# PENGARUH *PROBLEM-BASED LEARNING* DAN *DIRECT INSTRUCTION* BERBANTUAN *GEOGEBRA* TERHADAP PEROLEHAN DAN PENINGKATAN KEMAMPUAN BERPIKIR KRITIS MATEMATIS DITINJAU DARI *ADVERSITY QUOTIENT* SISWA

**DISERTASI**

Diajukan untuk Memenuhi Sebagian dari
Persyaratan Memperoleh Gelar Doktor Ilmu Pendidikan
dalam Bidang Pendidikan Matematika


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# PENGARUH *PROBLEM-BASED LEARNING* DAN *DIRECT INSTRUCTION* BERBANTUAN *GEOGEBRA* TERHADAP PEROLEHAN DAN PENINGKATAN KEMAMPUAN BERPIKIR KRITIS MATEMATIS DITINJAU DARI *ADVERSITY QUOTIENT* SISWA

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# PENGARUH *PROBLEM-BASED LEARNING* DAN *DIRECT INSTRUCTION* BERBANTUAN *GEOGEBRA* TERHADAP PEROLEHAN DAN PENINGKATAN KEMAMPUAN BERPIKIR KRITIS MATEMATIS DITINJAU DARI ADVERSITY QUOTIENT SISWA

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# ABSTRAK

**Nurul Rafiqah Nasution (2024)**. Pengaruh *Problem-Based Learning* dan *Direct Instruction* Berbantuan *Geogebra* Terhadap Perolehan dan Peningkatan Kemampuan Berpikir Kritis Matematis Ditinjau dari *Adversity Quotient* Siswa

Penelitian ini bertujuan untuk menganalisis dan mendeskripsikan tentang pengaruh *Problem-Based Learning* berbantuan *Geogebra* (PBL-Geo) dan *Direct Instruction* berbantuan *Geogebra* (DI-Geo) terhadap perolehan dan peningkatan kemampuan berpikir kritis matematis (KBKM) ditinjau dari *Adversity Quotient* (AQ) siswa, serta diperolehnya konjektur yang mengaitkan tingkat *Adversity Quotient* (AQ) dengan kemampuan berpikir kritis matematis (KBKM) siswa. Sampel dalam penelitian ini adalah siswa kelas XI MAN di Kota Medan yang berjumlah 58 siswa. Metode di dalam penelitian ini adalah *mixed method* dengan desain *explanatory sequential*. Tahap kuantitatif menggunakan desain *one group pretest-posttest design* dan *factorial design* $3 \times 2$. Sedangkan tahap kualitatif menggunakan desain *case study* dengan perspektif *grounded theory*. Hasil penelitian ini menunjukkan bahwa: (1) *Problem-Based Learning* berbantuan *Geogebra* (PBL-Geo) berpengaruh lebih tinggi dari *Direct Instruction* berbantuan *Geogebra* (DI-Geo) terhadap perolehan kemampuan berpikir kritis matematis (KBKM) siswa; (2) siswa yang memiliki *Adversity Quotient Climber* berpengaruh lebih tinggi dari *Adversity Quotient Camper*, siswa yang memiliki *Adversity Quotient Climber* berpengaruh lebih tinggi dari *Adversity Quotient Quitter*, dan siswa yang memiliki *Adversity Quotient Camper* berpengaruh lebih tinggi dari *Adversity Quotient Quitter* terhadap perolehan kemampuan berpikir kritis matematis (KBKM); (3) tidak terdapat efek interaksi antara pembelajaran dan tingkat *Adversity Quotient* (AQ) terhadap perolehan kemampuan berpikir kritis matematis (KBKM) siswa; (4) *Adversity Quotient* (AQ) berpengaruh positif terhadap kemampuan berpikir kritis matematis (KBKM) siswa; (5) kemampuan berpikir kritis matematis (KBKM) siswa yang memiliki tingkat *Adversity Quotient Climber* yang belajar dengan *Problem-Based Learning* berbantuan *Geogebra* (PBL-Geo) tergambarkan oleh kemampuan siswa yang mampu menginterpretasi, menganalisis, mengevaluasi, dan menginferensi.

**Kata Kunci:** *Adversity Quotient*, *Direct Instruction*, Kemampuan Berpikir Kritis Matematis, *Problem-Based Learning*

## ABSTRACT

**Nurul Rafiqah Nasution (2024)**. The Influence of Problem-Based Learning and Direct Instruction Assisted by Geogebra on Acquiring and Improving Mathematical Critical Thinking Ability Reviewed from Students' Adversity Quotient

This research aims to analyze and describe the influence of the Problem-Based Learning assisted by Geogebra (PBL-Geo) and Direct Instruction assisted by Geogebra (DI-Geo) on the acquisition and improvement of mathematical critical thinking ability (MCTA) in terms of students' Adversity Quotient (AQ) and obtained a conjecture that links the Adversity Quotient (AQ) level with students' mathematical critical thinking ability (MCTA). The sample in this research was class XI MAN students in Medan City, totaling 58 students. The method in this research is mixed method with sequential explanatory design. The quantitative stage uses one group pretest-posttest design and 3×2 factorial design. Meanwhile, the qualitative stage uses case study design with a grounded theory perspective. The results of this research show that: (1) PBL-Geo has a higher effect than DI-Geo on students' acquisition of mathematical critical thinking ability (MCTA); (2) students who have AQ Climber have higher influence than AQ Camper, students who have AQ Climber have higher influence than AQ Quitter, and students who have AQ Camper have higher influence than AQ Quitter on the acquisition of mathematical critical thinking ability (MCTA); (3) there is no interaction effect between learning and the AQ level on students' acquisition of mathematical critical thinking ability (MCTA); (4) AQ has a positive effect on students' mathematical critical thinking ability (MCTA); (5) mathematical critical thinking ability (MCTA) of students who have the AQ Climber level who learn with PBL-Geo is illustrated by the ability of students who are able to interpret, analyze, evaluate and infer.



**Keywords**: Adversity Quotient, Direct Instruction, Mathematical Critical Thinking Ability, Problem-Based Learning

## DAFTAR ISI

## DAFTAR GAMBAR

## DAFTAR TABEL

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# DAFTAR PUSTAKA

Abdullah, I. H. (2013). Berpikir Kritis Matematik. *Delta-Pi: Jurnal Matematika dan Pendidikan Matematika*, 2(1), 66-75. https://ejournal.unkhair.ac.id/index.php/deltapi/article/view/100.

Agam, R., Layn, M. R., Hidayani., & Rusnia, W. O. (2023). Pengaruh Kecerdasan Adversity Quotient (AQ) Terhadap Hasil Belajar Matematika Siswa. *KAMBIK: Journal of Mathematics Education*, 1(1), 23-39. https://ejournal.um-sorong.ac.id/index.php/jme/article/view/2462.

Aini, N. R., Syafril, S., Netriwati., & Pahrudin, A. (2019). Problem-Based Learning for Critical Thinking Skills in Mathematics. *Journal of Physics Conference Series*, 1155, 1-7. DOI:10.1088/1742-6596/1155/1/012026.

Aizikovitsh-Udi, E., & Radakovic, N. (2012). Teaching Probability by Using Geogebra Dynamic Tool and Implemanting Critical Thinking Skills. *Procedia - Social and Behavioral Sciences*, 46, 4943–4947. https://doi.org/10.1016/j.sbspro.2012.06.364.

Al-Makahleh, A. A. A. (2011). The Effect of Direct Instruction Strategy on Math Achievement of Primary 4th And 5th Grade Students with Learning Difficulties. *International Education Studies*, 4(4), 199-205. https://doi.org/10.5539/ies.v4n4p199.

Alyani, F., & Putri, N. D. S. (2022). Students' Mathematical Critical Thinking Using Geogebra Software Based on Adversity Quotient. *Jurnal Pendidikan dan Pengajaran*, 55(3), 562-575. htpps://doi.org/10.23887/jpp.v55i3.47491.

Amini, N. U., Maimunah, M., & Roza, Y. (2020). Analysis student's Critical Thinking Skills in Solving Problems in Terms of Cognitive Style. *Matematika dan Pembelajaran*, 7(2), 51-69. http://dx.doi.org/10.33477/mp.v6i2z.

Andini, R., Retno, E., & Mintarsih. (2022). Kemampuan Berpikir Kritis Matematis Siswa pada Model Problem-Based Learning Berbantuan Bahan Ajar dengan Pendekatan STEM. *PRISMA, Prosiding Seminar Nasional*

*Matematika*, 5(1), 467–474. https://journal.unnes.ac.id/sju/index.php/prisma/.

Arbain, N., & Shukor, N. A. (2015). The Effect of Geogebra on Students Achievement. *Procedia Social and Behavioral Sciences*, 172, 208-214. http://doi.org/10.1016/j.sbspro.2015.01.356.

Arif, D. S. F., Zaenuri., & Cahyono, A. N. (2020). Analisis Kemampuan Berpikir Kritis Matematis pada Model *Problem Based Learning* (PBL) Berbantu Media Pembelajaran Interaktif dan *Google Classroom*. Seminar Nasional Pascasarjana: Universitas Negeri Semarang.

As'ari, A. R., Kurniati, D., & Subanji. (2019). Teachers Expectation of Students' Thinking Processes in Written Works: A Survey of Teachers' Readiness in Making Thinking Visible. *Journal on Mathematics Education*, 10(3), 409–424. https://doi.org/10.22342/jme.10.3.7978.409-424.

Azis, S. (2014). *68 Model Pembelajaran Inovatif dalam Kurikulum 2013*. Yogyakarta: Ar-Ruzz Media.

Bandura, A. (1986b). *Social foundations of Thought and Action*. Prentice Hall.

Bandura, A. (2001). Social Cognitive Theory: An Agentic Perspective. *Annual Review Psychology*, 52, 1–26. https://psycnet.apa.org/doi/10.1146/annurev.psych.52.1.1.

Bashith, A., & Amin, S. (2017). The Effect of Problem Based Learning on EFL Students' Critical Thinking Skill and Learning Outcome. *Al-Ta Lim Journal*, 24(2), 93–102. https://doi.org/10.15548/jt.v24i2.271.

Basri, H., Purwanto, As'ari, A. R., & Sisworo. (2019). Investigating Critical Thinking Skill of Junior High School in Solving Mathematical Problem. *International Journal of Instruction*, 12(3), 745–758. https://doi.org/10.29333/iji.2019.12345a.

Bayaga, A., Mthethwa, M., Bossé, M., & Williams, D. (2019). Impacts of Implementing GeoGebra on Eleventh Grade Student's Learning of Euclidean Geometry. *South African Journal of Higher Education*, 33(6), 32–54. https://doi.org/10.20853/33-6-2824.

Bekhet, A. K., & Zauszniewski, J. A. (2012). Methodological Triangulation: An Approach to Understanding Data. *Nurse Researcher*, 20(2), 40–43. https://doi.org/10.7748/nr2012.11.20.2.40.c9442.

Berg, B. L. (2001). *Qualitative Research Methods for The Social Sciences*. (Sarah L. Kelbaugh, Ed.) (4th ed.). United State of Amerika: California State University.

Boxer, A. (2020). *Guide to Explicit & Direct Instruction: An Evidence-Informed Guide for Teachers*. Suffolk, John Catt Educational.

Butler, K. (2020). The Value of Direct Instruction for At-Risk Students. *Journal of Education and* Development, 4(2), 10-17. https://doi.org/10.20849/jed.v4i2.741.

Butterworth, J., & Thwaites, G. (2013). *Thinking Skills: Critical Thinking and Problem Solving*. UK: Cambridge University Press.

Ceker, E., & Ozdamli, F. (2021). Features and Characteristics of Problem Based Learning. *Cypriot Journal of Educational Sciences*, 11(4), 195–202. https://doi.org/10.18844/cjes.v11i4.1296.

Center for Instructional Development & Research. (2004). *Problem Based-Learning*. [Online]. http://depts.washington.edu/cidrweb/Bulletin/PBL.html.

Chaffee. (2017). *Thinking Critically, Tenth*. Boston: Wadsworth, Cengage Learning.

Choi, KS. (2010). Motivating Students in Learning Mathematics with Geogebra. *Anale. Seria Informatica*, 8(2), 65-76. https://anale-informatica.tibiscus.ro/download/lucrari/8-2-05-Choi.pdf.

Choy, S. C., & Cheah, P. K. (2009). Teacher Perceptions of Critical Thinking Among Students and Its Influence on Higher Education. *International Journal of Teaching and Learning in Higher Education*, 20(2), 198-206. http://www.isetl.org/ijtlhe/.

Chukwuyenum, A. N. (2013). Impact of Critical thinking on Performance in Mathematics Among Senior Secondary School Students in Lagos State. *IOSR Journal of Research & Method in Education (IOSRJRME)*, 3(5), 18–25. https://doi.org/10.9790/7388-0351825.

Cohen, J. (1988). *Statistical Power Analysis for The Behavioral Sciences* (2nd ed.). Hillsdale N.J.: L. Erlbaum Associates.

Cohen, L., Manion, L., & Morrison, K. (2008). *Research Methods in Education. In JETP Letters (Vol. 86, Issue 10)*. Rountledge Falmer Taylor & Francis Group. https://doi.org/10.1134/S0021364007220055.

Corbin, J. M., & Strauss, A. (1990). Grounded Theory Research: Procedures, Canons, and Evaluative Criteria. *Qualitative Sociology*, 13(1), 3–21. https://doi.org/10.1007/BF00988593.

Creswell, J. W. (2014). *Research Design, Qualitatives, Quantitative, and Mixed Methods Approcahes (Fourth Edition)*. Sage Publications: United State of America.

Daniyanti, N. A., & Sugiman. (2015). Hubungan antara Kemampuan Verbal, Kemampuan Interpersonal, dan Minat Belajar dengan Prestasi Belajar Matematika. *Phytagoras*, 10(1), 50-60. http://dx.doi.org/10.21831/pg.v10i1.9109.

Darmawati, Y., & Mustadi, A. (2023). The Effect of Problem-Based Learning on The Critical Thinking Skills of Elementary School Students. *Jurnal Prima Eduka*, 11(2), 142-151. http://dx.doi.org/10.21831/jpe.v11i2.55620.

Daugaard, D. (2020). Emerging New Themes in Environmental, Social and Governance Investing: A Systematic Literature Review. *Accounting and Finance*, 60(2), 1501–1530. https://doi.org/10.1111/acfi.12479.

Delina., Afrillianto, M., & Rohaeti, E. E. (2018). Kemampuan Berpikir Kritis Matematis dan Self Confidence Siswa Melalui Pendekatan Realistic Mathematic Education. *JPMI*, 1(3), 281-288. DOI:10.22460/jpmi.v1i3.281-288.

Denzin. (1970). *The Research Act in Sociology: A Theoretical Introduction to Sociological Methods.* Butterworth & Co, London.

Denzin. (1978). *The Research Act*. McGrawHill, New York NY.

Dewey, J. (1910). *How We Think.* Boston: D.C. Heath.

Dewi, O., & Wijayanti, K. (2022). Mathematical Critical Thinking Ability in Terms of Students Learning Motivation in Probing Prompting Learning. *Unnes*

*Journal of Mathematics Education*, 11(2), 183-190. DOI: 10.15294/ujme.v11i2.59937.

Dochy, F., Segers, M., Bossche, P. V. D., & Gijbels, D. (2003). Effects of Problem-Based Learning: A Meta Analysis from The Angle of Assessment. *Learning and Instruction*, 75(1), 533-568. https://doi.org/10.3102/00346543075001027.

Duron, R., Limbach, B., & Waugh, W. (2006). Critical Thinking Framework for Any Discipline. *International Journal of Teaching and Learning in Higher Education*, 17(2), 160–166. https://doi.org/10.1016/j.nepr.2006.09.004.

Eggen, P., & Kauchak, D. (2012). *Strategi dan Model Pembelajaran: Mengajarkan Konten dan Keterampilan Berpikir, Edisi 6*. Jakarta: PT Indeks.

Ellis, P. D. (2010). *The Essential Guide to Effect Size*: *Statistical Power, Meta-Analysis, and The Interpretation of Research Results*. New York: United States of America by Cambridge University Press.

Ennis, R. H. (1996). *Critical Thinking. Upper Saddle River*. New Jersey: Prentice Hall, Inc.

Ewing, B. (2011). Direct Instruction in Mathematics: Issues for Schools with High Indigenous Enrolments: A Literature Review. *Australian Journal of Teacher Education*, 36(5), 64-91. https://doi.org/10.14221/ajte.2011v36n5.5.

Facione P. A. (2015). *Critical Thinking: What It Is and Why It Counts*. Measured Reasons and the California Academic Press, Millbrae, CA.

Facione, P. A. (2011). *Critical Thinking: What It Is and Why It Counts. Millbrae*. New York: The California Academic Press.

Fajri, H. N., Johar, R., & Ikhsan, M. (2016). Peningkatan Kemampuan Spasial dan Adversity Quotient Siswa Melalui Model Discovery Learning Berbasis Multimedia. *Beta: Jurnal Tadris Matematika*, *9*(2 SE-Articles), 180–196. https://doi.org/10.20414/betajtm.v9i2.14.

Farmaki, V., & Paschos, T. (2007). The Interaction Between Intuitive and Formal Mathematical Thinking: A Case Study. *International Journal of Mathematical Education in Science and Technology*, 38(3), 353–365. https://doi.org/10.1080/00207390601035302.

Fauzia, H. A. (2018). Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Hasil Belajar Matematika. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 7(1), 55-63. http://dx.doi.org/10.33578/jpfkip.v7i1.5338.

Field PA, M. J. (1985). *Nursing Research: The Application of Qualitative Approaches.* Chapman and Hall, London.

Fieldman, D. A. (2010). *Berpikir Kritis Strategi untuk Mengembangkan Keputusan*. Terjemahan: Ati Cahayani. Jakarta: Indeks Fraenkel, J. R., & Wallen, N. E. (1993). In Education. Second edition. New McGraw-Hill, INC.

Fischbein, E. (1999). Intuitions and Schemata in Mathematical Critical Thinking. *Educational Studies in Mathematics*, 38(1–3), 11–50. https://doi.org/10.1007/978-94-017-1584-3_2.

Fisher, A. (2008). *Berpikir Kritis: Sebuah Pengantar*. Jakarta. Erlangga.

Fitriasari, P. (2017). Pemanfaatan Software Geogebra dalam Pembelajaran Matematika. *Jurnal Pendidikan Matematika RAFA*, 3(1), 57-69. https://doi.org/10.19109/jpmrafa.v3i1.1441.

Fristadi, R., & Bharata, H. (2015). Meningkatkan Kemampuan Berpikir Kritis Siswa dengan Problem Based Learning. *Seminar Nasional Matematika Dan Pendidikan Matematika UNY*, 597–602. ISBN. 978-602-73403-0-5.

Gall, M. D., Gall, J. P., & Borg, W. R. (2010). *Applying Educational Research* (7th ed.). NJ: Pearson.

Ghazali, A. F., Othman, A. K., Sokman, Y., Zainuddin, N. A., Suhaimi, A., Mokhtar, N. A., & Yusoff, R. M. (2021). Investigating Social Cognitive Theory in Online Distance and Learning for Decision Support: The Case for Community of Inquiry. *International Journal of Asian Social Science*, 11(11), 522–538. https://doi.org/10.18488/journal.1.2021.1111.522.538.'

Glaser, B. G. (1978). *Theoretical sensitivity*. Sociology Press.

Glazer, E. (2004). *Technology Enhanced Learning Environment That Are Conductive of Critical Thinking in Mathematics*. Retrieved from http://www.lonestar.texas.net/-scifert/crit2.html.

Glazer. (2001). *Problem Based Instruction. In M. Orey (ED), Emerging Perspective on learning, teching, and technology*. [Online]. http//www.coe.uga.edu/epltt/ProblemBasedInstruct.htm.

Gorghiu, G., Drăghicescu, L. M., Cristea, S., Petrescu, A. M., & Gorghiu, L. M. (2015). Problem-Based Learning-An Efficient Learning Strategy in The Science Lessons Context. *Procedia-Social and Behavioral Sciences*, 191,1865–1870. https://doi.org/10.1016/j.sbspro.2015.04.570.

Gunantara, G., Suarjana, I. M., & Riastini, P. N. (2014). Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa. *Jurnal Mimbar PGSD Universitas Pendidikan Ganesha Jurusan Pgsd*, 2(1). https://doi.org/10.23887/jjpgsd.v2i1.2058

Gurses, A., Dogar, C., & Geyik, E. (2015). Teaching of The Concept of Enthalpy Using Problem Based Learning Approach. *Procedia-Social and Behavioral Sciences*, 197, 2390-2394. https://doi.org/10.1016/j.sbspro.2015.07.298.

Harjo, B., Kartowagiran, B., & Mahmudi, A. (2019). Development of Critical Thinking Skill Instruments on Mathematical Learning High School. *International Journal Of Instruction*, 12(4), 149–166. https://doi.org/10.29333/iji.2019.12410a.

Hasanah, D., & Yarman. (2024). Pengaruh Model Problem Based Learning Berbantuan Geogebra Terhadap Pemahaman Konsep Matematis Peserta Didik Kelas X SMA Negeri 1 2x11 Enam Lingkung. *Jurnal Edukasi dan Penelitian Matematika*, 13(1), 44-48. http://dx.doi.org/10.24036/pmat.v13i1.15662.

Hermawan, C. M., Rosfiani, O., Yulia., & Lutfiana, V. (2020). The Effectiveness of Direct Instruction Model in Mathematics Subjects: A Classroom Action Research in Elementary School. *International Journal of Scientific & Technology Research*, 9 Issue 4, 2506-2509. http://www.ijstr.org/.

Hidayanti, D., As'ari, A. R., & Candra, T. D. (2016). Pengembangan Perangkat Pembelajaran Berbasis Pemecahan Masalah untuk Meningkatkan Kemampuan Berpikir Kritis Siswa SMA Kelas XI. *Jurnal Pendidikan:*

*Teori, Penelitian, dan Pengembangan*, 1(4), 634-649. DOI: 10.17977/jp.v1i4.6209.

Hidayat, R., Roza, Y., & Murni, A. (2019). Peran Penerapan Model Problem Based Learning (PBL) terhadap Kemampuan Literasi Matematis dan Kemandirian Belajar. *Juring (Journal for Research in Mathematics Learning)*, 1(3), 213-218. http://dx.doi.org/10.24014/juring.v1i3.5359.

Hidayat, W. (2017). Adversity Quotient dan Penalaran Kreatif Matematis Siswa SMA dalam Pembelajaran Argument Driven Inquiry pada Materi Turunan Fungsi. *Kalamatika Jurnal Pendidikan Matematika*, 2(1), 15–28. https://doi.org/10.22236/kalamatika.vol2no1.2017pp15-28.

Hidayat, W., & Sari, V. T. A. (2019). Kemampuan Berpikir Kritis Matematis dan *Adversity Quotient* Siswa SMA. *Jurnal Elemen*, 5(2), 242. https://doi.Org/10.29408/Jel.V5i2.1454.

Hidayati. L. N., Haji, S., & Sumardi, H. (2023). Pengaruh Langsung *Adversity Quotient*, Disposisi Matematika, dan Kemampuan Koneksi Matematika terhadap Kemampuan Berpikir Kritis Matematika. *Dharmas Education Journal*, 4(2), 811-824. DOI:10.56667/dejournal.v4i2.1165.

Hohenwarter, J., Hohenwarter, M.,& Lavicza, Z. (2008). Introducing Dynamic Mathematics Software to Secondary School Teachers: The Case of GeoGebra. *Journal. of Computers in Mathematics and Science Teaching*, 28 (2), 135-146. https://www.learntechlib.org/primary/p/30304/.

Hohenwarter, M., & Fuchs, K. (2004). Combination of Dynamic Geometry, Algebra, and Calculus in the Software System Geogebra. www.geogebra.org/publications/pecs_2004.pdf.

Hohenwarter, M., & Lavicza, Z. (2008). The Strength of The Community: How GeoGebra Can Inspire Technology Integration in Mathematics Teaching. *MSOR Connections*, 9 (2), 3-5. http://dx.doi.org/10.11120/msor.2009.09020003.

Huck, S. W. (2008). *Reading Statistics and Research* (5th ed.). Boston: Pearson/Allyn dan Bacon.

Hulaikah, M., Degeng, I. N. S., Sulton., & Murwani, F. D. (2020). The Effect of Experiental Learning and Adversity Quotient on Problem Solving Ability.

*International Journal of Instruction*, 13(1), 869-884. https://doi.org/10.29333/iji.2020.13156a.

Hung, W., Jonassen, D. H., & Liu, R. (2008). *Problem-Based Learning. In J. M. Spector, J. G. Van Merrienboer, M. D., Merrill, & M. Driscoll (Eds.), Handbook of Research on Educational Communications and Technology*. Mahwah, Nj: Erlbaum.

Hutkemri, E. Z. (2014). Impact of Using Geogebra on Students' Conceptual and Procedural Knowledge of Limit Function. *Mediterranean Journal of Social Sciences*, 5(23), 873-881. https://dx.doi.org/10.5901/mjss.2014.v5n23p873.

Ibrahim,H., Majid., & Oroh, F.A. (2023). Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kritis Siswa pada Pembelajaran Matematika. *EDUKASIA: Jurnal Pendidikan dan Pembelajaran*, 4(2), 1657-1668. https://doi.org/10.62775/edukasia.v4i2.485.

Ikram, F. Z., & Rosidah. (2023). Implementation of Direct Instruction in Mathematics Classrooms During The New Normal. *Mapan*, 11(1), 38–52. https://doi.org/10.24252/mapan.2023v11n1a3.

Inel, D., & Balim, A. G. (2010). The Effects of Using Problem-Based Learning in Science and Technology Teaching Upon Students' Academic Achievement and Levels of Structuring Concepts. *Asia-Pacific Forum on Science Learning and Teaching*, 11(2), 1–23. http://www.ied.edu.hk/apfslt/download/v11_issue2_files/inel.pdf.

Innabi, H., & Sheikh, O. E. (2007). The Change in Mathematics Teachers' Perceptions of Critical Thinking After 15 Years of Educational Reform in Jordan. *Educational Studies in Mathematics*, 64, 45-66. https://doi.org/10.1007/s10649-005-9017-x.

Ismail, S. N., Muhammad, S., Kanesan, A. G., & Ali, R. M. (2019). The Influence of Teachers' Perception and Readiness Towards The Implementation of Critical Thinking Skills (CTS) Practice in Mathematics. *International Journal of Instruction*, *12*(2), 337–352. https://doi.org/10.29333/iji.2019.12222a.

Istiqamah., Sugiarti., & Wijaya, M. (2019). Perbandingan Pemahaman Konsep dan Kemampuan Berpikir Kritis Matematis Melalui Model Pembelajaran Discovery Learning dan Direct Instruction. *Chemistry Education Review*, 3(1), 17-30. https://doi.org/10.26858/cer.v2i2.8671.

Iswara, E., & Sundayana, R. (2021). Penerapan Model Pembelajaran Problem Posing dan Direct Instruction dalam Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa. *Plus Minus: Jurnal Pendidikan Matematika*, 1(2), 223-234. https://doi.org/10.31980/plusminus.v1i2.897.

Jaleniauskienl, E. (2016). Revitalizing Foreign Language Learning in Higher Education Using a PBL Curriculum. *Procedia-Social and Behavioral Sciences*, 232, 265-275. DOI: 10.1016/j.sbspro.2016.10.014.

Jannah, M. M., Supriadi, N., & Suri, F. I. (2019). Efektivitas Model Pembelajaran *Visualization Kinesthetic* (VAK) Terhadap Pemahaman Konsep Matematis Berdasarkan Klasifikasi *Adversity Quotient*. *Aksioma*, 8(1), 215-224. https://doi.org/10.24127/ajpm.v8i1.1892.

Jong, D. T., Lazonder, A., Chinn, C., Fischer, F., Gobert, J., & Hmelo- Silver, C. (2023). Let's talk evidence – The Case for Combining Inquiry-Based and Direct Instruction. *Educational Research Review*, 39. https://doi.org/10.1016/j.edurev.2023.100536.

Joyce, B., Weil, M., & Calhoun, E. (2016). Models of Teaching, Penerjemah Pancasari. Yogyakarta: Pustaka Pelajar.

Jumaisyaroh, T., Napitupulu, E. E., & Hasratuddin. (2014). Peningkatan Kemampuan Berpikir Kritis Matematis dan Kemandirian Belajar Siswa Melalui Pembelajaran Berbasis Masalah. *Kreano*, 5(2), 157-169. https://doi.org/10.15294/kreano.v5i2.3325.

Kaharuddin. (2021). Kualitatif: Ciri dan Karakter sebagai Metodologi. *Equilibrium*, 9(1), 1-8. https://doi.org/10.26618/equilibrium.v9i1.4489.

Kemp, A., Palmer, E., & Strelan, P. (2019). A Taxonomy of Factors Affecting Attitudes Towards Educational Technologies for Use with Technology Acceptance Models. *British Journal of Educational Technology*, 0(0), 1–20. https://doi.org/10.1111/bjet.12833.

Khoiriyah, N., Abdurrahman, A., & Wahyudi, I. (2018). Implementasi Pendekatan

Pembelajaran STEM untuk Meningkatkan Kemampuan Berpikir Kritis Siswa SMA pada Materi Gelombang Bunyi. *Jurnal Riset dan Kajian Pendidikan Fisika*, 5(2), 53–62. https://doi.org/10.12928/jrkpf.v5i2.9977.

Kladchuen, R., & Srisomphan, J. (2021). The Synthesis of a Model of Problem-Based Learning with The Gamification Concept to Enhance The Problem-Solving Skills for High Vocational Certificate. *International Journal of Emerging Technologies in Learning*, 16(4), 4–21. https://doi.org/10.3991/ijet.v16i14.20439.

Krulik, S., & Rudnick, J. A. (1995). *The New Sourcebook for Teaching Reasoning and Problem Solving in Elementary School*. Boston: Temple University.

Kurniati, I. W., Pujiastuti, E., & Kurniasih, A. W. (2017). Model Pembelajaran Discovery Learning Berbantuan Smart Sticker untuk Meningkatkan Disposisi Matematik dan Kemampuan Berpikir Kritis. *Kreano*, 8(2), 109-118. https://doi.org/10.15294/kreano.v8i2.5060.

Kurniati., Kusumah, Y. S., Subandar, J., & Herman, T. (2015). Mathematical Critical Thinking Ability Through Contextual Teaching and Learning Approach. *IndoMS-JME*, 6(1), 53-62. DOI: dx.doi.org/10.22342/jme.61.53.

Kusumadhani., Waluya., & Rusilowati. (2015). Mathematics Literacy Based on Adversity Quotient on The Discovery Learning And Guilford Approach. International Conference on Mathematics, Science, and Education, 2015(Icmse), 18–23. https://icmseunnes.com/2015/wp-content/uploads/2016/03/9_ME.pdf.

Leonard., & Amanah, N. (2014). Pengaruh *Adversity Quotient* (AQ) dan Kemampuan Berpikir Kritis Terhadap Prestasi Belajar Matematika. *Perspektif Ilmu Pendidikan*, 28(1), 55-64. https://doi.org/10.21009/PIP.281.7.

Lepinsky, C. (2005). *Problem-Based Learning. A New Approach to Teaching, Training, & Developing Employees*. http://www.sacpd.org /RCPI/ProblemBasedLearing.pdf.

Lincoln YS, G. E. (1989). *Naturalistic Inquiry*. Sage Publications, Newbury Park

CA.

Madhavia, P., Murni, A., Saragih, S., & Riau, U. (2020). Pengaruh Model Problem Based Learning Terhadap Kemampuan Komunikasi Matematis Siswa Kelas VII SMP Kabupaten Kuantan Singingi. *Jurnal Cendekia*, 4(22), 1239–1245. https://doi.org/10.31004/cendekia.v4i2.357.

Mahmudi, A. (2010). *Pemanfaatan Geogebra dalam Pembelajaran Matematika*. UNY: FMIPA.

Mahmuzah, R. (2015). Peningkatan Kemampuan Berpikir Kritis Matematis Siswa Melalui Pendekatan Problem Posing. *Jurnal Peluang*, 4(1), 64–72. http://jurnal.unsyiah.ac.id/peluang/.

Manizade, A.G., & Mason, M. (2011). Choosing Geogebra Applications Most Appropriate for Teacher's Current Geometry Classroom: Pedagogical Perspective. *International Journal of Educational Studies in Mathematics*, 76(1), 214-218.

Martin, H. (2012). *Bremen and Freiburg Lectures: Insight into That Which Is and Basic Principles of Thinking.* Indian: Indiana University Press.

Maulida, D., Roesdiana, L., & Munandar, D. R. (2022). Kemampuan Berpikir Kritis Matematis Siswa Kelas XI pada Materi Trigonometri. *Jurnal Cendekia*, 7(1), 16-26. https://doi.org/10.31004/cendekia.v7i1.1659.

Maulidiya, M., & Nurlaelah, E. (2018). The Effect of Problem Based Learning on Critical Thinking Ability in Mathematics Education. *Journal of Physics: Conf. Series 1157*. Doi: 10.1088/1742-6596/1157/4/042063.

McPeck, J. E. (1990). Critical Thinking and Subject Specificity: A Reply to Ennis. *American Educational research*, 19(4), 10-12. https://doi.org/10.2307/1176382.

Mergendoller, J., Maxwell, N., & Bellisimo, Y. (2006). The Effectiveness of Problem-Based Instruction: A Comparative Study of Instructional Methods and Student Characteristics. The *Interdisciplinary Journal of Problem-Based Learning*, 1(2), 49–69. DOI:10.7771/1541-5015.1026.

Merritt, J., Lee, M. Y., Rillero, P., & Kinach B. M. (2017). Problem-Based Learning in K–8 Mathematics and Science Education: A Literature Review. *Ijpbl*, 11(2), 5-17. https://doi.org/10.7771/1541-5015.1674.

Miatun, A., & Khusna, H. (2020). Pengaruh Geogebra Online Berbasis Scaffolding dan Tingkat Self-Regulated Learning Terhadap Kemampuan Berpikir Kritis. *Phytagoras: Jurnal Pendidikan Matematika*, 15(2), 124-136. http://dx.doi.org/10.21831/pg.v15i2.34499.

Miller, S. E., & Topple, T. A. (2020). Thinking and Thinking About Thinking: A Qualitative Study of Learning in a Process-Centric Teaching Model. Journal of Social Work Education, 56(1), 115–130. https://doi.org/10.1080/10437797.2019.1648224.

Minarni, A., Napitupulu, E. E., Lubis, S. D., & Annajmi. (2020). *Kemampuan Berfikir Matematis Dan Aspek Afektif Siswa*. Unimed: Harapan Cerdas Publisher.

Monteleone., Chrissy., Miller., Jodie., Warren., & Elizabeth. (2023). Conceptualising Critical Mathematical Thinking in Young Students. *Springer*, 35(2), 339-359. https://doi.org/10.1007/s13394-023-00445-1.

Moore, D. S. (2007). *The Basic Practice of Statistics* (4th ed.). New York: W.H. Freeman and Co.

Moutinho, S., Torres, J., Fernandes, I., & Vasconcelos, C. (2015). Problem-Based Learning and Nature of Science: A Study with Science Teachers. *Procedia- Social and Behavioral Sciences*, 191, 1871–1875. https://doi.org/10.1016/j.sbspro.2015.04.324.

Mulyanto, H., Gunarhandi., & Indriayu, M. (2018). The Effect of Problem Based Learning Model on Student Mathematics Learning Outcomes Viewed from Critical Thinking Skills. *International Online Journal of Education and Teaching (IOJET)*, 5(3), 553-563. http://iojet.org/index.php/IOJET/article/view/392/253.

Munte, D. I., Yusmin, E., & Hamdani, H. (2017). Kemampuan Berpikir Kritis Matematis Siswa dalam Penyelesaian Soal Materi Pertidaksamaan Linier Satu Variabel di SMP. *JPPK: Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 6(11), 1-12. http://dx.doi.org/10.26418/jppk.v6i11.22743.

Muslimahayati. (2020). Development of Critical Thinking Skills Questions Based on Local Wisdom of South Sumatra on Trigonometry Material.

*AKSIOMA: Journal of the Mathematics Education Study Program*, 9(1), 12-20. http://dx.doi.org/10.24127/ajpm.v9i1.2459.

MZ, Z. A., Risnawati., Kurniati, A., & Prahmana, R. C. I. (2017). Adversity Quotient in Mathematics Learning Quantitative (Study on Students Boarding School in Pekanbaru). *IJEME*, 1(2), 169-176. http://dx.doi.org/10.12928/ijeme.v1i2.5780.

MZ, Z. A., Risnawati., Nurdin, E., Azmi, M. P., & Andrian, D. (2021). The Increasing of Math Adversity Quotient in Mathematics Cooperative Learning Through Metacognitive. *International Journal of Instruction*, 14(4), 841-856. https://doi.org/10.29333/iji.2021.14448a.

NH, M. I. S., & Winata, H. (2016). Meningkatkan Hasil Belajar Siswa Melalui Penerapan Model Pembelajaran *Direct Instruction*. *Jp Manper*, 1(1), 49-60. DOI:10.17509/jpm.v1i1.3262.

Nurfitriyanti, M., Rosa, N. M., & Nursa'adah, F. P. (2020). Pengaruh Kemampuan Berpikir Kritis, Adversity Quotient dan Locus of Control terhadap Prestasi Belajar Matematika. *JKPM*, 5(2), 263-272. http://dx.doi.org/10.30998/jkpm.v5i2.5929.

Nurlaeli., Noornia, A., & Wiraningsih, E. D. (2018). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemampuan Berpikir Kritis Matematis Siswa Ditinjau Dari Adversity Quotient. *Fibonacci*, 4(2), 145-154. DOI:10.24853/fbc.4.2.145-154.

Nursyahidah, F., & Albab, I. U. (2018). Identifikasi Kemampuan Berpikir Kritis Matematis Siswa Berkemampuan Pemecahan Masalah Level Rendah dalam Pembelajaran Integral Berbasis *Problem Based Learning*. *Jurnal Elemen*, 4(1), 34-40. https://doi.org/10.29408/jel.v4i1.513.

Olejnik, S., & Algina, J. (2000). Measures of Effect Size for Comparative Studies: Applications, Interpretations, and Limitations. *Contemporary Educational Psychology,* 25(3), 241-286. https://psycnet.apa.org/doi/10.1006/ceps.2000.1040.

Padmavathy, R. D., & Mareesh, K. (2013). Effectiveness of Problem Based Learning in Mathematics. *International Multidisciplinary e-Journal*, 2(1), 45-51. http://www.shreeprakashan.com/.

Parvathy, U., & Praseeda, M. (2014). Relationship Between Adversity Quotient and Academic Problems Among Student Teachers. *IOSR Journal of Humanities and Social Science*, 19(11), 23-26. DOI:10.9790/0837-191172326.

Pratiwi, E. T., & Setyaningtyas, E. W. (2020). Kemampuan Berpikir Kritis Siswa SMA dengan Model Pembelajaran *Problem-Based Learning* dan Model Pembelajaran *Project-Based Learning*. *Jurnal Basicedu*, 4(2), 379-388. https://doi.org/10.31004/basicedu.v4i2.362.

Pritandhari, M. (2017). Implementasi Model Pembelajaran *Direct Instruction* untuk Meningkatkan Kemampuan Berpikir Kreatif Mahasiswa. *Jurnal Promosi*, 5(1), 47-56. DOI:10.24127/ja.v5i1.845.

Purwanto, W. R., Waluya, S. B., Rochmad, & Wardono. (2020). Analysis Of Mathematical Critical Thinking Ability in Student Learning Style. *Journal Of Physics: Conference Series*, *1511*(1). https://doi.org/10.1088/1742-6596/1511/1/012057.

Putri, A. (2018). Profil Kemampuan Berpikir Kritis Matematis Siswa SMP Kelas VII Materi Bangun Ruang Sisi Datar. *Jurnal Pendidikan Tambusai*, 2(2), 793-801. https://doi.org/10.31004/jptam.v2i4.26.

Rahadyan, A., Hartuti, P. M., & Awaludin, A.A.R. (2018). Penggunaan Aplikasi Geogebra dalam Pembelajaran Matematika di Sekolah Menengah Pertama. *Jurnal Pkm: Pengabdian Kepada Masyarakat*, 1(1), 11-19. http://dx.doi.org/10.30998/jurnalpkm.v1i01.2356.

Ramadhanti, F. T., Juandi, D., & Jupri, A. (2022). Pengaruh Problem-Based Learning terhadap Kemampuan Berpikir Tingkat Tinggi Matematis Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11 (1), 667–682. https://doi.org/10.24127/ajpm.v11i1.4715.

Rasmussen, K., & Schmidt, M. C. S. (2022). Together in Adidactic Situations-Student Dialogue During Reciprocal Peer Tutoring in Mathematics. *International Journal of Educational Research Open*, 3, 1–8. https://doi.org/10.1016/j.ijedro.2022.100126.

Rattanatumma, T. (2016). Assessing The Effectiveness of STAD Model and Problem Based Learning in Mathematics Learning Achievement and

Problem-Solving Ability. *Journal Of Education and Practice*, 7(12), 194-199. http://www.iiste.org/.

Raymond, S. N. (2010). *Mathematical Critical Thinking Ability (Patterns, Problems, Conjectures, and Proofs)*. In *Psychology Press*. Psychology Press Taylor & Francis Group.

Rides, S. dan Sparks, K. (2005). *Educator and Learner in PBL*. [Online]. http://scifiles.larc.nasa.gov/text/educators/start/pb1/pb1_roles.html.

Roh, K. H. (2003). *Problem-Based Learning in Mathematics*. ERIC Identifier: EDO-SE-03-07. [Online]. Tersedia: http://www.ericdigest.org/.

Rohmatulloh., Novaliyosi., Nindiasari, H., & Fatah, A. (2022). Integrasi Media Pembelajaran pada Penerapan *Problem Based Learning* (PBL) dalam Pembelajaran Matematika: *Systematic Literature Review*. *Edukatif*, 4(4), 5544-5557. https://edukatif.org/index.php/edukatif/article/view/3249.

Royani, I., Mirawati, B., & Jannah, H. (2018). Pengaruh Model Pembelajaran Langsung Berbasis Praktikum Terhadap Keterampilan Proses Sains dan Kemampuan Berpikir Kritis Siswa. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, 6(2), 46-55. https://doi.org/10.33394/j-ps.v6i2.966.

Sadegi, K., Ghaderi, F., & Abdollahpour, Z. (2021). Self-Reported Teaching Effectiveness and Job Satisfaction Among Teachers: The Role of Subject Matter and Other Demographic Variables. *Heliyon*, 7, issue 6, 1-8. https://doi.org/10.1016/j.heliyon.2021.e07193.

Salam, M., Ibrahim, N., & Sukardjo, M. (2019). Effects of Instructional Models and Spatial Intelligence on the Mathematics Learning Outcomes after Controlling for Students' Initial Competency. International Journal of Instruction, 12(3), 699-716. https://doi.org/10.29333/iji.2019.12342a.

Samura, A. O., Juandi, D., & Darhim. (2020). Improving Mathematical Critical Thinking Skills Through Problem-Based Learning. *Journal Of Physics: Conference Series*, 1521(3). https://doi.org/10.1088/1742-6596/1521/3/032102.

Sanders, S. (2016). Critical and Creative Thinkers in Mathematics Classrooms. *Journal of Student Engagement: Education Matters*, 6(1), 19-27. https://ro.uow.edu.au/jseem/vol6/iss1/4.

Saputra, T. A., Dewi, K., & Istiningsih, S. (2020). Pengaruh Model Problem Based Learning Terhadap Hasil Belajar Matematika. *Progress Pendidikan*, 1(1), 7-13. https://prospek.unram.ac.id/index.php/PROSPEK/Index.

Savery, J. R. (2006). Overview Of Problem-Based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 9-20. http://x.doi.org/10.7771/1541-5015.1002.

Selan, R., Mamoh, O., Patricia, Y., & Laja, W. (2023). Analisis Kemampuan Berpikir Kritis Siswa Ditinjau dari Adversity Quotient. *Mandalika Mathematics and Education Journal*, 5, 28. https://doi.org/10.29303/jm.v5i1.4839.

Selvy, Y., Ikhsan, M., Johar, R., & Saminan. (2019). *Improving Students' Mathematical Creative Thinking and Motivation Through Geogebra Assisted Problem Based Learning*. IOP Conf. Series: Journal of Physics: Conf. Series 1460 (2020) 012004. DOI:10.1088/1742-6596/1460/1/012004.

Setiawi, A. P. (2020). *Pengaruh Model Problem Based Learning Berbantuan Geogebra Terhadap Kemampuan Pemecahan Masalah dan Berpikir Kritis Matematis Siswa Kelas X SMA Negeri Petang*. Bali: Undiksha Repository.

Siegel, H. (2010). Critical Thinking. *International Encyclopedia of Education*, 6, 141-145.

Smith R. S., & Harland T. (2009). Learning to Teach with Problem-Based Learning. *Active Learning in Higher Education*, 10(2), 138-153. http://dx.doi.org/10.1177/1469787409104787.

Snyder, L.G., & Snyder, M. J. (2008). Teaching Critical Thinking and Problem Solving Skills. *The Delta Pi Epsilon Journal*, 50(2), 90-99. http://www.dpe.org/core/home.htm.

Sobur, A. (2010). *Psikologi Umum*. Bandung: Pustaka Setia.

Soidik, A., Solichin, E., & Safitri, E. (2020). Perbedaan Metode Pembelajaran Kooperatif Tipe Problem Based Learning dengan Metode Konvensional Terhadap Hasil Belajar IPS Terpadu Kelas XII SMK. *Jurnal Muara Pendidikan*, 5(1), 602-608. https://doi.org/10.52060/mp.v5i1.276.

Soraya, D., Jampel, I. N., & Diputra, K. S. (2019). The influence of Problem Based Learning (PBL) Learning Model Based on Local Wisdom on Social Attitudes and Critical Thinking in Mathematics Subjects. *Thinking Skills and Creativity Journal*, 1(2), 76–85. https://doi.org/10.23887/tscj.v1i2.20409.

Stentoft, D. (2017). From Saying to Doing Interdisciplinary Learning: Is Problem-Based Learning The Answer?. *Sage Journal*, 18(1), 1-11. https://doi.org/10.1177/1469787417693510.

Stoltz, P G. (2004). *Adversity Quotient: Mengubah Hambatan Menjadi Peluang*. Jakarta: PT Grasindo.

Strauss, A., & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, CA: Sage Publications, Inc.

Suardi. (2020). Implementasi Pembelajaran Berbasis STEM untuk Meningkatkan Kemampuan dalam Berpikir Kritis, Kreatif dan Bekerjasama Peserta Didik Kelas XIA SMA Negeri 4 Sibulue. *Jurnal Sains dan Pendidikan Fisika*, 6(2), 135-144. https://doi.org/10.35580/jspf.v16i2.12557.

Sudihartinih, E., & Purniati, T. (2019). *Using Geogebra to Develop Students Understanding on Circle Concept*. International Conference on Mathematics and Science Education (Icmsce 2018). Atlanta: US. Doi:10.1088/1742-6596/1157/4/042090.

Sukmawati, I., Neviyarni., Syukur, Y., Said, A. (2013). Peningkatan Hasil Belajar Melalui Dinamika Kelompok dalam Perkuliahan Psikologi Dan Bimbingan Konseling. *Pedagogi*, 13(2), 10-18. https://doi.org/10.24036/pedagogi.v13i2.4276.

Sumartini, T. S. (2015). Peningkatan Kemampuan Penalaran Matematis Siswa Melalui Pembelajaran Berbasis Masalah. *Jurnal Pendidikan Matematika*, 5(1), 1-10.

Supardi, U. S. (2015). Pengaruh Adversity Qoutient Terhadap Prestasi Belajar Matematika. *Formatif Jurnal Ilmiah Pendidikan Mipa*, 3(1), 61-71. https://dx.doi.org/10.30998/formatif.v3i1.112.

Supriadi, N. (2015). Pembelajaran Geometri Berbasis *Geogebra* sebagai Upaya Meningkatkan Kemampuan Komunikasi Matematis. *Al-Jabar*, 6(2), 99-109. http://dx.doi.org/10.24042/ajpm.v6i2.20.

Suryadi, D. (2005). *Penggunaan Pendekatan Pembelajaran Tidak Langsung serta Pendekatan Gabungan Langsung dan Tidak Langsung dalam Rangka Meningkatkan Kemampuan Berpikir Matematis Tingkat Tinggi Siswa*. Disertasi UPI. Bandung: Tidak Dipublikasikan.

Suryaningrum, C. W., Purwanto, P., Subanji, S., Susanto, H., Ningtyas, Y. D. W. K., & Irfan, M. (2020). Semiotic Reasoning Emerges in Constructing Properties of A Rectangle: A Study of Adversity Quotient. *Journal on Mathematics Education*, 11(1), 95–110. https://doi.org/10.22342/jme.11.1.9766.95-110.

Sustekova, E., Kubiatko, M., & Usak, M. (2019). Validation of critical thinking test on Slovak conditions. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(12), 1-10. https://doi.org/10.29333/ejmste/112295.

Sutarni, S., & Gatiningsih. (2022). Improving Mathematical Critical Thinking Ability Through Realistic Mathematics Learning in Junior High School Students. *Jurnal Riset Pendidikan Matematika*, 9(1), 46-56. http://dx.doi.org/10.21831/jrpm.v9i1.48750.

Syahbana, A. (2012). Peningkatan Kemampuan Berpikir Kritis Matematis Siswa Melalui Pendekatan *Contextual Teaching And Learning*. *Edumatica*, 2(1), 45-57. https://doi.org/10.22437/edumatica.v2i01.604.

Tajudeen, S., K., Madarsha, B. N., Suryani, N., & Badariah, T. A. T. (2011). Investigating Students' Attitude and Intention to Use Social Software in Higher Institution of Learning in Malaysia. *Multicultural Education & Technology Journal*, 5(3), 194–208. http://dx.doi.org/10.1108/17504971111166929.

Tanujaya, B. (2014). *Pengukuran Keterampilan Berpikir Kritis Siswa SMA dalam Pembelajaran Matematika*. Proceeding Seminar Nasional Psikometri. Surakarta: Fakultas Psikologi Universitas Muhammadiyah Surakarta.

Tong, L. C., Rosli, M. S., & Saleh, N. S. (2022). Enhancing Hots Using Problem-Based Learning and Digital Game in The Context of Malaysian Primary School. *International Journal of Interactive Mobile Technologies*, 16(02), 101–112. https://doi.org/10.3991/Ijim.V16i02.27677.

Trianto, (2007). *Model-Model Pembelajaran Iinovatif Berorientasi Kontruktivistik*. Jakarta: Prestasi Pustaka.

Tunde, J., & Listiani, T. (2021). The Implementation of Direct Instruction Assisted by Incomplete Handout To Increase Conceptual Understanding. *Journal of Physics: Conference Series*, 1806 (2021) 012067. DOI:10.1088/1742-6596/1806/1/012067.

Ulfah, M., Fatirul, A. N., & Walujo, D. A. (2022). The Effect of Problem Based Learning (PBL) Strategy, and Learning Motivation on Students' Chemistry Learning Outcomes. *Jurnal Mantik*, 6(22), 2111-2119. https://iocscience.org/ejournal/index.php/mantik/article/view/2746.

Ulfah, S., Satriani, S., Putri, P., Utami, A. M., Muklis, I., & Hadi, R. (2021). Implementasi Model Pembelajaran Direct Instruction Menggunakan Pendekatan Saintifik pada Mata Pelajaran Ekonomi Kelas X MAN 2 Malang. Jurnal Pendidikan Ekonomi, 14(2), 160–166.

Uliyandari, M., Candrawati, E., Herawati, A. A., & Latipah, N. (2021). Problem-Based Learning to Improve Concept Understanding and Critical Thinking Ability of Science Education Undergraduate Students. *IJORER*, 2(1), 65-72. https://doi.org/10.46245/ijorer.v2i1.56.

Wardono., Waluya, B., Kartono., Mulyono., & Mariani, S. (2018). Development of Innovative Problem Based Learning Model with PMRI-Scientific Approach Using ICT to Increase Mathematics Literacy and Independence-Character of Junior High School Students. *Journal of Physics: Conference Series*, 983(1). DOI: 10.1088/1742-6596/983/1/012099.

Wassie, Y. A., & Zergaw, G. A. (2019). Some of the Potential Affordances, Challenges and Limitations of Using Geogebra in Mathematics Education. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(8), 1-11. https://doi.Org/10.29333/ejmste/108436.

Watson, G., & Glaser, E. M. (2008). *Watsonglaser Critical Thinking Appraisal: Short Form Manual.* USA: Pearson Education, Inc.

Wechsler, S. M., Saiz, C., Vendramini, C. M. M., Almeida, L. S., Mundim, M. C., & Franco, A. (2017). Creative and critical thinking: Independent or overlapping components?. *Elsevier*, 27, 114-122. https://doi.org/10.1016/j.tsc.2017.12.003.

Widyatiningtyas, R., Kusumah, Y. S., Sumarmo, U., & Sabandar, J. (2015). The Impact of Problem-Based Learning Approach to Senior High School Students' Mathematics Critical Thinking Ability. *JME,* 6(2), 107-116. https://doi.org/10.22342/jme.6.2.2165.107-116.

Yaghmour, K. S., & Obaidat, L. T. (2022). The Effectiveness of Using Direct Instruction in Teaching Comprehension Skill of Third-Grade Students. *IJI*, 15(2), 373-392. https://doi.org/10.29333/iji.2022.15221a.

Yew, E. H., & Goh, K. (2016). Problem-Based Learning: An Overview of Its Process and Impact on Learning. *Health Professions Education*, 2(3), 75-79. https://doi.org/10.1016/j.hpe.2016.01.004.

Yunita, N., Rosyana, T., & Hendriana, H. (2018). Analisis Kemampuan Berpikir Kritis Matematis Berdasarkan Motivasi Belajar Matematis Siswa. *JPMI*, 1(3), 325-332. DOI:10.22460/jpmi.v1i3.p325-332.

Zetriuslita., Nofriyandi., Istikomah, E. (2020). The Effect of Geogebra-Assisted Direct Instruction on Students' Self-Efficacy And Self-Regulation. *Infinity*, 9(1), 41-48. https://doi.org/10.22460/infinity.v9i1.p41-48.

Zulnaidi, H., & Zamri, S. N. A. S. (2017). The Effectiveness of Geogebra Software: The Intermediary Role of Procedural Knowledge on Students' Conceptual Knowledge and Their Achievement in Mathematics. *Eurasia Journal of Mathematics Science and Technology Education*, 13(6), 2155-2180. https://doi.org/10.12973/eurasia.2017.01219a.