCTM). (2013). *National Council of Teachers of Mathematics*.
- Nauli, N., Harisman, Y., & Armiati, Y. (2024). Junior High School Students' Habits of Mind in Solving Mathematical Problems. *Jurnal Pendidikan Matematika*, 18(1),

39–58. <https://doi.org/10.22342/jpm.v18i1.pp39-58>

Negreiros, M. (2017). *Elementary Mathematics Teachers' Beliefs and Practices: Understanding the Influence of Teaching in a STEAM Setting*. [http://gateway.proquest.com/openurl?url\\_ver=Z39.88-2004&rft\\_val\\_fmt=info:ofi/fmt:kev:mtx:dissertation&res\\_dat=xri:pqm&rft\\_dat=xri:pqdiss:10266526](http://gateway.proquest.com/openurl?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&res_dat=xri:pqm&rft_dat=xri:pqdiss:10266526)

Nguyen, C. K., Tran, H. T., & Nguyen, M. L. T. (2021). The Development of a Social Problem Solving Test for Elementary School Students. *Journal of Rational-Emotive and Cognitive-Behavior Therapy*, 39(1), 35–57. <https://doi.org/10.1007/s10942-020-00360-5>

Niss, M. (2015). Mathematical Literacy. *The Proceedings of the 12th International Congress on Mathematical Education*, 409–414. <https://doi.org/10.1007/978-3-319-12688-3>

Novak, J. D., Editor, S., & Lawson, A. E. (1982). Formal Reasoning, Achievement, and Intelligence: An Issue of Importance. *Science Education*, 66(1), 77–83. <https://doi.org/10.1002/sce.3730660110>

Novianawati, N. (2019). *An investigation of reasoning ability at the secondary level students*. <https://doi.org/10.1088/1742-6596/1157/2/022061>

Novita, S. (2024). Pengaruh Penerapan Model Problem Based Learning Terhadap Kemampuan Representasi Matematika Siswa Sekolah Menengah Pertama IT Az-Zuhra Islamic School Pekanbaru. *Jurnal Jendela Pendidikan*, 4(01), 66–73.

Nugraheni, A. D. (2019). Penguatan Pendidikan Bagi Generasi Alfa Melalui Pembelajaran Steam Berbasis Loose Parts Pada PAUD. *Seminar Nasional Pendidikan Dan Pembelajaran 2019*, 1(1), 512–518. <http://seminar.umpo.ac.id/index.php/SNPP2019/article/view/352>

Nugroho, S. (2014). Pemanfaatan Mobile Learning Game Barisan Dan Deret Geometri Untuk Meningkatkan Minat Dan Hasil Belajar Matematika SMA Kesatrian 1 Semarang. *Jurnal Indonesian Digital Journal of Mathematics and Education*, Vol. 1, 1–7.

Nurmasari, L., Budiyono, Nurkamto, J., & Ramli, M. (2024). Realistic Mathematics Engineering for improving elementary school students' mathematical literacy. *Journal on Mathematics Education*, 15(1), 1–26. <https://doi.org/10.22342/jme.v15i1.pp1-26>

Nuurjannah, P. E. I., Hendriana, H., & Fitrianna, A. Y. (2018). Faktor Mathematical Habits of Mind dan Kemampuan Literasi Matematis Siswa SMP di Kabupaten Bandung Barat. *Jurnal Mercumatika: Jurnal Penelitian Matematika Dan Pendidikan Matematika*, 2(2), 51. <https://doi.org/10.26486/jm.v2i2.423>

O'Donoghue, J. (2002). Numeracy and Mathematics. In *How to Succeed at Assessment Centres* (Vol. 48, pp. 47–55). Macmillan Education UK. [https://doi.org/10.1007/978-1-37-46932-8\\_4](https://doi.org/10.1007/978-1-37-46932-8_4)

- OECD. (2013). PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy. In *OECD Report*. <https://doi.org/10.1787/9789264190511-en>
- OECD. (2015). *PISA 2015 Results (Volume IV): Students' Financial Literacy: Vol. IV*. <https://doi.org/10.1787/9789264270282-en>
- Ohta, N., MacLeod, C. M., & Utzl, B. (2005). Dynamic cognitive processes. In *Dynamic Cognitive Processes*. Springer. <https://doi.org/10.1007/b139064>
- Oktaviyanti, R. (2017). Pemberdayaan Keterampilan Guru Matematika Dalam Menyusun Bahan Ajar Berbantuan Mathematics Education Software. *Jurnal Pengabdian Masyarakat Wikrama Parahita*, 1(1), 19–24. <http://ejurnal.lppmunsera.org/index.php/parahita/article/view/270/523>
- Olarewaju, A., Awofala, A., Akinoso, S. O., Adeniyi, C. O., Jega, S. H., Fatade, A. O., & Arigbabu, A. A. (2024). Primary Teachers' Mathematics Anxiety and Mathematics Teaching Anxiety as Predictors of Students' Performance in Mathematics. *ASEAN Journal of Science and Engineering Education*, 4(1), 9–24. <https://ejournal.upi.edu/index.php/AJSEE/article/view/51065>
- Onwuegbuzie, A. J., Gerber, H. R., & Schamroth Abrams, S. (2017). Mixed Methods Research. In *The International Encyclopedia of Communication Research Methods* (pp. 1–33). John Wiley & Sons, Inc. <https://doi.org/10.1002/9781118901731.iecrm0156>
- Palinussa, A. L., Molle, J. S., & Gaspersz, M. (2021). Realistic mathematics education: Mathematical reasoning and communication skills in rural contexts. *International Journal of Evaluation and Research in Education*, 10(2), 522–534. <https://doi.org/10.11591/ijere.v10i2.20640>
- Park, S. Y., Lee, H. D., & Kim, S. Y. (2018). South Korean university students' mobile learning acceptance and experience based on the perceived attributes, system quality and resistance. *Innovations in Education and Teaching International*, 55(4), 450–458. <https://doi.org/10.1080/14703297.2016.1261041>
- Penprase, B. E. (2018). The Fourth Industrial Revolution and Higher Education. In N. W. Gleason (Ed.), *Higher Education in the Era of the Fourth Industrial Revolution*. Springer Singapore. <https://doi.org/10.1007/978-981-13-0194-0>
- Perales, F. J., & Aróstegui, J. L. (2024). The STEAM approach: Implementation and educational, social and economic consequences. *Arts Education Policy Review*, 125(2), 59–67. <https://doi.org/10.1080/10632913.2021.1974997>
- Peters, G. (2018). *A Framework Supporting Literacy in Mathematics and Software Programming*. 1(Iceis), 497–506. <https://doi.org/10.5220/0006629304970506>
- Polya, G. (1971). *How to Solve It: A New Aspect of Mathematics Method*. Princeton University Press.
- Prado, J., Chadha, A., & Booth, J. R. (2011). The Brain Network for Deductive

- Reasoning : A Quantitative Meta-analysis of 28 Neuroimaging Studies. *Journal of Cognitive Neuroscience*, 23(11), 3483–3497. [https://doi.org/10.1162/jocn\\_a\\_00063](https://doi.org/10.1162/jocn_a_00063)
- Prater, C. H. & A. (2012). Teachers Comment On The Horizon Report. *Annual Proceedings*, 168–174.
- Project Based Learning at Harmony Public Schools (2015).
- Puji Lestari, L. A., Listyarini, I., Sary, R. M., & Budiman, M. A. (2024). Mathematical Reasoning Ability for Class IV Students on Polygon Materials. *AIP Conference Proceedings*, 3046(1). <https://doi.org/10.1063/5.0195136>
- Purnamasari, M. (2017). Upaya Meningkatkan Hasil Belajar Matematika Terhadap Konsep Bangun Ruang Materi Luas dan Volume Balok dan Kubus Menggunakan Metode Drill SMP Islam Al-Ghazali Kelas VIII. *Jurnal Pendidikan Matematika Dan Matematika*, 3(1), 45–52.
- Putnam, R. T. (1992). Teaching the “Hows” of Mathematics for Everyday Life: A Case Study of a Fifth-Grade Teacher. *The Elementary School Journal*, 93(2), 163–177. <https://doi.org/10.1086/461720>
- Putri, A. D., Juandi, D., & Turmudi, T. (2024). Realistic mathematics education and mathematical literacy: a meta-analysis conducted on studies in Indonesia. *Journal of Education and Learning (EduLearn)*, 18(4), 1468–1476. <https://doi.org/10.11591/edulearn.v18i4.21650>
- Quinn, C. (2000). *m-Learning: Mobile, wireless, in-your-pocket learning*. LiNE Zine.
- Rahmawati, Y., Erdawati, E., Ridwan, A., Veronica, N., & Hadiana, D. (2024). Developing Students’ Chemical Literacy Through the Integration of Dilemma Stories Into a Steam Project on Petroleum Topic. *Journal of Technology and Science Education*, 14(2), 376–392. <https://doi.org/10.3926/jotse.2221>
- Rahmawati, Y., Ridwan, A., Hadinugrahaningsih, T., & Soeprijanto. (2019). Developing critical and creative thinking skills through STEAM integration in chemistry learning. *Journal of Physics: Conference Series*, 1156(1). <https://doi.org/10.1088/1742-6596/1156/1/012033>
- Rakhmat, M. (2013). *Pengantar Logika Dasar*. REPOSITORY BUKU DAN JURNAL.
- Ramful, A. (2015). Reversible reasoning and the working backwards problem solving strategy. *Australian Mathematics Teacher*, 71(4), 28–32.
- Razak, R. A. (2015). *Mobile learning for teaching and learning Science , Technology , Engineering and Mathematics ( STEM ): A review of literature*. November, 1–6. <https://doi.org/10.1201/b19921-29>
- Reiter, R. (1980). A Logic for Default Reasoning. *Artificial Intelligence*, 13, 81–132. [https://doi.org/10.1016/0004-3702\(80\)90014-4](https://doi.org/10.1016/0004-3702(80)90014-4)
- Reyes, M. L. (2016). Categories of Illustrated Problems for Training Children in

- Inductive Reasoning. *The Asia-Pacific Education Researcher*, 25(2), 239–250. <https://doi.org/10.1007/s40299-015-0257-y>
- Richard, R. (1998). Interactive-Engagement vs. Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses. *American Journal of Physics*, 1–27.
- Rizqiani, S. A., & Hayuhantika, D. (2020). Analisis metakognisi dalam penyelesaian masalah matematika ditinjau dari tingkat kemampuan matematika. *JP2M (Jurnal Pendidikan Dan Pembelajaran Matematika)*, 5(1), 26. <https://doi.org/10.29100/jp2m.v5i1.1734>
- Rodgers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. *Teachers College Record*, 104(4), 842–866. <https://doi.org/10.1111/1467-9620.00181>
- Romero Ariza, M., Quesada Armenteros, A., & Estepa Castro, A. (2024). Promoting critical thinking through mathematics and science teacher education: the case of argumentation and graphs interpretation about climate change. *European Journal of Teacher Education*, 47(1), 41–59. <https://doi.org/10.1080/02619768.2021.1961736>
- Rosida, H., Sunarno, W., & Supurwoko. (2015). Hubungan Antara Kemampuan Awal dan Kemampuan Numerik dengan Hasil Belajar Fisika Siswa SMP. *Jurnal Materi Dan Pembelajaran Fisika*, 1.
- Rycroft-Smith, L., Müller, D., Chiodo, M., & Macey, D. (2024). A useful ethics framework for mathematics teachers. *Cham: Springer Nature Switzerland*, 2018, 1–36.
- Sahidin, L., & Sari, T. I. (2024). Analysis of Mathematical Literacy in Solving PISA Problems based on Students' mathematical Ability. *AL-ISHLAH: Jurnal Pendidikan*, 14(4), 5347–5362. <https://doi.org/10.35445/alishlah.v14i4.1789>
- Samsudin, et all. (2017). Physics Achievement in Stem Project Based Learning (PjBL): A Gender Study. *Asia Pacific Journal of Educators and Education*, 32, 21–28. <https://doi.org/10.21315/apjee2017.32.2>
- Santrock, J. W. (2002). , *Life Span Development Perkembangan masa hidup*, (Jakarta: Erlangga ). Erlangga.
- Saracho, O. N. (2017). Literacy in the twenty-first century: children, families and policy. *Early Child Development and Care*, 187(3–4), 630–643. <https://doi.org/10.1080/03004430.2016.1261513>
- Sari, D. P. (2014). Pendekatan Scientific Berbasis Ict Untuk Mengembangkan Kemampuan Berpikir Matematik. *Indonesian Journal of Curriculum and Educational Technology Studies*, 3(1), 33–38.
- Sasanguie, D., De Smedt, B., Defever, E., & Reynvoet, B. (2012). Association between basic numerical abilities and mathematics achievement. *British Journal of Developmental Psychology*, 30(2), 344–357. <https://doi.org/10.1111/j.2044->

835X.2011.02048.x

Sayre, C. W. (2008). *Complete Wireless Design* (Second). The McGraw-Hill Companies. <https://doi.org/10.1036/0071544526>

Schmidt, M., & Fulton, L. (2017). Lessons Learned from Creation of an Exemplary STEM Unit for Elementary Pre-Service Teachers: A Case Study. *Journal of Computers in Mathematics & Science Teaching*, 36(2), 189–204. <http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=125510670&lang=zh-cn&site=ehost-live>

Setiawati, N., Kartika, I., & Purwanto, J. (2016). Pengembangan Mobile Learning ( M-Learning ) Berbasis Moodle Sebagai Daya Dukung Pembelajaran Fisika Di. *Pengembangan Mobile Learning ( M-Learning )*, 178–186.

Sharan, Y. (2015). Meaningful learning in the cooperative classroom. *International Journal of Primary, Elementary and Early Years Education*, 43(1), 83–94. <https://doi.org/10.1080/03004279.2015.961723>

Sharples, M. (2000). *The design of personal mobile technologies for lifelong learning*. 34, 177–193. [https://doi.org/10.1016/S0360-1315\(99\)00044-5](https://doi.org/10.1016/S0360-1315(99)00044-5)

Shaughnessy, J. M. (2013). Mathematics in a STEM Context. *National Council of Teachers of Mathematics*, 18(6), 324.

Shaxnoza, Q. (2024). Problematic education , which is one of the foundations of the STEAM approach in education. *Modern Science and Research*, 3(1), 1–6. <https://doi.org/https://doi.org/10.5281/zenodo.10449276>

Sidhartani, S. (2016). Literasi Visual Sebagai dasar Pemaknaan Dalam Apresiasi dan Proses Kreasi Visual. *Jurnal Desain*, 03(03), 155–163. [http://journal.lppmunindra.ac.id/index.php/Jurnal\\_Desain/article/viewFile/709/622](http://journal.lppmunindra.ac.id/index.php/Jurnal_Desain/article/viewFile/709/622)

Sigit, D. V., Ristanto, R. H., & Mufida, S. N. (2022). Integration of project-based e-learning with STEAM: An innovative solution to learn ecological concept. *International Journal of Instruction*, 15(3), 23–40. [https://www.e-iji.net/dosyalar/iji\\_2022\\_3\\_2.pdf](https://www.e-iji.net/dosyalar/iji_2022_3_2.pdf)

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2018). Improving Students' Mathematical Problem Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context. *International Electronic Journal of Mathematics Education*, 14(1), 61–72. <https://doi.org/10.12973/iejme/3966>

Siraj, S. (2004). Pembelajaran Mobile dalam Kurikulum Masa Depan. *Masalah Pendidikan*, 27, 128–142. <http://myais.fsktm.um.edu.my/5093/>

Siregar, Y. E. Y. (2019). The impacts of science, technology, engineering, and mathematics (STEM) on critical thinking in elementary school. *Journal of Physics: Conference Series*, 1175, 012156. <https://doi.org/10.1088/1742-6596/1175/1/012156>

- Sitopu, J. W. (2024). The Importance of Integrating Mathematical Literacy in the Primary Education Curriculum : a Literature Review. *Journal of Information Systems and Management (JISMA)*, 2(1), 121–134.
- Smith, K., & Moore, T. (2014). Advancing the State of the Art of STEM Integration. *Journal of STEM Education*, 15(1), 5–10.
- Soemarmo, H. &. (2014). *Penilaian pembelajaran matematika*. Refika Aditama.
- Sokolowski, A. (2018). Scientific inquiry in mathematics - Theory and practice: A STEM perspective. In *Scientific Inquiry in Mathematics - Theory and Practice: A STEM Perspective* (Issue October). <https://doi.org/10.1007/978-3-319-89524-6>
- Sokolowski, A. (2019). Developing Mathematical Reasoning Using a STEM Platform. *Interdisciplinary Mathematics Education*, 93–111. [https://doi.org/10.1007/978-3-030-11066-6\\_7](https://doi.org/10.1007/978-3-030-11066-6_7)
- Suciari, N. K. D., Lbrohim, L., & Suwono, H. (2021). The impact of PjBL integrated STEAM on students' communication skills and concept mastery in high school biology learning. *AIP Conference Proceedings*, 2330(March), 1–10. <https://doi.org/10.1063/5.0043395>
- Sumarmo, U. (2010). *Berpikir Dan Disposisi Matematik: Apa, Mengapa, dan bagaimana dikembangkan pada peserta didik*.
- Sumirattana, S., Makanong, A., & Thipkong, S. (2017). Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy. *Kasetsart Journal of Social Sciences*, 38(3), 307–315. <https://doi.org/10.1016/j.kjss.2016.06.001>
- Suryonegoro, B. M., Wuryastuti, M. L., & Dewi, N. R. (2024). Literature Review: Inquiry Social Complexity-STEAM Model Based on Math Trail-Virtual Reality Activity Nuanced with Javanese Culture in Improving Critical Thinking Ability. *Journal Evaluation in Education (JEE)*, 5(2), 89–100. <https://doi.org/10.37251/jee.v5i2.863>
- Tarigan, D. dan S. S. (2015). Utilizing Instructional Media for Teaching Infrastructure Administration. *Jurnal Teknologi Informasi & Komunikasi Dalam Pendidikan*, 2(2), 187–200.
- Taylor. (2016). Why is a STEAM Curriculum Perspective Crucial to the 21st Century ? *14th Annual Conference of the Australian Council for Educational Research, August*, 89–93. [https://link.springer-com.ezproxy1.library.usyd.edu.au/content/pdf/10.1007%2F978-94-007-2150-0\\_212.pdf](https://link.springer-com.ezproxy1.library.usyd.edu.au/content/pdf/10.1007%2F978-94-007-2150-0_212.pdf)
- Taylor. (2018). Transformative STEAM Education for Sustainable Development. *Proceedings of the Science and Mathematics International Conference (SMIC)*. <https://doi.org/10.13140/RG.2.2.16860.44160>
- Taylor, E. (2019). Ethical Dilemma Story Pedagogy – A Constructivist Approach to

Values Learning and Ethical Understanding. *Proceedings of the Science and Mathematics International Conference (SMIC) 2018. Taylor & Francis, December, 1–7.*

Thohari, A. N. A., Satoto, K. I., & Martono, K. T. (2016). Pembuatan Aplikasi Mobile Learning sebagai Sarana Pembelajaran di Lingkungan Universitas Diponegoro. *Jurnal Teknologi Dan Sistem Komputer*, 1(2), 56. <https://doi.org/10.14710/jtsiskom.1.2.2013.56-65>

Thorn., W. J. (2006). Points to Consider when Evaluating Interactive Multimedia. *The Internet TESL*, 2(3).

Time, S. R., & Matching, S. S. (2012). Social Constructivism. In *Encyclopedia of the Sciences of Learning* (Vol. 50, Issue 03, pp. 3098–3098). Springer US. [https://doi.org/10.1007/978-1-4419-1428-6\\_2415](https://doi.org/10.1007/978-1-4419-1428-6_2415)

Treffers, A. (1991). Meeting innumeracy at primary school. *Educational Studies in Mathematics*, 22(4), 333–352. <https://doi.org/10.1007/BF00369294>

Triana, N., & Utaminingsih, S. (2024). The Effectiveness of Steam-Based Interactive Module to Improving Learning Outcomes of Elementary School Students. *ICCCM Journal of Social Sciences and Humanities*, 3(1), 37–45. <https://doi.org/https://doi.org/10.53797/icccmjssh.v3i1.6.2024>

Troutner, J. (2010). Mathematics and Mobile Learning. *Teacher Librarian*, 38(1), 44–46. <https://doi.org/10.1007/978-1-4419-0585-7>

Trowsdale, J., & Davies, R. (2024). How a particular STEAM model is developing primary education: lessons from the Teach-Make project (England). *Journal of Research in Innovative Teaching and Learning*, 1(1), 1–14. <https://doi.org/10.1108/JRIT-10-2022-0066>

Tutkun, O. F., & Erdogan, D. G. (2014). Levels of Visual Mathematics Literacy Self-Efficacy Perception of the Secondary School Students. *Middle Eastern & African Journal of Educational Research*, 19(8), 19–27.

UNESCO. (2017). *Education for sustainable development goals: Learning objectives* (Issue March). <https://books.google.com.au/books?hl=en&lr=&id=Fku8DgAAQBAJ&oi=fnd&pg=PP4&ots=ZMKwiC58h6&sig=6KTcQGaqPomg7dIruPgGA-NOdw4>

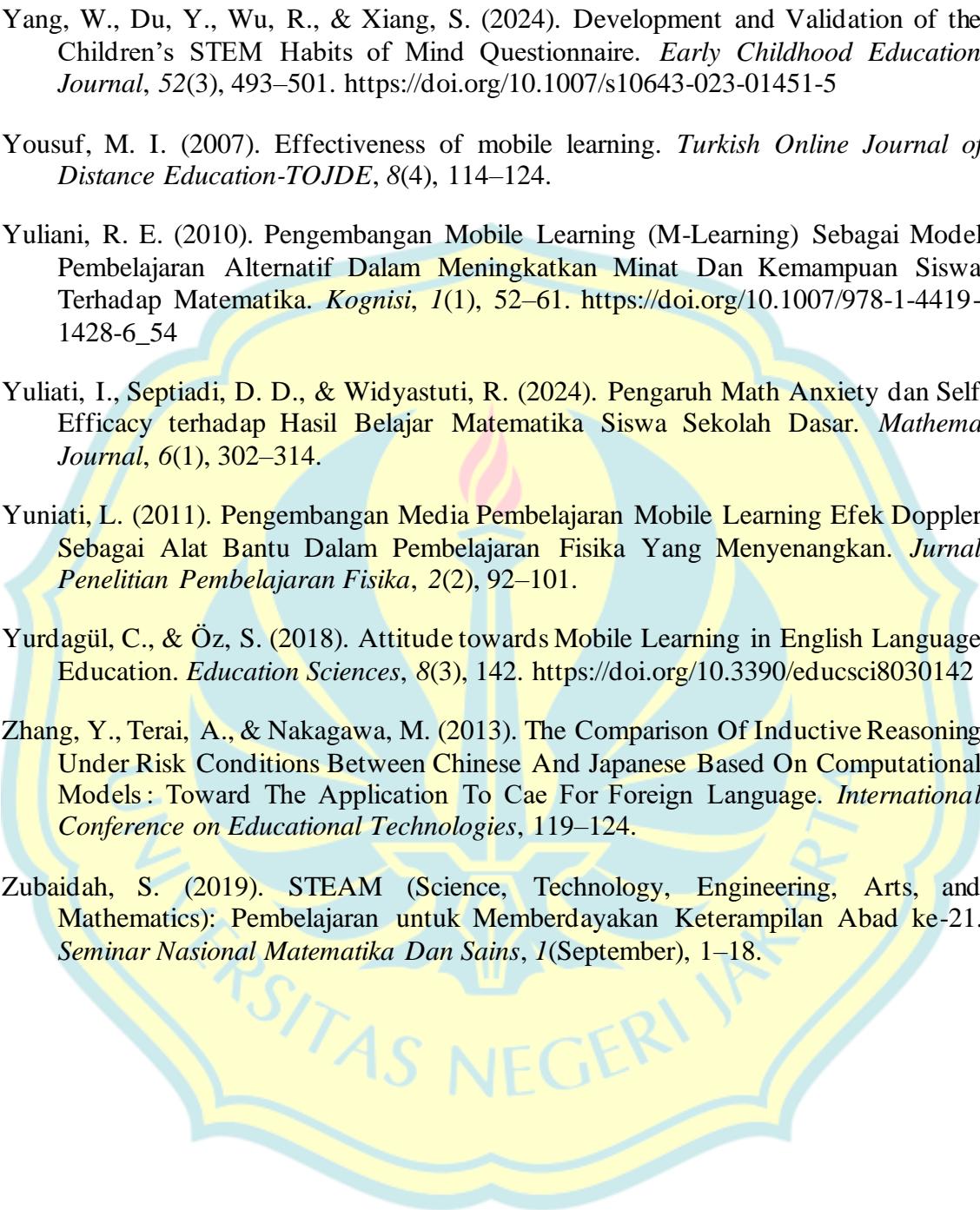
Urquhart, C., Cheuk, B., Lam, L., & Snowden, D. (2024). Sense-making, sensemaking and sense making—A systematic review and meta-synthesis of literature in information science and education: An Annual Review of Information Science and Technology (ARIST) paper. *Journal of the Association for Information Science and Technology*, August 2022. <https://doi.org/10.1002/asi.24866>

Uther, M. (2019). Mobile Learning—Trends and Practices. *Education Sciences*, 9(1), 33. <https://doi.org/10.3390/educsci9010033>

Wahyudi. (2024). Studi Meta-Analisis Pengaruh Problem Based Learning Terhadap

- Keterampilan Matematis Siswa. *SECONDARY: Jurnal Inovasi Pendidikan Menengah*, 4(1), 53–54.
- Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviours and performance: Report from a large blended classroom Minjuan. *British Journal of Educational Technology*, 40(4), 673–695. <https://doi.org/10.1111/j.1467-8535.2008.00846.x>
- Weber, K. (2010). Mathematics Majors ' Perceptions of Conviction , Validity , and Proof. *Mathematical Thinking and Learning*, December 2014, 37–41. <https://doi.org/10.1080/10986065.2010.495468>
- Wedge, T. (2010). Ethnomathematics and mathematical literacy : People knowing mathematics in society. *Proceedings of MADIF 7. The Seventh Mathematics Education Research*, 7, 31–46.
- Weinberg, P. J. (2017). Mathematical Description and Mechanistic Reasoning: A Pathway Toward STEM Integration. *Journal of Pre-College Engineering Education Research (J-PEER)*, 7(1). <https://doi.org/10.7771/2157-9288.1124>
- Weiping, T. Z. & S. (2017). On the Logic and Process of Collaborative Innovation in Higher Vocational Education and Industrial Development. *Chinese Education and Society*, 50(5–6), 458–468. <https://doi.org/10.1080/10611932.2017.1408327>
- Wiradnyana, I. G. A., Lasmawan, I. W., Suastra, I. W., & Suarni, N. K. (2024). Problem-Based Learning With Tri Kaya Parisudha Model To Improve the Mathematical Problem-Solving Skills and Character of Elementary School Students. *Revista de Gestao Social e Ambiental*, 18(2), 1–20. <https://doi.org/10.24857/RGSA.V18N2-133>
- Wirawan, P. W. (2012). Pengembangan Kemampuan E-Learning Berbasis Web Ke Dalam M-Learning. 2(4), 21–26.
- Wisdom, J. P., Cavalieri, M. A., Onwuegbuzie, A. J., & Green, C. A. (2012). Methodological reporting in qualitative, quantitative, and mixed methods health services research articles. *Health Services Research*, 47(2), 721–745. <https://doi.org/10.1111/j.1475-6773.2011.01344.x>
- Wong, R. (2013). Cultural Difference in Stereotype Perceptions and Performances in Nonverbal Deductive Reasoning and Creativity. *The Journal of Creative Behavior*, 47(1), 41–59. <https://doi.org/10.1002/jocb.22>
- Woolfolk, A. (2004). *Educational Psychology* (Ninth). International Edition.
- Wulandari, D. U., Mariana, N., Wiryanto, W., & Amien, M. S. (2024). Integration of Ethnomathematics Teaching Materials in Mathematics Learning in Elementary School. *IJORER : International Journal of Recent Educational Research*, 5(1), 204–218. <https://doi.org/10.46245/ijorer.v5i1.542>
- Yamamoto, E., & Houghton, M. (2011). *Ontario ENERGY CONSERVATION LEARNING ACTIVITIES*.

- Yang, W., Du, Y., Wu, R., & Xiang, S. (2024). Development and Validation of the Children's STEM Habits of Mind Questionnaire. *Early Childhood Education Journal*, 52(3), 493–501. <https://doi.org/10.1007/s10643-023-01451-5>
- Yousuf, M. I. (2007). Effectiveness of mobile learning. *Turkish Online Journal of Distance Education-TOJDE*, 8(4), 114–124.
- Yuliani, R. E. (2010). Pengembangan Mobile Learning (M-Learning) Sebagai Model Pembelajaran Alternatif Dalam Meningkatkan Minat Dan Kemampuan Siswa Terhadap Matematika. *Kognisi*, 1(1), 52–61. [https://doi.org/10.1007/978-1-4419-1428-6\\_54](https://doi.org/10.1007/978-1-4419-1428-6_54)
- Yuliati, I., Septiadi, D. D., & Widystuti, R. (2024). Pengaruh Math Anxiety dan Self Efficacy terhadap Hasil Belajar Matematika Siswa Sekolah Dasar. *Mathema Journal*, 6(1), 302–314.
- Yuniati, L. (2011). Pengembangan Media Pembelajaran Mobile Learning Efek Doppler Sebagai Alat Bantu Dalam Pembelajaran Fisika Yang Menyenangkan. *Jurnal Penelitian Pembelajaran Fisika*, 2(2), 92–101.
- Yurdagül, C., & Öz, S. (2018). Attitude towards Mobile Learning in English Language Education. *Education Sciences*, 8(3), 142. <https://doi.org/10.3390/educsci8030142>
- Zhang, Y., Terai, A., & Nakagawa, M. (2013). The Comparison Of Inductive Reasoning Under Risk Conditions Between Chinese And Japanese Based On Computational Models: Toward The Application To Cae For Foreign Language. *International Conference on Educational Technologies*, 119–124.
- Zubaidah, S. (2019). STEAM (Science, Technology, Engineering, Arts, and Mathematics): Pembelajaran untuk Memberdayakan Keterampilan Abad ke-21. *Seminar Nasional Matematika Dan Sains*, 1(September), 1–18.



*Intelligentia - Dignitas*