

**PENGEMBANGAN BAHAN AJAR BANGUN RUANG SISI DATAR
UNTUK MENINGKATKAN KEMAMPUAN KOMUNIKASI MATEMATIS
DAN KEMANDIRIAN BELAJAR SISWA
MELALUI PEMBELAJARAN BERBASIS MASALAH
BERBANTUAN GEOGEBRA**



DISERTASI

Diajukan untuk Memenuhi Sebagian dari Syarat Memperoleh
Gelar Doktor Pendidikan Matematika

**Oleh
Toni Hidayat**

**NIM
2208087**

**PROGRAM STUDI PENDIDIKAN MATEMATIKA
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU
PENGETAHUAN ALAM UNIVERSITAS PENDIDIKAN INDONESIA
2025**

**PENGEMBANGAN BAHAN AJAR BANGUN RUANG SISI DATAR
UNTUK MENINGKATKAN KEMAMPUAN KOMUNIKASI MATEMATIS
DAN KEMANDIRIAN BELAJAR SISWA
MELALUI PEMBELAJARAN BERBASIS MASALAH
BERBANTUAN GEOGEBRA**

Oleh
Toni Hidayat

S.Pd. Universitas Bengkulu, 2013
M.Pd. Universitas Negeri Malang, 2017

Sebuah disertasi yang diajukan untuk memenuhi salah satu syarat
memperoleh gelar Doktor Pendidikan (Dr.) pada Fakultas Pendidikan
Matematika dan IPA

© Toni Hidayat
Universitas Pendidikan Indonesia
Agustus 2025

Hak Cipta dilindungi undang-undang.

Disertasi ini tidak boleh diperbanyak seluruhnya atau sebagian,
dengan dicetak ulang, difoto kopi, atau cara lainnya tanpa ijin penulis.

HALAMAN PENGESAHAN DISERTASI

TONI HIDAYAT

**PENGEMBANGAN BAHAN AJAR BANGUN RUANG SISI DATAR
UNTUK MENINGKATKAN KEMAMPUAN KOMUNIKASI MATEMATIS
DAN KEMANDIRIAN BELAJAR SISWA
MELALUI PEMBELAJARAN BERBASIS MASALAH
BERBANTUAN GEOGEBRA**

disetujui dan disahkan oleh panitia disertasi:

Promotor

Prof. Dr. H. Darhim, M.Si.

NIP. 195503031980021002

Kopromotor

Prof. Dr. H. Sufyani Prabawanto, M.Ed.

NIP. 19600830 1986031003

Anggota

Dr. H. Jarnawi Afgani Dahlan, M.Kes

NIP. 196805111991011001

Penguji

Dr. H. Endang Cahya Mulyaning Asih, M.Si.

NIP. 196506221990011001

Penguji

Prof. Dr. Dr. Wardono, M.Si.

NIP. 196202071986011001

Mengetahui,
Ketua Program Studi Pendidikan Matematika

Dr. H. Jarnawi Afgani Dahlan, M.Kes

NIP. 196805111991011001

**PENGEMBANGAN BAHAN AJAR BANGUN RUANG SISI DATAR
UNTUK MENINGKATKAN KEMAMPUAN KOMUNIKASI MATEMATIS
DAN KEMANDIRIAN BELAJAR SISWA
MELALUI PEMBELAJARAN BERBASIS MASALAH
BERBANTUAN GEOGEBRA**

ABSTRAK

Penelitian ini bertujuan untuk mengembangkan bahan ajar matematika pada materi bangun ruang sisi datar guna meningkatkan kemampuan komunikasi matematis dan kemandirian belajar siswa melalui pembelajaran berbasis masalah berbantuan GeoGebra. Penelitian dilaksanakan di salah satu SMP Negeri di Kota Bengkulu dengan menggunakan metode penelitian dan pengembangan model ADDIE yang meliputi tahap validasi ahli, uji coba terbatas, serta uji kepraktisan dan efektivitas. Hasil validasi menunjukkan bahwa bahan ajar berada dalam kategori sangat valid berdasarkan penilaian dari ahli materi, media, bahasa, pedagogi, dan evaluasi. Uji kepraktisan menunjukkan bahwa bahan ajar sangat praktis dan mudah digunakan dalam kegiatan pembelajaran. Uji efektivitas dilakukan melalui *paired sample t-test*, yang menghasilkan nilai signifikansi sebesar 0,000 ($<0,05$), menunjukkan peningkatan yang signifikan dalam kemampuan komunikasi matematis siswa. Nilai N-Gain sebesar 0,77 mengindikasikan efektivitas yang tinggi terhadap hasil belajar. Uji Friedman terhadap angket kemandirian belajar dari pertemuan 1 hingga 7 menghasilkan nilai Chi-Square sebesar 237.996 dengan signifikansi 0,000, yang menunjukkan perbedaan signifikan serta kecenderungan peningkatan positif dalam kemandirian belajar siswa selama proses pembelajaran berlangsung. Dengan demikian, bahan ajar dinyatakan valid, praktis, dan efektif dalam mendukung pembelajaran.

Kata Kunci: bahan ajar, GeoGebra, komunikasi matematis, kemandirian belajar, pembelajaran berbasis masalah

DEVELOPMENT OF TEACHING MATERIALS ON POLYHEDRA TO ENHANCE STUDENTS' MATHEMATICAL COMMUNICATION SKILLS AND LEARNING INDEPENDENCE THROUGH PROBLEM- BASED LEARNING ASSISTED BY GEOGEBRA

ABSTRACT

This study aims to develop mathematics teaching materials to enhance students' mathematical communication skills and learning independence through problem-based learning supported by GeoGebra. The research was conducted at a state secondary school in Bengkulu City using the ADDIE development model, which consists of expert validation, limited trials, and tests of practicality and effectiveness. The validation results indicated that the teaching materials are categorised as highly valid, based on assessments by experts in subject content, media, language, pedagogy, and evaluation. The practicality test showed that the materials are highly practical and easy to implement in classroom activities. The effectiveness test, carried out using a paired sample t-test, produced a significance value of 0.000 (<0.05), indicating a significant improvement in students' mathematical communication abilities. An N-Gain score of 0.77 reflects a high level of effectiveness in improving learning outcomes. The Friedman test applied to the learning independence questionnaire across meetings 1 to 7 yielded a Chi-Square value of 237.996 with a significance level of 0.000, demonstrating significant differences and a positive trend in students' learning independence throughout the learning process. Therefore, the developed teaching materials are considered valid, practical, and effective in supporting mathematics learning.

Keywords: teaching materials, GeoGebra, mathematical communication, learning independence, problem-based learning.

DAFTAR ISI

Halaman Judul	
Halaman Hak Cipta	i
Halaman Pengesahan	ii
Abstrak	iii
Abstract	iv
Daftar Isi	v
Daftar Tabel	vii
Daftar Gambar	viii
Daftar Lampiran	xi

BAB I PENDAHULUAN

1.1 Latar Belakang Penelitian	1
1.2 Rumusan Masalah	26
1.3 Tujuan Penelitian	27
1.4 Manfaat Penelitian	28
1.5 Defenisi Operasional	29

BAB II TINJAUAN PUSTAKA

2.1 Kemampuan Komunikasi Matematis	31
2.2 Kemandirian Belajar	36
2.3 Pembelajaran Geometri	43
2.4 Materi Bangun Ruang Sisi Datar	45
2.5 Pembelajaran Berbantuan Geogebra	48
2.6 Pembelajaran Berbasis Masalah	53
2.7 Pembelajaran Berbasis Masalah Berbantuan Geogebra	60
2.8 Bahan Ajar	67
2.9 Media Pembelajaran	69
2.10 Penelitian Relevan	71
2.11 Keterbaruan Penelitian	73

2.12 Hipotesis Penelitian	73
2.13 Kerangka Berpikir.....	74

BAB III METODE PENELITIAN

3.1 Metode Penelitian.....	76
3.2 Subjek dan Tempat Penelitian	81
3.3 Prosedur Pengumpulan data.....	82
3.4 Teknik analisis Data.....	84

BAB IV HASIL

4.1 Hasil Penelitian	95
4.1.1 Deskripsi Pengembangan Bahan Ajar	95
4.1.2 Gambaran Hasil Validitas, Kepraktisan dan keefektifan Bahan Ajar	177
4.1.3 Aktivitas Siswa Dalam Pembelajaran.....	191
4.1.4 Deskripsi Kemampuan Komunikasi Matematis.....	218
4.1.5 Deskripsi Kemandirian Belajar Siswa	249

BAB V PEMBAHASAN

5.1 Pengembangan Bahan Ajar	272
5.2 Validitas, Praktikalitas dan Efektivitas Bahan Ajar	276
5.3 Aktivitas Siswa Menggunakan Bahan Ajar di Kelas	285
5.4 Peningkatan Komunikasi Matematis Siswa	292
5.5 Kemandirian Belajar Siswa.....	299

BAB VI SIMPULAN, IMPLIKASI DAN REKOMENDASI

6.1 Simpulan	304
6.2 Implikasi.....	307
6.3 Rekomendasi	308

DAFTAR PUSTAKA	300
----------------------	-----

DAFTAR TABEL

Tabel 2.1 Strategi desain SRL.....	42
Tabel 2.2 Langkah-langkah PBL	58
Tabel 3.1 Kategori Kevalidan	89
Tabel 3.2 Kategori Kepraktisan	90
Tabel 3.3 Tingkat Kefektifan	92
Tabel 3.4 Kriteria Keberhasilan Tes	93
Tabel 4.1 Data Keterampilan Teknologi Siswa	98
Tabel 4.2 Lingkungan Pendukung Pembelajaran.....	100
Tabel 4.3 Kondisi Pembelajaran di Kelas	103
Tabel 4.4 Inisial Subjek Menyelesaikan Soal Komunikasi Matematis.....	107
Tabel 4.5 Hasil Validasi Bahan Ajar Oleh Ahli.....	178
Tabel 4.6 Hasil Validasi Instrumen.....	186
Tabel 4.7 Skor Angket Kepraktisan Bahan Ajar.....	188
Tabel 4.8 Hasil <i>Pair Paired Samples Correlations</i>	224
Tabel 4.9 <i>Paired Samples Test</i> Komunikasi Matematis	224
Tabel 4.10 Hasil <i>N-Gain Pretest</i> dan <i>Post test</i>	226
Tabel 4.11 Hasil <i>Friedman Test</i> Angket Kemandirian Belajar.....	252

DAFTAR GAMBAR

Gambar 1.1 Jawaban Siswa LF	6
Gambar 1.2 Jawaban Siswa RD	7
Gambar 1.3 Jawaban Siswa AR	8
Gambar 1.4 <i>Network Visualization VOSviewer</i>	23
Gambar 1.5 Visualisasi Bibliometrik	24
Gambar 2.1 Tiga Fase Kemandirian Belajar	41
Gambar 2.2 Kerangka Berpikir	75
Gambar 3.1 Bagan Alur Penelitian	80
Gambar 4.1 Diagram Kepemilikan Perangkat Teknologi	97
Gambar 4.2 Gambar Jumlah Siswa Melakukan Kesalahan per Indikator.....	106
Gambar 4.3 Jawaban Subjek SB1	107
Gambar 4.4 Jawaban Subjek SB2	110
Gambar 4.5 Jawaban Subjek SB3	111
Gambar 4.6 Jawaban Subjek SB4	114
Gambar 4.7 Jawaban Subjek SB5	116
Gambar 4.8 Jawaban Subjek SB6	118
Gambar 4.9 Jawaban Subjek SB7	121
Gambar 4.10 Mind Map Materi Bahan ajar	134
Gambar 4.11 Beranda Akun Geogebra	135
Gambar 4.12 Langkah-langkah Membuat Folder	136
Gambar 4.13 Pemberian Nama Folder.....	136
Gambar 4.14 Menu <i>Create</i> Dalam Folder.....	137
Gambar 4.15 Folder Topik Pembahasan Bahan Ajar	137
Gambar 4.16 Menu <i>Activity</i> di Dalam Folder Kubus	138
Gambar 4.17 Menu <i>Insert</i>	139
Gambar 4.18 Pembuatan Pembahasan Pembelajaran.....	140
Gambar 4.19 Menu <i>Insert</i> GeoGebra.....	141
Gambar 4.20 Tampilan Opsi saat <i>Insert</i> GeoGebra	142
Gambar 4.21 Tampilan setelah <i>Insert</i> GeoGebra	142
Gambar 4.22 Menu Pembuatan Latihan Soal.....	144

Gambar 4.23 Tampilan Soal <i>Multiple Choice</i>	145
Gambar 4.24 Opsi <i>Book</i> Pembuatan Bahan Ajar	146
Gambar 4.25 Opsi <i>Title</i> Bahan Ajar	147
Gambar 4.26 Tampilan <i>Add Chapter</i> , <i>Add Activity</i> dan <i>View Book</i>	149
Gambar 4.27 Tampilan Menu Bahan Ajar	150
Gambar 4.28 Materi Sisi Kubus Sebelum Validasi	153
Gambar 4.29 Materi Sisi Kubus Setelah Validasi	154
Gambar 4.30 Materi Jaring-jaring Kubus Sebelum Validasi	155
Gambar 4.31 Materi Jaring-jaring Kubus Setelah Validasi	156
Gambar 4.32 Menu Jawaban Siswa Sebelum Validasi	157
Gambar 4.33 Menu Jawaban Siswa Setelah Validasi	158
Gambar 4.34 Materi Bidang Diagonal Balok Sebelum Validasi	158
Gambar 4.35 Materi Bidang Diagonal Balok Setelah Validasi	159
Gambar 4.36 Materi Volume Balok Sebelum Validasi	160
Gambar 4.37 Materi Volume Balok Setelah Validasi	161
Gambar 4.38 Materi Jaring-jaring Balok Setelah Validasi	163
Gambar 4.39 Materi Jaring-jaring Balok Setelah Validasi	164
Gambar 4.40 Materi Rusuk Limas Sebelum Validasi	165
Gambar 4.41 Materi Rusuk Limas Setelah Validasi	166
Gambar 4.42 Uji Coba Terbatas	168
Gambar 4.43 <i>Observer</i> di Kelas	171
Gambar 4.44 Siswa Menggunakan Bahan Ajar di Kelas	172
Gambar 4.45 Siswa Mengeksplor Bahan Ajar Geogebra	173
Gambar 4.46 Peneliti Memantau Diskusi Siswa	174
Gambar 4.47 Siswa Mempresentasikan Hasil Diskusi Kelompok	175
Gambar 4.48 Siswa Mengerjakan <i>Post-Test</i>	176
Gambar 4.49 Pembelajaran yang Berorientasi pada Permasalahan	192
Gambar 4.50 Siswa Eksplorasi Jaring-jaring.....	194
Gambar 4.51 Eksplorasi Siswa Bagian-bagian Kubus	195
Gambar 4.52 <i>Jawaban Post Test</i> NAH	226
Gambar 4.53 <i>Jawaban Post Test</i> AH	229

Gambar 4.54 <i>Jawaban Post Test CAB</i>	233
Gambar 4.55 <i>Jawaban Post Test AAH</i>	237
Gambar 4.56 <i>Jawaban Post Test HAW</i>	239
Gambar 4.57 <i>Jawaban Post Test NS</i>	242
Gambar 4.58 <i>Jawaban Post Test HT</i>	246

DAFTAR LAMPIRAN

Lampiran 1 Link Bahan Ajar	334
Lampiran 2 Modul Ajar (RPP).....	335
Lampiran 3 Angket Kepraktisan	359
Lampiran 4 Lembar Validasi Bahan Ajar	364
Lampiran 5 Soal Komunikasi Matematis.....	390
Lampiran 6 Lembar Validasi Soal Komunikasi Matematis.....	403
Lampiran 7 Skor Pretest dan Posttest Siswa	421
Lampiran 8 Kisi-Kisi Angket Kemandirian Belajar.....	423
Lampiran 9 Lembar Angket Kemandirian Belajar	426
Lampiran 10 Lembar Validasi Angket Kemandirian Belajar	431
Lampiran 11 Hasil Angket Kemandirian Belajar	436
Lampiran 12 Surat Keterangan Selesai Penelitian.....	453
Lampiran 13 Riwayat Hidup.....	454

DAFTAR PUSTAKA

- Abdullah, I. H., & Suratno, J. (2015). Pengaruh Pendekatan Pembelajaran Berbasis Masalah Terhadap Kemampuan Komunikasi Matematis Siswa. *Jurnal Pengajaran Matematika Dan Ilmu Pengetahuan Alam*, 6(1), 112.
<https://doi.org/10.18269/jpmipa.v20i2.572>
- Afifah, U. N., Waluya, B., & Dewi, N. R. (2023). Membangun Kemampuan Komunikasi Matematis: Strategi Integrasi Self-Concept Dan Brainstorming Dalam Model Problem Based Learning. *Jurnal Cendekia Jurnal Pendidikan Matematika*, 7(3), 3159–3176. <https://doi.org/10.31004/cendekia.v7i3.2846>
- Ajai, J. T., & Imoko, B. I. (2015). Gender Differences in Mathematics Achievement and Retention Scores: A Case of Problem-Based Learning Method. *International Journal of Research in Education and Science (IJRES)*, 1(1), 45–50. www.ijres.net
- Aliasgari, M., Riahinia, N., & Mojdehavar, F. (2010). Computer-assisted instruction and student attitudes towards learning mathematics. *Education, Business and Society: Contemporary Middle Eastern Issues*, 3(1), 6–14.
<https://doi.org/10.1108/17537981011022779>
- Alqahtani, M. M., & Powell, A. B. (2016). Instrumental Appropriation of a Collaborative, Dynamic-Geometry Environment and Geometrical Understanding. *International Journal of Education in Mathematics, Science and Technology*, 4(2), 72.
<https://doi.org/10.18404/ijemst.38054>
- Amalia, L. R., & Sholeh, M. (2024). Analisis Implementasi Profil Pelajar Pancasila Melalui Pembelajaran Pendidikan Agama Islam Dan Budi Pekerti Di Sekolah Dasar. *Jurnal Pendidikan Dasar Flobamorata*, 5(2), 181–189.
<https://doi.org/10.51494/jpdf.v5i2.1142>
- Amjad, A. I. (2022). Neuroscientific Study on the Effect of Brain-Based Learning on Students' Intrinsic Motivation to Learn Mathematics. *Annals of Human and Social Sciences*, 3(II). [https://doi.org/10.35484/ahss.2022\(3-ii\)69](https://doi.org/10.35484/ahss.2022(3-ii)69)
- Amri, S., & Rohman, M. (2013). *Strategi dan Desain Pengembangan Sistem Pembelajaran*. Prestasi Pusaka Karya.
- Arends, R. I. (2012). *Learning to teach*. McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc.
- Asih, N., & Ramdhani, S. (2019). Peningkatan Kemampuan Pemecahan Masalah Matematis Dan Kemandirian Belajar Siswa Menggunakan Model Pembelajaran Means End Analysis. *Mosharafa Jurnal Pendidikan Matematika*, 8(3), 435–446.

- <https://doi.org/10.31980/mosharafa.v8i3.534>
- Aziz, Z., & Anowar Hossain, M. (2010). A comparison of cooperative learning and conventional teaching on students' achievement in secondary mathematics. *Procedia - Social and Behavioral Sciences*, 9, 53–62.
<https://doi.org/10.1016/j.sbspro.2010.12.115>
- Azizah1, H. G., & Muhammad Ghiyats Ristiana. (2023). *Pengembangan Bahan Ajar Materi Bangun Ruang*. 13(April 2023), 47–53.
<https://doi.org/10.22460/jpmi.v6i4.17661>
- Baist, A., Firmansyah, M. A., & Pamungkas, A. S. (2019). Desain Bahan Ajar Komputasi Matematika Berbantuan Software Mathematica Untuk Mengembangkan Kemandirian Belajar Mahasiswa. *Fibonacci Jurnal Pendidikan Matematika Dan Matematika*, 5(1), 29. <https://doi.org/10.24853/fbc.5.1.29-36>
- Barrows, H. (1996). *New Direction for Teaching and Learning "ProblemBased Learning in Medichine and Beyond; Abrief Overview*. Jossey Bass Publishers.
- Barus, A. N., Sembiring, J. S. P., & Aditia, Y. H. (2023). Meta Analisis Efektivitas Model Pembelajaran Berbasis Masalah Terhadap Kemampuan Pemecahan Masalah Dan Hasil Belajar Fisika Di SMA. *Jurnal Inovasi Pendidikan Sains Dan Terapan (Intern)*, 2(2), 40–50. <https://doi.org/10.58466/intern.v2i2.1146>
- Battista, M. (1999). Geometry results from the third international mathematics and science study. *Teaching Children Mathematics*, 5(6), 367–373.
- Bhagwonparsadh, Y., & Pule, K. G. (2024). The Effects of Educators' Mathematics Pedagogical Content Knowledge on the Mentoring of Grade 12 Students Using Problem-Based Learning. *Journal of Culture and Values in Education*, 7(1), 99–117. <https://doi.org/10.46303/jcve.2024.7>
- Birgin, O., & Yazıcı, K. U. (2021). The Effect Of GeoGebra Software–supported mathematics Instruction on Eighth-grade Students' Conceptual Understanding and Retention. *Journal of Computer Assisted Learning*, 37(4), 925–939.
<https://doi.org/10.1111/jcal.12532>
- Bohalima, Y. H. (2022). Analisis Kemampuan Pemahaman Konsep Siswa Pada Materi Persamaan Garis Lurus. *Educativo Jurnal Pendidikan*, 1(1), 22–28.
<https://doi.org/10.56248/educativo.v1i1.4>
- Branch, R. M. (2009). Prologue. In *Instructional Design: The ADDIE Approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6_1
- Bretscher, N. (2021). Challenging Assumptions About Relationships Between

- Mathematics Pedagogy and ICT Integration: Surveying Teachers in English Secondary Schools. *Research in Mathematics Education*, 23(2), 142–158.
<https://doi.org/10.1080/14794802.2020.1830156>
- Bülbül, B. Ö., & Güler, M. (2022). Examining the Effect of Dynamic Geometry Software on Supporting Geometric Habits of Mind: A Qualitative Inquiry. *E-Learning and Digital Media*, 20(2), 138–161. <https://doi.org/10.1177/20427530221107776>
- Cantona, I. G. E., Suastra, I. W., & Ardana, I. M. (2023). HOTS Oriented Problem-Based Learning Model: Improving Critical Thinking Skills and Learning Outcomes of Fifth Grade Students in Science Learning. *Thinking Skills and Creativity Journal*, 6(1), 19–26. <https://doi.org/10.23887/tscj.v6i1.61654>
- Capili, K. D., Tamban, V. E., Yazon, A. D., Sapin, S. B., & Manaig, K. A. (2023). Effectiveness of Triangle Congruency (Tricon) Learning Guide in Improving the Proving Skills of Grade 8 Learners. *International Journal of Social Science and Human Research*, 06(06). <https://doi.org/10.47191/ijsshr/v6-i6-67>
- Chan, S., Mamat, N. H., & Nadarajah, V. D. (2022). Mind Your Language: The Importance of English Language Skills in an International Medical Programme (IMP). *BMC Medical Education*, 22(1). <https://doi.org/10.1186/s12909-022-03481-w>
- Chang, C., & Bhagat, K. K. (2015). Incorporating GeoGebra Into Geometry Learning-a Lesson From India. *Eurasia Journal of Mathematics Science and Technology Education*, 11(1). <https://doi.org/10.12973/eurasia.2015.1307a>
- Chapko, Mary Ann; Buchko, M. (2004). Math Instruction for Inquiring Minds: Two Principals Explain Why They Turned From Conventional Math Instruction to an Approach that Focuses on Understanding and Applying Math Concepts. *Principal*. <https://doi.org/https://eric.ed.gov/?id=EJ693872>
- Chasanah, I. M. (2021). Proses Matematisasi Siswa SMP dalam Menyelesaikan Masalah Kontekstual Ditinjau dari Kemampuan. *MATHEdunesa*, 10(1), 69–78.
<https://doi.org/10.26740/mathedunesa.v10n1.p69-78>
- Cheng, E. C. K. (2011). The role of self-regulated learning in enhancing learning performance. *The International Journal of Research and Review*, 6(1), 1–17.
- Dahlan, J. A., & Juandi, D. (2011). Analisis Representasi Matematik Siswa Sekolah Dasar Dalam Penyelesaian Masalah Matematika Kontekstual. *Pengajaran MIPA*, 16, 128–138.
- Damar Jati Nugroho;, Suparni;, & Tugiman. (2024). Pembelajaran matematika berbasis

- lesson study dengan menggunakan model problem based learning (PBL) pada materi barisan dan deret. *NOTASI: Jurnal Pendidikan Matematika*, 2(2), 91–101. <https://doi.org/10.70115/notasi.v2i2.191>
- Damayanti, D., & Nuzuli, A. K. (2023). Evaluasi Efektivitas Penggunaan Teknologi Komunikasi Dalam Pengajaran Metode Pendidikan Tradisional Di Sekolah Dasar. *Journal of Sciencetech Research and Development*, 5(1), 208–219. <https://doi.org/10.56670/jsrd.v5i1.130>
- Daulay, L. A., Asnawi, A., & Letisa, R. (2020). Pengaruh Model Pembelajaran Problem Based Learning (PBL) Dan Think Pair Share Terhadap Kemampuan Komunikasi Matematis Siswa. *Suska Journal of Mathematics Education*, 6(2), 129. <https://doi.org/10.24014/sjme.v6i2.9648>
- Delima, N., & Cahyawati, D. (2021). Students' Mathematics Self-Concept, Mathematics Anxiety and Mathematics Self-Regulated Learning During the Covid-19 Pandemic. *Jurnal Pendidikan Matematika*, 15(2), 103–114. <https://doi.org/10.22342/jpm.15.2.13200.103-114>
- Dikovic, L. (2009). Implementing dynamic mathematics resources with geogebra at the college level. *International Journal of Emerging Technologies in Learning*, 4(3), 51–54. <https://doi.org/10.3991/ijet.v4i3.784>
- Effendi, E., Mursilah, M., & Mujiono, M. (2018). Korelasi Tingkat Perhatian Orang Tua Dan Kemandirian Belajar Dengan Prestasi Belajar Siswa. *Titian Ilmu Jurnal Ilmiah Multi Sciences*, 10(1), 17–23. <https://doi.org/10.30599/jti.v10i1.131>
- Eka Putri, H., Nuraeni, F., Herlina Arrum, A., Karisma Pertiwi, C., Nurhanifa, R., & Wulandari, H. (2024). Development of Motion Graphics Video Based on CPA Approach to Enhance Elementary Students' Mathematical Creative Thinking Ability. *KnE Social Sciences*, 2024, 540–551. <https://doi.org/10.18502/kss.v9i8.15613>
- Ekawati, A. (2016). Penggunaan software geogebra dan microsoft mathematic dalam pembelajaran matematika. *Math Didactic: Jurnal Pendidikan Matematika*, 2(3), 148–153. <https://doi.org/10.33654/math.v2i3.43>
- Elvi, M., & Nurjanah, N. (2017). Improvement of the Ability of Junior High School Students Thinking Through Visual Learning Assisted Geo Gbra Tutorial. *Journal of Physics Conference Series*, 812, 12008. <https://doi.org/10.1088/1742-6596/812/1/012008>
- Ersyandi, A. (2023). *Strategi Pembelajaran Yang Mudah Diterapkan Untuk*

- Memfasilitasi Pembelajaran Mandiri*. <https://doi.org/10.31219/osf.io/q2dpr>
- Eyitayo, E., & Gumbo, M. T. (2017). The Effects of Self-Regulated Learning Training on Students' Metacognition and Achievement in Chemistry. *International Journal of Innovation in Science and Mathematics Education*, 25(2), 34–48.
- Fasa, I. L., Pratama, D. Y., & Firmansyah, E. (2020). Peningkatan Kemampuan Representasi Matematis dan Kemandirian Belajar Siswa melalui Model Pembelajaran PBL Berbantuan Geogebra. *Pasundan Journal of Mathematics Education : Jurnal Pendidikan Matematika*, 10(Vol 10 No. 2). <https://doi.org/10.23969/pjme.v10i2.2741>
- Firmansyah, D., Gyanendra, A., Zafitri, P., Surya, P., Nadid, T., Auliya, A. S., & Lutfianti, L. (2024). Seminar Introduction AI: Membangun Kesiapan Guru Menghadapi Pembaharuan Teknologi Pendidikan Di SDN 15 Cakranegara. *Rengganis Jurnal Pengabdian Masyarakat*, 4(2), 266–274. <https://doi.org/10.29303/rengganis.v4i2.446>
- Fitra, A., & Sitorus, M. (2021). Pengaruh Pembelajaran Berbantuan Aplikasi Geogebra Terhadap Hasil Belajar Siswa Di Kelas VIII SMP Kemala Bhayangkari I Medan. *Jurnal Media Informatika*, 2(2), 51–61. <https://doi.org/10.55338/jumin.v2i2.694>
- Fitriani, N., Hidayah, I. S., & Nurfauziah, P. (2021). Live Worksheet Realistic Mathematics Education Berbantuan Geogebra: Meningkatkan Abstraksi Matematis Siswa SMP Pada Materi Segiempat. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 5(1), 37. <https://doi.org/10.33603/jnpm.v5i1.4526>
- Freeman, B., Higgins, K. N., & Horney, M. (2020). How Students Communicate Mathematical Ideas: An Examination of Multimodal Writing Using Digital Technologies. *Contemporary Educational Technology*, 7(4), 281–313. <https://doi.org/10.30935/cedtech/6178>
- Froiland, J. M., & Worrell, F. C. (2016). Intrinsic Motivation, Learning Goals, Engagement, and Achievement in a Diverse High School. *Psychology in the Schools*, 53(3), 321–336. <https://doi.org/10.1002/pits.21901>
- Gardenia, N., Herman, T., & Dahlan, T. (2019). *PQ4R Strategy (Preview, Question, Read, Reflection, Recite, Review) for Mathematical Communication Ability*. 253(Aes 2018), 322–327. <https://doi.org/10.2991/aes-18.2019.75>
- Garon-Carrier, G., Boivin, M., Guay, F., Kovas, Y., Dionne, G., Lemelin, J., Séguin, J. R., Vitaro, F., & Tremblay, R. E. (2015). Intrinsic Motivation and Achievement in Mathematics in Elementary School: A Longitudinal Investigation of Their

- Association. *Child Development*, 87(1), 165–175.
<https://doi.org/10.1111/cdev.12458>
- Ghifari, S. S. A., Dahlan, J. A., & Usdiyana, D. (2023). Studi Meta Analisis: Pengaruh Strategi React Terhadap Kemampuan Komunikasi Matematis Siswa. *Aksioma Jurnal Program Studi Pendidikan Matematika*, 12(1), 1106.
<https://doi.org/10.24127/ajpm.v12i1.6689>
- González, G., & Herbst, P. G. (2009). Students' Conceptions of Congruency Through the Use of Dynamic Geometry Software. *International Journal of Computers for Mathematical Learning*, 14(2), 153–182. <https://doi.org/10.1007/s10758-009-9152-z>
- Günhan, B. C., & Açıkan, H. (2016). The Effect of Using Dynamic Geometry Software on the Success of Geometry: A Meta-Analysis Study. *Turkish Journal of Computer and Mathematics Education (Turcomat)*, 7(1), 1.
<https://doi.org/10.16949/turcomat.67541>
- Haciomeroglu, E. S., Bu, L., Schoen, R. C., & Hohenwarter, M. (2009). Learning to Develop Mathematics Lessons with GeoGebra. *MSOR Connections*, 9(2), 24–26.
<https://doi.org/10.11120/msor.2009.09020024>
- Haerani, R., Rosdiana, R., Ansor, A. S., Hadiyana, R. W., Asrori, K., Farida, R. D. M., & Irianto, J. (2022). Pemanfaatan Teknologi Informasi Dan Komunikasi Untuk Peningkatan Kualitas Pembelajaran Bagi Santri Darul Falah Serang, Banten. *Minda Baharu*, 6(2), 154–162. <https://doi.org/10.33373/jmb.v6i2.4557>
- Handriana, D., Rolina, R., & Mulyana, A. (2018). Implementation of Geogebra Help Inkuiri Method To Increase Ability of Mathematical Problems Class Students Xi-Tei B Smk It Development of Cimahi City on Materials Rules of Sinus and Cosinus. *Journal Of Educational Experts (JEE)*, 1(1), 27.
<https://doi.org/10.30740/jee.v1i1p27-36>
- Hanifah, H., & Istikommar, I. (2023). *Validity and Practicality of Student Activity Sheets (LAM) of Real Number Sequences With the Aid of Geogebra Based on the APOS Model*. 97–106. https://doi.org/10.2991/978-2-38476-012-1_14
- Hanifah, U., Budayasa, I. K., Sulaiman, R., & Masriyah, M. (2024). TPACK Competence of Mathematics Education Students in Designing Constructivist Learning. *Perspectives of Science and Education*, 68(2), 249–260.
<https://doi.org/10.32744/pse.2024.2.15>
- Herman Tatang. (2007). Pembelajaran Berbasis Masalah untuk Meningkatkan

- Kemampuan Berpikir Matematis Tingkat Tinggi Siswa Sekolah Menengah Pertama. *Educationist*, 1(1), 3.
<http://ejournal.sps.upi.edu/index.php/educationist/article/view/28/22>
- Herwina, W. (2021). Optimalisasi Kebutuhan Murid Dan Hasil Belajar Dengan Pembelajaran Berdiferensiasi. *Perspektif Ilmu Pendidikan*, 35(2), 175–182.
<https://doi.org/10.21009/pip.352.10>
- Hidayat, R., Noor, W. N. W. M., Nasir, N., & Ayub, A. F. M. (2024). The Role of GeoGebra Software in Conceptual Understanding and Engagement Among Secondary School Student. *Infinity Journal*, 13(2), 317–332.
<https://doi.org/10.22460/infinity.v13i2.p317-332>
- Hidayat, T., ;Darhim., & Herman, T. (2023). Kemampuan Komunikasi Matematis Dan Kemandirian Belajar Siswa Dalam Pembelajaran Matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 12(2), 1812–1828.
<https://ojs.fkip.ummetro.ac.id/index.php/matematika/article/view/6628/pdf>
- Hidayati, D. W., & Riszal, A. (2019). Bahan Ajar Geometri Analitik Berbasis Geogebra Dan Kreativitas Belajar: Dapatkah Meningkatkan Kemampuan Pemecahan Masalah? *JNPM (Jurnal Nasional Pendidikan Matematika)*, 3(2), 191.
<https://doi.org/10.33603/jnpm.v3i2.2509>
- Hidayati, K., & Listyani, E. (2010). Improving Instruments Of Students' Self-Regulated Learning. *Jurnal Pendidikan Matematika Univertias Negeri Yogyakarta*.
- Hidayatussakinah, H., Marzuki, I., & Ulfa, N. (2021). Peningkatan Kemampuan Berpikir Kritis Melalui Model Pembelajaran Berbasis Masalah. *Biolearning Journal*, 8(1), 20–23. <https://doi.org/10.36232/jurnalbiolearning.v8i1.892>
- Hohenwarter, M., Hohenwarter, J., Kreis, Y., & Lavicza, Z. (2008). Teaching and calculus with free dynamic mathematics software GeoGebra. *11th International Congress on Mathematical Education*, 1–9.
- Hohenwarter, M., Jarvis, D., & Lavicza, Z. (2009). Linking geometry, algebra, and mathematics teachers: GeoGebra software and the establishment of the International GeoGebra Institute. *International Journal for Technology in Mathematics Education*, 16(2), 83–87.
- Hohenwarter, M., & Lavicza, Z. (2009). The strength of the community: how GeoGebra can inspire technology integration in mathematics teaching. *MSOR Connections*, 9(2), 3–5. <https://doi.org/10.11120/msor.2009.09020003>
- Horzum, T., & Ünlü, M. (2017). Pre-Service Mathematics Teachers' Views About

- GeoGebra and Its Use. *Acta Didactica Napocensia*, 10(3), 77–90.
<https://doi.org/10.24193/adn.10.3.8>
- Hoyles, C. (2018). Transforming the Mathematical Practices of Learners and Teachers Through Digital Technology. *Research in Mathematics Education*, 20(3), 209–228.
<https://doi.org/10.1080/14794802.2018.1484799>
- Hutajulu, M. (2022). The Effectiveness of Using Google Meet in Online Learning to Improve Mathematical Communication Skills. (*Jiml*) *Journal of Innovative Mathematics Learning*, 5(1), 53–61. <https://doi.org/10.22460/jiml.v5i1.10858>
- İbili, E. (2019). The Use of Dynamic Geometry Software From a Pedagogical Perspective: Current Status and Future Prospects. *Journal of Computer and Education Research*, 7(14), 337–355. <https://doi.org/10.18009/jcer.579517>
- Ishartono, N., Nurcahyo, A., Waluyo, M., Prayitno, H. J., & Hanifah, M. (2022). Integrating GeoGebra Into the Flipped Learning Approach to Improve Students' Self-Regulated Learning During the Covid-19 Pandemic. *Journal on Mathematics Education*, 13(1), 69–86. <https://doi.org/10.22342/jme.v13i1.pp69-86>
- Ismail, Z., & Rahman, S. N. A. (2017). Learning 2-Dimensional and 3-Dimensional Geometry With Geogebra: Which Would Students Do Better? *International Journal on Emerging Mathematics Education*, 1(2), 121.
<https://doi.org/10.12928/ijeme.v1i2.5541>
- Ismiati, N. (2024). Implementing STEAM Education in the Independent Curriculum: Enhancing 21st Century Skills. *Tadibia Islamika*, 4(1), 21–27.
<https://doi.org/10.28918/tadibia.v4i1.7238>
- Isnaini, J. F., & Azhar, E. (2021). Mathematics learning independence: The relationship of youtube as a media for mathematics learning. *Desimal: Jurnal Matematika*, 4(2), 177–184. <https://doi.org/10.24042/djm>
- Isnaini, S. N., Firman, F., & Desyandri, D. (2023). Penggunaan Media Video Pembelajaran Dalam Meningkatkan Minat Belajar Matematika Siswa Di Sekolah Dasar. *Alpen Jurnal Pendidikan Dasar*, 7(1), 42–51.
<https://doi.org/10.24929/alpen.v7i1.183>
- Istimuryani, N., Sunardi, S., & Prastiti, T. D. (2023). The Analysis of the Improvement of Student's Mathematical Communication Skills in Solving Problems of Circumference and Area of Circles Under the Implementation of Inquiry-Based Learning. *International Journal of Current Science Research and Review*, 06(03).
<https://doi.org/10.47191/ijcsrr/v6-i3-35>

- Jelatu, S., Sariyasa, & Made Ardana, I. (2018). Effect of GeoGebra-aided REACT strategy on understanding of geometry concepts. *International Journal of Instruction*, 11(4), 325–336. <https://doi.org/10.12973/iji.2018.11421a>
- Johar, R., Junita, E., & Saminan, S. (2018). Students' Mathematical Communication Ability and Self-Efficacy Using Team Quiz Learning Model. *International Journal on Emerging Mathematics Education*, 2(2), 203. <https://doi.org/10.12928/ijeme.v2i2.8702>
- Julaechea, S., & Baist, A. (2019). Hubungan Kemandirian Belajar Dengan Hasil Belajar Siswa SMK Kelas XII Pada Pelajaran Matematika. *Jurnal Analisa*, 5(2), 103–108. <https://doi.org/10.15575/ja.v5i2.4752>
- Jumaisyaroh, T., & Hasratuddin, E. E. N. (2016). Peningkatan Kemampuan Berpikir Kritis Matematis Dan Kemandirian Belajar Siswa Smp Melalui Pembelajaran Berbasis Masalah. *AdMathEdu : Jurnal Ilmiah Pendidikan Matematika, Ilmu Matematika Dan Matematika Terapan*, 5(1). <https://doi.org/10.12928/admathedu.v5i1.4786>
- Kado, & Dem, N. (2020). Effectiveness of GeoGebra in Developing the Conceptual Understanding of Definite Integral at Gongzim Ugyen Dorji Central School, in Haa Bhutan. *Asian Journal of Education and Social Studies*, 60–65. <https://doi.org/10.9734/ajess/2020/v10i430276>
- Kado, K. (2021). Impact of GeoGebra on the Students' Conceptual. *International Journal of Asian Education*, 2(4), 539–548. <https://doi.org/10.46966/ijae.v2i4.140>
- Kaharuddin, A. (2019). Effect of Problem Based Learning Model on Mathematical Learning Outcomes of 6th Grade Students of Elementary School Accredited B in Kendari City. *International Journal of Trends in Mathematics Education Research*, 1(2), 43–46. <https://doi.org/10.33122/ijtmr.v1i2.14>
- Kamid, Rusdi, M., Fitaloka, O., Basuki, F. R., & Anwar, K. (2020). Mathematical communication skills based on cognitive styles and gender. *International Journal of Evaluation and Research in Education*, 9(4), 847–856. <https://doi.org/10.11591/ijere.v9i4.20497>
- Kaya, D., & Aydin, H. (2016). Elementary mathematics teachers' perceptions and lived experiences on mathematical communication. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(6), 1619–1629. <https://doi.org/10.12973/eurasia.2014.1203a>
- Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Nomor 032/H/KR/2024,

- Kepala Badan Standar, Kurikulum dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi Nomor 032/H/KR/2024 1 (2024).
- Kesumawati, N., Syahbana, A., Ningsih, Y. L., Octaria, D., & Sari, E. F. P. (2021). Pelatihan Penggunaan Geogebra Bagi Guru Smp, Sma, Dan SMK Se-Sumatera Bagian Selatan Dalam Pembelajaran Matematika. *Jurnal Cemerlang Pengabdian Pada Masyarakat*, 3(2). <https://doi.org/10.31540/jpm.v3i2.1202>
- Khan, L., Chaerul, A., & Resita, C. (2022). Implementasi Model Pembelajaran Berbasis Masalah Dalam Pembelajaran Pendidikan Jasmani Secara Daring. *Jurnal Educatio Fkip Unma*, 8(3), 1174–1183. <https://doi.org/10.31949/educatio.v8i3.3138>
- Khansila, P., Yonwilad, W., Nongharnpituk, P., & Thienyutthakul, S. (2022). Improving Academic Performance in Geometry Using a Mastery Learning Approach Through GeoGebra. *Journal of Educational Issues*, 8(2), 876. <https://doi.org/10.5296/jei.v8i2.20494>
- Kharisma, J. Y., & Asman, A. (2018). Pengembangan Bahan Ajar Matematika Berbasis Masalah Berorientasi Pada Kemampuan Pemecahan Masalah Matematis Dan Prestasi Belajar Matematika. *Indonesian Journal of Mathematics Education*, 1(1), 34–46. <https://doi.org/10.31002/ijome.v1i1.926>
- Khoiri, N., Roshayanti, F., & Widarti, R. (2023). Integration of STEAM and ESD: Improving the understanding of fluid concepts and creativity. *Journal of Education and E-Learning Research*, 10(3), 578–584. <https://doi.org/10.20448/jeelr.v10i3.4987>
- Kllogjeri, P., & Kllogjeri, L. (2015). Dynamic Models for Addition and Subtraction. *Oalib*, 02(09), 1–7. <https://doi.org/10.4236/oalib.1101814>
- Kosko, K. W., & Wilkins, J. L. M. (2010). Mathematical communication and its relation to the frequency of manipulative use. *International Electronic Journal of Mathematics Education*, 5(2), 79–90. <https://doi.org/10.29333/iejme/251>
- Kustiawati, D. (2017). Pembelajaran Geometri Berbantuan Software Geogebra Terhadap Kemampuan Komunikasi Matematik Siswa. *JIPMat*, 1(2), 113–120. <https://doi.org/10.26877/jipmat.v1i2.1237>
- Kusuma, A. B., & Utami, A. (2017). Penggunaan Program Geogebra Dan Casyopee Dalam Pembelajaran Geometri Ditinjau Dari Motivasi Belajar Siswa. *Jurnal Mercumatika Jurnal Penelitian Matematika Dan Pendidikan Matematika*, 2(1), 119. <https://doi.org/10.26486/mercumatika.v1i2.259>
- Kusuma, W. S., & Sutapa, P. (2020). Dampak Pembelajaran Daring Terhadap Perilaku

- Sosial Emosional Anak. *Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini*, 5(2), 1635–1643. <https://doi.org/10.31004/obsesi.v5i2.940>
- Kusumah, Y. S., Juandi, D., & Mulyana, E. (2014). *Development Of Didactical Design Of Mathematics Pedagogy Through Professional Program Of Mathematics Teacher Education*. 21(1), 10–23.
- Kusumah, Y. S., Kustiawati, D., & Herman, T. (2020). The effect of geogebra in three-dimensional geometry learning on students' mathematical communication ability. *International Journal of Instruction*, 13(2), 895–908. <https://doi.org/10.29333/iji.2020.13260a>
- Kusumaningrum, D. E., Budiarti, E. M., Triwiyanto, T., & Utari, R. (2020). The Effect of Distance Learning in an Online Learning Framework on Student Learning Independence during the Covid-19 Pandemic. *Proceedings - 2020 6th International Conference on Education and Technology, ICET 2020*, 182–185. <https://doi.org/10.1109/ICET51153.2020.9276564>
- Liando, M. A. J. (2022). Peningkatan Hasil Belajar Matematika Pada Materi Pecahan Dengan Menggunakan Pendekatan Pendidikan Matematika Realistik (PMR) Pada Siswa Kelas IV SD GMIM Malola. *Eduetik Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, 2(2), 193–204. <https://doi.org/10.53682/edutik.v2i2.4443>
- Liburd, K. K. D., & Jen, H. (2021). Investigating the Effectiveness of Using a Technological Approach on Students' Achievement in Mathematics—Case Study of a High School in a Caribbean Country. *Sustainability*, 13(10), 5586. <https://doi.org/10.3390/su13105586>
- Lidinillah, D. A. M. (2013). Pembelajaran Berbasis Masalah (Problem Based Learning). *Jurnal Pendidikan Inovatif*, 5(1), 1–7. <https://doi.org/10.17605/OSF.IO/GD8EA>
- Lin, Y. W., Tseng, C. L., & Chiang, P. J. (2017). The effect of blended learning in mathematics course. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(3), 741–770. <https://doi.org/10.12973/eurasia.2017.00641a>
- Lindenbauer, E., & Lavicza, Z. (2021). Using Automated Reasoning Tools in GeoGebra in the Teaching and Learning of Proving in Geometry. *International Journal of Technology in Mathematics Education*, 28(3), 133–141. <https://doi.org/10.1564/tme>
- Maarif, S. (2017). Mengkonstruksi Bukti Geometri Melalui Kegiatan Eksplorasi Berbantu Cabri Ii Plus. *Euclid*, 3(2). <https://doi.org/10.33603/e.v3i2.331>
- Mahjoobin, M. H. (2016). *GeoGebra-Assisted Problem Based Learning to Improve Mathematical Problem Solving Ability*. 467(Semantik 2019), 2672–2689.

- Mahmudi, A. (2017). Pemanfaatan Program Geogebra Dalam Pembelajaran Matematika. In *Delta-Pi: Jurnal Matematika dan Pendidikan Matematika* (Vol. 5, Issue 1). The National Council of Teachers of Mathematics, Inc.
<https://doi.org/10.33387/dpi.v5i1.236>
- Majid, A. A., & Indrawati, D. (2023). Tradisi Udik-Udikan Sebagai Pembelajaran Matematika Realistik Berbasis Etnomatematika Di Kelas 2 Sekolah Dasar. *Elementary School Journal PGSD Fip Unimed*, 13(1), 44–53.
<https://doi.org/10.24114/esjpgsd.v13i1.41625>
- Malgieri, M., Onorato, P., & Ambrosis, A. D. (2014). Teaching Quantum Physics by the Sum Over Paths Approach and GeoGebra Simulations. *European Journal of Physics*, 35(5), 55024. <https://doi.org/10.1088/0143-0807/35/5/055024>
- Masitoh, L. F., & Fitriyani, H. (2018). Improving students' mathematics self-efficacy through problem based learning. *Malikussaleh Journal of Mathematics Learning (MJML)*, 1(1), 26–30. <https://ojs.unimal.ac.id/index.php/mjml/article/view/679/469>
- Maskar, S., & Dewi, P. S. (2020). Praktikalitas Dan Efektifitas Bahan Ajar Kalkulus Berbasis Daring Berbantuan Geogebra. *Jurnal Cendekia Jurnal Pendidikan Matematika*, 4(2), 888–899. <https://doi.org/10.31004/cendekia.v4i2.326>
- Maulana, M., Zamnah, L. N., & Amam, A. (2021). Pengembangan Bahan Ajar Berbasis Aplikasi Geogebra Pada Materi Bangun Ruang Sisi Datar Berdasarkan Kemampuan Pemahaman Matematis Siswa. *J-KIP (Jurnal Keguruan Dan Ilmu Pendidikan)*, 2(2), 1. <https://doi.org/10.25157/j-kip.v2i2.5203>
- Mautone, J. A., DuPaul, G. J., & Jitendra, A. K. (2005). The Effects of Computer-Assisted Instruction on the Mathematics Performance and Classroom Behavior of Children With ADHD. *Journal of Attention Disorders*, 9(1), 301–312.
<https://doi.org/10.1177/1087054705278832>
- Maysyaroh, U., Kristanto, Y. D., & Partini, P. (2022). Upaya Meningkatkan Kemandirian Belajar Siswa Melalui Pembelajaran Kooperatif Tipe Group Investigation (Gi). *Jipmat*, 7(2), 70–82. <https://doi.org/10.26877/jipmat.v7i2.13298>
- Meilani, A., & Ritonga, M. W. (2025). Pengembangan modul ajar berbasis problem based learning berbantuan Canva untuk meningkatkan kemampuan komunikasi matematis. *Jurnal Pendidikan Matematika*, 5(2), 170–183.
<https://doi.org/https://doi.org/10.XXXX/jpm.v5i2.XXXX>
- Moh Ghoizi Eriyanto, M.V. Roesminingsih, Soedjarwo, & Ivan Kusuma Soeherman. (2021). The Effect of Learning Motivation on Learning Independence and Learning

- Outcomes of Students in the Package C Equivalence Program. *IJORER : International Journal of Recent Educational Research*, 2(4), 455–467.
<https://doi.org/10.46245/ijorer.v2i4.122>
- Molefe, N., & Brodie, K. (2010). Teaching mathematics in the context of curriculum change. *Pythagoras*, 71. <https://doi.org/10.4102/pythagoras.v0i71.5>
- Muga, W., Suryono, B., & Januarisca, E. L. (2017). Pengembangan Bahan Ajar Elektronik Berbasis Model Problem Based Learning Dengan Menggunakan Model Dick and Carey. *Journal of Education Technology*, 1(4), 260.
<https://doi.org/10.23887/jet.v1i4.12863>
- Muhammad Farooq, J., & Muhammad Ashraf, K. (2011). Cognitive development in Jean Piaget's work and its implications for teachers. *World Applied Sciences Journal*, 12(8), 1260–1265.
- Mulyanto, H., Gunarhadi, G., & Indriayu, M. (2018). The Effect of Problem Based Learning Model on Student Mathematics Learning Outcomes Viewed from Critical Thinking Skills. *International Journal of Educational Research Review*, 3(2), 37–45. <https://doi.org/10.24331/ijere.408454>
- Mulyosari, E. T., & Khosiyono, B. H. C. (2023). Pengaruh Penggunaan Media Pembelajaran Berbasis Teknologi Dalam Pembelajaran Terhadap Motivasi Belajar Siswa Sekolah Dasar. *Edukatif Jurnal Ilmu Pendidikan*, 5(6), 2395–2405.
<https://doi.org/10.31004/edukatif.v5i6.5037>
- Murray, G. (2014). The Social Dimensions of Learner Autonomy and Self-Regulated Learning. *Studies in Self-Access Learning Journal*, 5, 320–341.
<https://doi.org/10.37237/050402>
- Muslim, N. E. I., Zakaria, M. I., & Fang, C. Y. (2023). A Systematic Review of GeoGebra in Mathematics Education. *International Journal of Academic Research in Progressive Education and Development*, 12(3).
<https://doi.org/10.6007/ijarped/v12-i3/19133>
- Muzdalipah, I., Rustina, R., Patmawati, H., & Yulianto, E. (2023). Pengembangan Bahan Ajar Dengan Menggunakan Geogebra Pada Materi Segitiga Dan Segiempat. *Teorema Teori Dan Riset Matematika*, 8(1), 181.
<https://doi.org/10.25157/teorema.v8i1.10090>
- Narh-Kert, M., & Sabtiwu, R. (2022). Use of GeoGebra to Improve Performance in Geometry. *African Journal of Educational Studies in Mathematics and Sciences*, 18(1), 29–36. <https://doi.org/10.4314/ajesms.v18i1.3>

- Nasution, D. P., & Ahmad, M. (2018). Penerapan Pembelajaran Matematika Realistik Untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa. *Mosharafa Jurnal Pendidikan Matematika*, 7(3), 389–400.
<https://doi.org/10.31980/mosharafa.v7i3.133>
- Nayan, A. D., & Fitri, I. (2021). Analisis Kemampuan Komunikasi Matematis Siswa Ditinjau Dari Gaya Belajar Siswa. *Juring (Journal for Research in Mathematics Learning)*, 4(2), 171. <https://doi.org/10.24014/juring.v4i2.11803>
- NCTM. (2000). *Principles Standards and for School Mathematics* (2nd ed.). The National Council of Teachers of Mathematics, Inc.
- Nieveen, N. (1999). *Designing a curriculum for educational materials*. In J. van den Akker, R. Branch, K. G. Gustafson, & N. Nieveen (Eds.), *Design approaches and tools in education and training* (pp. 126–133). Kluwer Academic Publishers.
- Noer, S. H., Gunowibowo, P., & Triana, M. (2022). Pengaruh Kecerdasan Emosional Dan Kemampuan Awal Terhadap Kemampuan Komunikasi Matematis Siswa Dalam Pembelajaran Online. *11*(1), 482–492.
<http://repository.lppm.unila.ac.id/id/eprint/42618>
- Noviarini, N. P., Suarni, N. K., & Margunayasa, I. G. (2024). Dampak Teknologi Sebagai Dasar Pengembangan Media Pembelajaran Terhadap Prestasi Siswa Ditinjau Dari Teori Belajar Humanistik. *Ideguru Jurnal Karya Ilmiah Guru*, 9(1), 425–431.
<https://doi.org/10.51169/ideguru.v9i1.865>
- Nugraha, T. H., Nindiasari, H., & Syamsuri, S. (2019). Pengaruh Strategi Pembelajaran React Terhadap Kemampuan Komunikasi Matematis Siswa SMP Berdasarkan Gender. *Symmetry Pasundan Journal of Research in Mathematics Learning and Education*. <https://doi.org/10.23969/symmetry.v4i1.1631>
- Nur, I. M. (2017). Pemanfaatan Program Geogebra Dalam Pembelajaran Matematika. *Delta-Pi Jurnal Matematika Dan Pendidikan Matematika*, 5(1).
<https://doi.org/10.33387/dpi.v5i1.236>
- Nuraeni, L. S., Hafsyah, H., Nurdin, N., & Putriyani, S. (2024). Literatur Review: Pengembangan Bahan Ajar Matematika Berbasis Proyek Untuk Meningkatkan Keterampilan Berpikir Kritis. *Jagomipa Jurnal Pendidikan Matematika Dan Ipa*, 4(2), 352–365. <https://doi.org/10.53299/jagomipa.v4i2.652>
- Nuraida, I., & Amam, A. (2019). Hypothetical Learning Trajectory in Realistic Mathematics Education To Improve the Mathematical Communication of Junior High School Students. *Infinity Journal*, 8(2), 247.

- <https://doi.org/10.22460/infinity.v8i2.p247-258>
- Nurjanah, Dahlan, J. A., & Wibisono, Y. (2020). The Effect of Hands-On and Computer-Based Learning Activities on Conceptual Understanding and Mathematical Reasoning. *International Journal of Instruction*, 14(1), 143–160.
<https://doi.org/10.29333/IJI.2021.1419A>
- Octamela, K. S., Suweken, G., & Ardana, I. M. (2019). Pemahaman Matematis Siswa Dengan Menggunakan Buku Elektronik Interaktif Berbantuan Geogebra. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 3(2), 305.
<https://doi.org/10.33603/jnpm.v3i2.1761>
- OECD. (2023). PISA 2022 Results (Volume I): The State of Learning and Equity in Education. In *Factsheets: Vol. I*. OECD Publishing.
<https://doi.org/https://doi.org/10.1787/53f23881-en>
- Pamungkas, M. D., Rahmawati, F., & Dinara, H. A. (2020). *Integrating GeoGebra Into Space Geometry in College*. <https://doi.org/10.2991/assehr.k.200129.123>
- Parno, P., Asim, A. E., Suwasono, P., & Ali, M. (2019). The Influence of Problem Based Learning on Critical Thinking Ability for Students in Optical Instrument Topic. *Jurnal Pendidikan Fisika Indonesia*, 15(1), 39–45.
<https://doi.org/10.15294/jpfi.v15i1.19309>
- Pepadu, J., Octarina, S., Bahtera, P., Bangun, J., Indrawati, I., Puspita, F. M., & Yuliza, E. (2023). Pendampingan Pemanfaatan Geogebra Untuk Meningkatkan Kemampuan Teknologi Informasi Guru Sd Matematika Di Kecamatan Pemulutan Dalam Membuat Media Pembelajaran. *Jurnal Pepadu*, 4(1), 84–94.
<https://doi.org/10.29303/pepadu.v4i1.2241>
- Perwitasari, D., & Surya, E. (2017). The Development of Learning Material Using Problem Based Learning to Improve Mathematical Communication Ability of Secondary School Students. *International Journal of Sciences: Basic and Applied Research (IJSBAR)* *International Journal of Sciences: Basic and Applied Research*, 33(3), 200–207. <http://gssrr.org/index.php?journal=JournalOfBasicAndApplied>
- Plomp, T. (2013). Educational Design Research: An Introduction. In T. Plomp & N. Nieveen (Eds.), *Educational design research: An introduction*. In *Etika Jurnalisme Pada Koran Kuning : Sebuah Studi Mengenai Koran Lampu Hijau*. SLO.
- Pramesworo, I. S., Fathurrochman, I., Sembing, D., Bangkara, B. M. A. S. A., & Sudrajat, D. (2023). Relevance Between Blended Learning and Students' Independent Learning Curriculum : An Overview of Digital Age Education, Student

- and Teacher Engagement, Technological Resources. *Jurnal Kependidikan Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan Pengajaran Dan Pembelajaran*, 9(3), 858. <https://doi.org/10.33394/jk.v9i3.8320>
- Prananto, I. W., Rakhmawati, Y., & Pamungkas, T. (2022). Content Validity Ratio (CVR), Content Validity Index (CVI) and Confirmatory Factor Analysis (CFA) in Mathematics Learning Independence Instruments. *Kontinu Jurnal Penelitian Didaktik Matematika*, 6(2), 116. <https://doi.org/10.30659/kontinu.6.2.116-132>
- Priwanto, S. W., Fahmi, S., & Y., D. A. (2019). Pelatihan Peningkatan Kemampuan It Bagi Guru Matematika Menggunakan Geogebra. *Jurnal Terapan Abdimas*, 4(2), 203. <https://doi.org/10.25273/jta.v4i2.4847>
- Pujiastuti, H., Utami, R. R., & Haryadi, R. (2020). The development of interactive mathematics learning media based on local wisdom and 21st century skills: Social arithmetic concept. *Journal of Physics: Conference Series*, 1521(3), 0–7. <https://doi.org/10.1088/1742-6596/1521/3/032019>
- Purnamasari, S., & Herman, T. (2017). Penggunaan Multimedia Interaktif Terhadap Peningkatan Kemampuan Pemahaman Dan Komunikasi Matematis, Serta Kemandirian Belajar Siswa Sekolah Dasar. *EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru*, 8(2), 178. <https://doi.org/10.17509/eh.v8i2.5140>
- Purwanto, W., Zaenuri, Z., Wardono, & Junaedi, I. (2024). Teachers' Perceptions of Ethnomathematics Learning in the Independent Curriculum Program in Indonesia. *International Journal of Education and Practice*, 13(1), 98–113. <https://doi.org/10.18488/61.v13i1.3963>
- Puspita, R. Y., Sutiarto, S., & Bharata, H. (2023). Pengembangan LKPD Berbasis Discovery Learning Dengan Pendekatan Kontekstual Terhadap Kemampuan Komunikasi Matematis. *Aksioma Jurnal Program Studi Pendidikan Matematika*, 12(2), 1704. <https://doi.org/10.24127/ajpm.v12i2.6731>
- Putra, Z. H., Hermita, N., Alim, J. A., Dahnilsyah, D., & Hidayat, R. (2021). GeoGebra Integration in Elementary Initial Teacher Training: The Case of 3-D Shapes. *International Journal of Interactive Mobile Technologies (Ijim)*, 15(19), 21. <https://doi.org/10.3991/ijim.v15i19.23773>
- Putri, S. K., Hasratuddin, H., & Syahputra, E. (2019). Development of Learning Devices Based on Realistic Mathematics Education to Improve Students' Spatial Ability and Motivation. *International Electronic Journal of Mathematics Education*, 14(2), 243–252. <https://doi.org/10.29333/iejme/5729>

- Qian, J. (2024). Construction of Incentive Mechanism for Students' Independent Learning Based on Flipped Classroom Context in the Context of Informatization. *Applied Mathematics and Nonlinear Sciences*, 9(1). <https://doi.org/10.2478/amns-2024-1063>
- Rahmawati, N., Buska, W., & Suhartono, S. (2024). Penerapan Model Problem Based Learning (PBL) Dengan Media Konkret Untuk Meningkatkan Hasil Belajar Matematika Tentang Bangun Datar Kelas III SD. *Kalam Cendekia Jurnal Ilmiah Kependidikan*, 12(1). <https://doi.org/10.20961/jkc.v12i1.76117>
- Rahmayani, D. (2014). Penerapan Pembelajaran Reciprocal Teaching Untuk Meningkatkan Kemampuan Komunikasi Matematis dan Kemandirian Belajar Siswa. *Pasundan Journal of Mathematics Education : Jurnal Pendidikan Matematika*, 2(Vol 3 No 1), 13–23. <https://doi.org/10.23969/pjme.v3i1.2486>
- Rahmayani, F. (2019). Hubungan Karakter Mandiri Siswa Dalam Belajar Dengan Hasil Belajar Siswa. *Jurnal Pendidikan Edutama*, 6(2), 87. <https://doi.org/10.30734/jpe.v6i2.510>
- Ranti, M. G., Budiarti, I., & Trisna, B. N. (2017). Pengaruh kemandirian belajar (self regulated learning) terhadap hasil belajar mahasiswa pada mata kuliah struktur aljabar. *Math Didactic: Jurnal Pendidikan Matematika*, 3(1), 75–83. <https://doi.org/10.33654/math.v3i1.57>
- Reyes, M. R., Brackett, M. A., Rivers, S. E., White, M., & Salovey, P. (2012). Classroom Emotional Climate, Student Engagement, and Academic Achievement. *Journal of Educational Psychology*, 104(3), 700–712. <https://doi.org/10.1037/a0027268>
- Ringu, A. A. T., & Wangge, M. (2021). Penerapan Model Pembelajaran Kooperatif Tipe Jigsaw Untuk Meningkatkan Hasil Belajar Pokok Bahasan Integral Fungsi Aljabar Pada Peserta Didik Kelas XI IPA SMA Negeri 2 Waingapu. *Fraktal Jurnal Matematika Dan Pendidikan Matematika*, 2(1), 91–100. <https://doi.org/10.35508/fractal.v2i1.3999>
- Riyati, I., & Suparman, S. (2019). Design student worksheets based on problem-learning to enhance mathematical communication. *Asian Journal of Assessment in Teaching and Learning*, 9(2), 9–17. <https://doi.org/10.37134/ajatel.vol9.no2.2.2019>
- Rokan, N., Elmania, P., Sihombing, F. G., Hasibuan, A. M., & Rizqi, N. R. (2023). Development of Problem-Based Learning-Based Mathematics With the Assistance of Geogebra Applications to Improve Students' Mathematical Concepts Understanding Ability. *Jurnal Eduscience*, 10(2), 451–467.

<https://doi.org/10.36987/jes.v10i2.4584>

- Rosiyanti, H., Eminita, V., & Riski, R. (2020). Desain Media Pembelajaran Geometri Ruang Berbasis Powtoon. *Fibonacci Jurnal Pendidikan Matematika Dan Matematika*, 6(1), 77. <https://doi.org/10.24853/fbc.6.1.77-86>
- Sa'diyah, H., Alfiyah, H. Y., Ar, Z. T., & Nasaruddin, N. (2020). Model Research and Development Dalam Pembelajaran Pendidikan Agama Islam. *El-Banat Jurnal Pemikiran Dan Pendidikan Islam*, 10(1), 42–73. <https://doi.org/10.54180/elbanat.2020.10.1.42-73>
- Safrida, L. N., Setiawan, T. B., Susanto, S., Yudianto, E., Ambarwati, R., & Putri, I. W. S. (2020). Integrating GeoGebra Into Geometry Space Learning: A Lesson From Traditional Cultural Festival Tumpeng Sewu. *Journal of Physics Conference Series*, 1465(1), 12046. <https://doi.org/10.1088/1742-6596/1465/1/012046>
- Salahuddin, S., Sastradika, D., Purnama, B. Y., Pransiska, S., & Ramadani, S. P. (2022). Meningkatkan Hasil Belajar Fisika Melalui Penerapan Pembelajaran Self-Directed Learning (SDL). *Jurnal Phi Jurnal Pendidikan Fisika Dan Fisika Terapan*, 3(3), 35. <https://doi.org/10.22373/p-jpft.v3i3.14677>
- Saputra, E., & Fahrizal, E. (2019). The Development of Mathematics Teaching Materials through Geogebra Software to Improve Learning Independence. *Malikussaleh Journal of Mathematics Learning (MJML)*, 2(2), 39–44. <https://doi.org/10.29103/mjml.v2i2.1860>
- Saralar-Aras, İ. (2022). An Exploration of Middle School Mathematics Teachers' Beliefs and Goals Regarding a Dynamic Tool in Mathematics Lessons: Case of GeoGebra. *Journal of Research in Science Mathematics and Technology Education*, 5(SI), 41–63. <https://doi.org/10.31756/jrsmte.113si>
- Sari, D. P., Dayanti, F. R., Achmad, N. M., Annur, S., & Sya'ban, M. F. (2023). Meta-Analisis Pengaruh Model Pembelajaran Project Based Learning Terhadap Hasil Belajar Ipa. *Physics and Science Education Journal (Psej)*, 161–168. <https://doi.org/10.30631/psej.v3i3.2164>
- Sari, D. S., Kusnandi, K., & Suhendra, S. (2017). A Cognitive Analysis of Students' Mathematical Communication Ability on Geometry. *Journal of Physics: Conference Series*, 895(1). <https://doi.org/10.1088/1742-6596/895/1/012083>
- Schettino, C. (2016). Framework for problem-based learning: Teaching mathematics with a relational problem-based pedagogy. *Interdisciplinary Journal of Problem-Based Learning*, 10(2). <https://doi.org/10.7771/1541-5015.1602>

- Septia, Y. I. (2021). Penerapan Bahan Ajar Matematika Berbasis Realistic Mathematics Education (RME) Terhadap Kemampuan Berpikir Kreatif Matematis. *Jurnal Peka*, 3(2), 41–43. <https://doi.org/10.37150/jp.v3i2.797>
- Shaffitri, N., Siagian, T. A., Yensy, N. A., Utari, T., & Agustinsa, R. (2022). Efektivitas Penggunaan LKPD Discovery Learning Berbantuan Geogebra Terhadap Kemampuan Pemahaman Konsep Bangun Ruang Sisi Datar. *Jurnal Penelitian Pembelajaran Matematika Sekolah (Jp2ms)*, 6(3), 351–361. <https://doi.org/10.33369/jp2ms.6.3.351-361>
- Shefira, A., Dewi, N. R., & Octaviani, R. (2024). Inovasi Pembelajaran PKN Di Era Digital Dengan Pemanfaatan Teknologi Dalam Meningkatkan Pemahaman Siswa. *PGSD*, 1(3), 10. <https://doi.org/10.47134/pgsd.v1i3.447>
- Singh, Y., Singh, V. P., Singh, G., Yadav, D. S., Sinha, R. K. P., Johnson, D. E., & Mortimer, A. M. (2011). The implications of land preparation, crop establishment method and weed management on rice yield variation in the rice–wheat system in the Indo-Gangetic plains. *Field Crops Research*, 121(1), 64–74. <https://doi.org/https://doi.org/10.1016/j.fcr.2010.11.012>
- Siswadi, S., Saragih, R. M. B., & Wardana, G. D. (2023). Penggunaan Model Problem Based Learning (PBL) Dalam Meningkatkan Kemampuan Komunikasi Matematis Siswa. *Farabi Jurnal Matematika Dan Pendidikan Matematika*, 6(1), 97–104. <https://doi.org/10.47662/farabi.v6i1.581>
- Sitompul, H. S., & Efendi, S. (2021). Keefektifan Pembelajaran Kimia Melalui Model Pembelajaran Blended Learning Pada Masa Pandemi Covid-19. *Jurnal Pendidikan Sains Dan Komputer*, 1(01), 1–8. <https://doi.org/10.47709/jpsk.v1i01.1210>
- Solso, Robert L. ; Machlin, Otto H. ; Maclin, M. K. (2008). *Cognitive Psychology*.
- Solvang, L., & Haglund, J. (2021). How can GeoGebra support physics education in upper-secondary school - A review. *Physics Education*, 56(5). <https://doi.org/10.1088/1361-6552/ac03fb>
- Sugiharni, G. A. D., & Suwastika, I. W. K. (2021). Meta-Analisis Penggunaan Bahan Ajar Terhadap Prestasi Matematika. *Sebatik*, 25(2), 468–476. <https://doi.org/10.46984/sebatik.v25i2.1472>
- Sugrah, N. (2020). Implementasi Teori Belajar Konstruktivisme Dalam Pembelajaran Sains. *Humanika*, 19(2), 121–138. <https://doi.org/10.21831/hum.v19i2.29274>
- Sumarniasih, I. G. A. S., Ardana, I. M., & Suastra, I. W. (2023). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Keterampilan Berpikir Tingkat Tinggi

- Dan Minat Belajar Ipa Siswa Sekolah Dasar Kelas V. *Pendasi Jurnal Pendidikan Dasar Indonesia*, 7(2), 263–274. https://doi.org/10.23887/jurnal_pendas.v7i2.2263
- Sumartono, S., & Karmila, M. (2018). Kemampuan Komunikasi Matematis Dan Kemandirian Siswa Dalam Pembelajaran Matematika Menggunakan Model Knisley Di Kelas Viii. *Edu-Mat Jurnal Pendidikan Matematika*, 5(2). <https://doi.org/10.20527/edumat.v5i2.4650>
- Sumbawati, M. S., Munoto, Basuki, I., Ismayati, E., & Rijanto, T. (2020). *Student Learning Independence in Online Learning Depends on Motivation*. 196(Ijce), 342–347. <https://doi.org/10.2991/aer.k.201124.062>
- Sunawan, S., Dwistia, H., Kurniawan, K., Hartati, S., & Sofyan, A. (2017). *Classroom Engagement and Mathematics Achievement of Senior and Junior High School Students*. <https://doi.org/10.2991/iccte-17.2017.26>
- Suratno, J., Tonra, W. S., & Ardiana. (2019a). The effect of guided discovery learning on students' mathematical communication skill. *AIP Conference Proceedings*, 2194(October 2016). <https://doi.org/10.1063/1.5139851>
- Suratno, J., Tonra, W. S., & Ardiana. (2019b). The effect of guided discovery learning on students' mathematical communication skill. *AIP Conference Proceedings*, 2194(December), 1–7. <https://doi.org/10.1063/1.5139851>
- Syahputra, E. (2014). *The Development of Problem Based Learning Model to Construct High Order Thinking Skill Students ' on Mathematical Learning in SMA / MA*. 5(39), 80–85.
- Tarmizi, R. A., & Bayat, S. (2012). Collaborative problem-based learning in mathematics: A cognitive load perspective. *Procedia - Social and Behavioral Sciences*, 32(2011), 344–350. <https://doi.org/10.1016/j.sbspro.2012.01.051>
- Theobald, E. J., Hill, M. J., Tran, E. T., Agrawal, S., Arroyo, E. N., Behling, S., Chambwe, N., Cintrón, D. L., Cooper, J. D., Dunster, G. P., Grummer, J. A., Hennessey, K. M., Hsiao, J., Iranon, N. N., Jones, L. N., Jordt, H., Keller, M., Lacey, M. E., Littlefield, C. E., ... Freeman, S. (2020). Active Learning Narrows Achievement Gaps for Underrepresented Students in Undergraduate Science, Technology, Engineering, and Math. *Proceedings of the National Academy of Sciences*, 117(12), 6476–6483. <https://doi.org/10.1073/pnas.1916903117>
- Thompson, D. R., & Chappell, M. F. (2007). Communication and representation as elements in mathematical literacy. *Reading and Writing Quarterly*, 23(2), 179–196. <https://doi.org/10.1080/10573560601158495>

- Tomás Recio¹, Philippe R. Richard² and M. P. V. (2021). Designing Tasks Supported by GeoGebra Automated Reasoning Tools for the Development of Mathematical Skills. *International Journal of Technology in Mathematics Education*, 28(3), 133–141. <https://doi.org/10.1564/tme>
- Ulandari, M., Lesmana, C., & Santoso, D. (2022). Pengembangan Media Pembelajaran Interaktif Pada Mata Pelajaran Informatika Kelas VII SMP LKIA Pontianak. *Glosains Jurnal Sains Global Indonesia*, 3(2), 49–61. <https://doi.org/10.59784/glosains.v3i2.86>
- Umar, W. (2012). Membangun Kemampuan Komunikasi Matematis Dalam Pembelajaran Matematika. *Infinity Journal*, 1(1), 1. <https://doi.org/10.22460/infinity.v1i1.2>
- Uwineza, I., Uworwabaye, A., & Yokoyama, K. (2023). Effects of Interactive Mathematics Software on Grade-5 Learners' Performance. *International Journal of Learning Teaching and Educational Research*, 22(1), 166–190. <https://doi.org/10.26803/ijlter.22.1.10>
- Uwurukundo, M. S., Maniraho, J. F., & Tusiime, M. (2020). GeoGebra Integration and Effectiveness in the Teaching and Learning of Mathematics in Secondary Schools: A Review of Literature. *African Journal of Educational Studies in Mathematics and Sciences*, 16(1), 1–13. <https://doi.org/10.4314/ajesms.v16i1.1>
- Uwurukundo, M. S., Maniraho, J. F., & Tusiime, M. (2022). Effects of GeoGebra on Students' Attitudes Towards Learning Geometry: A Review of Literature. *African Journal of Educational Studies in Mathematics and Sciences*, 17(2), 127–138. <https://doi.org/10.4314/ajesms.v17i2.10>
- Vejačka, M. (2021). Efficiency of University Course During the Covid-19 Pandemic. *Tem Journal*, 1588–1596. <https://doi.org/10.18421/tem104-13>
- Vojkuvkova, I. (2012). The van Hiele Model of Geometric Thinking. *WDS'12 Proceedings of Contributed Papers*, 1, 72–75.
- Wahyuni, A., & Angraini, L. M. (2021). Pengaruh Bahan Ajar Berbasis Pemecahan Masalah Terhadap Kemampuan Pemecahan Masalah Matematis. *Jurnal Cendekia Jurnal Pendidikan Matematika*, 5(3), 2208–2217. <https://doi.org/10.31004/cendekia.v5i3.749>
- Wahyuni, P., & Yolanda, F. (2021). Pengaruh Penggunaan Bahan Ajar Berbantuan Multimedia Interaktif Pada Mata Kuliah Statistika Pendidikan Terhadap Kemampuan Komunikasi Matematis Mahasiswa. *Jurnal Cendekia Jurnal Pendidikan Matematika*, 5(3), 3284–3294.

<https://doi.org/10.31004/cendekia.v5i3.1029>

- Wahyuni, Y., Edrizon, E., & Fauziah, F. (2022). Pengembangan Bahan Ajar Matematika Dengan Pemanfaatan Geogebra. *Jurnal Cendekia Jurnal Pendidikan Matematika*, 6(1), 1120–1130. <https://doi.org/10.31004/cendekia.v6i1.1139>
- Walshaw, M., & Anthony, G. (2008). The teacher's role in classroom discourse: A review of recent research into mathematics classrooms. *Review of Educational Research*, 78(3), 516–551. <https://doi.org/10.3102/0034654308320292>
- Wang, Y., Li, C.-R., Lin, H., & Shih, Y.-W. (2014). The Measurement and Dimensionality of E-Learning Blog Satisfaction. *Internet Research*, 24(5), 546–565. <https://doi.org/10.1108/intr-05-2013-0092>
- Weinhandl, R., Lavicza, Z., Hohenwarter, M., & Schallert, S. (2020a). Enhancing flipped mathematics education by utilising GeoGebra. *International Journal of Education in Mathematics, Science and Technology*, 8(1), 1–15. <https://doi.org/10.46328/IJEMST.V8I1.832>
- Weinhandl, R., Lavicza, Z., Hohenwarter, M., & Schallert, S. (2020b). Enhancing Flipped Mathematics Education by Utilising GeoGebra. *International Journal of Education in Mathematics Science and Technology*, 8(1), 1. <https://doi.org/10.46328/ijemst.v8i1.832>
- Westwood, P. (2011). The problem with problems: Potential difficulties in implementing problem-based learning as the core method in primary school mathematics. *Australian Journal of Learning Difficulties*, 16(1), 5–18. <https://doi.org/10.1080/19404158.2011.563475>
- Widianjani, W., Patimah, L., & Saniah, L. (2021). Komunikasi Matematis Melalui Penerapan Problem Based Learning (Pbl) Di SMK Kesehatan Cianjur. *Symmetry Pasundan Journal of Research in Mathematics Learning and Education*, Volume 6. <https://doi.org/10.23969/symmetry.v6i2.4605>
- Widianti, L. (2023). Implementation of Geogebra Application Media in Improving the Work Results of Three-Dimensional Mathematics Subjects in Class XII MIPA B Man 1 Bandung City. *Edunity Kajian Ilmu Sosial Dan Pendidikan*, 2(3), 343–351. <https://doi.org/10.57096/edunity.v2i3.70>
- Widiartini, Ketut, N., & Sudhirta, G. (2019). Effect of KWL Learning Method (Know-Want-Learn) and Self- Assessment on Student Learning Independence Vocational. *International Journal of Social Sciences and Humanities*, 3(2), 277–284.
- Wijaksana, A. H., & Kusumah, Y. S. (2023). Peran Dynamic Geometry Software Untuk

- Meningkatkan Kemampuan Spasial Peserta Didik Dalam Belajar Descriptive Geometry: Sebuah Review Literatur. *Jurnal Riset Pembelajaran Matematika Sekolah*, 7(1), 9–15. <https://doi.org/10.21009/jrpms.071.10>
- Wulan, E. R., & Rusdiana. (2014). Evaluasi pembelajaran. In *Pustaka Setia*. Pustaka Setia.
- Yates, A., Starkey, L., Egerton, B., & Flueggen, F. (2020). High School Students' Experience of Online Learning During Covid-19: The Influence of Technology and Pedagogy. *Technology Pedagogy and Education*, 30(1), 59–73. <https://doi.org/10.1080/1475939x.2020.1854337>
- Yerizon, Arnawa, I. M., Fitriani, N., & Tajudin, N. M. (2022). Constructing Calculus Concepts through Worksheet Based Problem-Based Learning Assisted by GeoGebra Software. *HighTech and Innovation Journal*, 3(3), 282–296. <https://doi.org/10.28991/HIJ-2022-03-03-04>
- Yoki Ariyana, Ari Pudjiastuti, Z. (2018). *buku pegangan pembelajaran berorientasi pada keterampilan berpikir tingkat tinggi*. Direktorat Jenderal Guru dan Tenaga kependidikan, Kementerian pendidikan dan kebudayaan.
- Yudhanegara, M. R., & Lestari, K. E. (2014). Meningkatkan Kemampuan Representasi Beragam Matematis Siswa melalui Pembeajaran Berbasis Masalah Terbuka. *Jurnal Ilmiah Solusi*, 1(4), 97–106.
- Yulkifli, Y., Risma, M., Festiyed, F., & Azis, H. (2023). Validity of E-Module Integrated Scientific Literacy Using the Smartphone-Assisted IBL Model to Improve Student Competence. *Journal of Physics Conference Series*, 2582(1), 12051. <https://doi.org/10.1088/1742-6596/2582/1/012051>
- Yunita, Y., Juandi, D., Tamur, M., Adem, A. M. G., & Pereira, J. (2020). A Meta-Analysis of the Effects of Problem-Based Learning on Students' Creative Thinking in Mathematics. *Beta Jurnal Tadris Matematika*, 13(2), 104–116. <https://doi.org/10.20414/betajtm.v13i2.380>
- Yunitasari, I., Sahrudin, A., Kartasasmita, B. G., & Prakoso, T. B. (2019). Pengembangan Bahan Ajar Matematika dengan Memanfaatkan Program. *Journal of Mathematics Learning*, 2(2), 1–11.
- Zhang, J. (2020). The Relationship Between Mathematics Attitude, Learning Engagement and Academic Achievement. (*Jiml*) *Journal of Innovative Mathematics Learning*, 3(1), 24–36. <https://doi.org/10.22460/jiml.v3i1.p24-36>
- Žilinskienė, I., & Demirbilek, M. (2015). Use of GeoGebra in Primary Math Education in

- Lithuania: An Exploratory Study From Teachers' Perspective. *Informatics in Education*, 14(1), 127–142. <https://doi.org/10.15388/infedu.2015.08>
- Zulfikar, Z. (2022). Pengembangan Media Pembelajaran Iqra Berbasis Multimedia Menggunakan Metode ADDIE. *Jurnal Tika*, 7(2), 215–227. <https://doi.org/10.51179/tika.v7i2.1343>
- Zumbrunn, S. (2011). Encourage self regulated learning in the classroom. *Journal Virginia Commonwealth University*, 278–299. http://scholarscompass.vcu.edu/merc_pubs/18