

**DESAIN DIDAKTIS UNTUK PROSES GENERALISASI:
FOKUS MATERI POLA BILANGAN**

TESIS

Diajukan untuk memenuhi salah satu syarat untuk memperoleh gelar
Magister Pendidikan Matematika



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untuk memperoleh gelar Magister Pendidikan (M.Pd.)
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ABSTRAK

Nyla Farhatul Maula (2217017). Desain Didaktis untuk Proses Generalisasi: Fokus Materi Pola Bilangan.

Penelitian ini bertujuan untuk mengidentifikasi hambatan belajar dalam proses generalisasi pola bilangan pada siswa dan mengembangkan desain didaktis hipotesis untuk mengatasi hambatan tersebut. Hambatan belajar ditinjau melalui tiga kategori utama: ontogenik, didaktik, dan epistemologi. Studi ini melibatkan analisis terhadap desain pembelajaran yang ada, serta implementasi instrumen asesmen untuk mengidentifikasi hambatan yang dialami siswa. Temuan menunjukkan bahwa hambatan ontogenik meliputi kesulitan siswa dalam memahami konsep akibat keterbatasan mental dan kesiapan belajar. Hambatan didaktik diidentifikasi terkait dengan penyajian materi dan urutan pembelajaran yang kurang sesuai dengan alur pikir siswa, sementara hambatan epistemologi mencakup keterbatasan pemahaman siswa dalam mengaplikasikan konsep pada konteks baru. Berdasarkan hasil analisis, penelitian ini mengusulkan lintasan belajar yang disesuaikan dengan kebutuhan siswa untuk mendukung proses generalisasi pola bilangan. Desain didaktis yang dihasilkan diharapkan dapat memfasilitasi siswa dalam mengembangkan pemahaman pola bilangan secara bertahap dan mendalam. Temuan ini dapat memberikan kontribusi pada pengembangan desain didaktis pada pembelajaran matematika yang lebih efektif dalam mendukung proses generalisasi dan mengatasi hambatan belajar.

Kata kunci:

Desain Didaktis, Generalisasi, Hambatan Belajar, Pola Bilangan, Lintasan Belajar

ABSTRACT

Nyla Farhatul Maula (2217017). Didactic Design for Generalization Process: Focus on Number Pattern.

This study aims to identify learning obstacles in students' generalization of number patterns and to develop a hypothetical didactic design to address these obstacles. Learning obstacles are reviewed through three main categories: ontogenic, didactic, and epistemological. The study involves an analysis of existing instructional designs and the implementation of assessment instruments to identify obstacles encountered by students. Findings indicate that ontogenic obstacles include difficulties in understanding concepts due to mental limitations and readiness to learn. Didactic obstacles are identified as related to the presentation of material and the instructional sequence, which are not fully aligned with students' thought processes. Meanwhile, epistemological obstacles encompass students' limited understanding in applying concepts to new contexts. Based on the analysis, this study proposes a learning trajectory tailored to students' needs to support the generalization process of number patterns. The resulting didactic design is expected to facilitate students in developing a gradual and in-depth understanding of number patterns. These findings contribute to the development of a more effective didactic design in mathematics education, supporting generalization processes and overcoming learning obstacles.

Keywords:

Didactic Design, Generalization, Learning Obstacles, Number Patterns, Learning Trajectory

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DAFTAR PUSTAKA

- Abakah, F., & Brijlall, D. (2024). Misconceptions of mathematical concepts vis-à-vis how they pose as barriers to developing students' conceptual understanding. *Gulf Journal of Mathematics*, 16(2), 81-99. <https://doi.org/10.56947/gjom.v16i2.1871>
- Abend, G. (2008). The Meaning of Theory. *Sociological Theory*, 26(2), 173-199, <https://doi.org/10.1111/j.1467-9558.2008.00324.x>
- Adelia, V., Susanti, E., Sari, N., & Simarmata, R. H. (2020). Abstraction ability in number patterns problems. *Journal of Physics: Conference Series*, 1480(1), 012049. <https://doi.org/10.1088/1742-6596/1480/1/012049>
- Anderson, J., White, P., & Sullivan, P. (2018). *Implementing problem-solving in mathematics classrooms: What works?* Springer.
- Aiyub (2023). Ways of Thinking Siswa dalam Menyelesaikan Masalah Pola Bilangan Non Rutin: Suatu Penelitian Fenomenologi Hermeneutik. *Journal of Didactic Mathematics*, 4(2), 65-76, <https://doi.org/10.34007/jdm.v4i2.1851>
- Akkan, Yasar (2013). Comparison of 6th-8th Graders' Efficiencies, Strategies and Representations Regarding Generalization Patterns. *Boletim de Educacao Matematica*, 27(43), 703-732
- Anwar, A., & Rahimu, W. O. S. O. (2021). Efektivitas Penggunaan Media Pembelajaran Visual pada Mata Pelajaran Matematika Terhadap Prestasi Belajar Siswa. *Jurnal Akademik Pendidikan Matematika*, 7(1), 50-57. <https://doi.org/10.55340/japm.v7i1.390>
- Barbosa, A. & Vale, I. (2015). Visualization in Pattern Generalization: Potential and Challenges. *Journal of the European Teacher Education Network*, 10(3), 57–70
- Barbosa, A. & Vale, I. (2024). Pre-service Teachers' Generalization Strategies Solving Figurative Growth Patterns. *Proceedings of Thirteenth Congress of the European Society for Research in Mathematics Education*. Hungary
- Barsalou, L. W., Dutriaux, L., & Scheepers, C. (2018). Moving beyond the distinction between concrete and abstract concepts. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1752), 20170144. <https://doi.org/10.1098/rstb.2017.0144>
- Bolisani, E., & Bratianu, C. (2018). The Elusive Definition of Knowledge. In: *Knowledge Management and Organizational Learning* (1-22). Springer
- Braithwaite, D. W., & Sprague, L. (2021). Conceptual knowledge, procedural knowledge, and metacognition in routine and nonroutine problem solving. *Cognitive Science*, 45(10). <https://doi.org/10.1111/cogs.13048>
- Brousseau, G. (2002). *Theory of Didactical Situation in Mathematics*. New York: Kluwer Academic Publishers
- Brief, I. (2003). *Algebraic Skills & Strategies for Elementary Teachers & Students*.

Algebraic Strategies for Elementary Grades, 3(1), 1-6.

- Cahyanto, I. D., & Prabawati, M. N. (2019). Konstruktivisme dalam pembelajaran matematika. Dalam *Prosiding Seminar Nasional & Call For Papers Program Studi Magister Pendidikan Matematika Universitas Siliwangi* (pp. 274-280). Universitas Siliwangi.
- Chevallard, Y. (2007). Readjusting Didactics to a Changing Epistemology. *European Educational Research Journal*, 6(2), 131-134. <https://doi.org/10.2304/eeerj.2007.6.2.131>
- Chevallard, Y. & Sensevy, G. (2014). Anthropological Approaches in Mathematics Education French Perspectives. In S. Lerman (Ed.), *Encyclopedia of Mathematics Education* (38-43). Dordrecht: Springer
- Clements, D. H., & Sarama (2004). Learning Trajectory in Mathematics Education. *Mathematical Thinking and Learning*, 6(2), 81-89, https://doi.org/10.1207/s15327833mtl0602_1
- Cordova Cornejo, V.E., Aravena Díaz, M.D., & Parraguez González, M.C. (2024). Construction and mental mechanisms for learning about the exponential function in a school setting. *Uniciencia*.
- Creswell, J. W. (2016). *Research Design: Pendekatan Metode Kualitatif, Kuantitatif, dan Campuran Edisi Keempat*. Yogyakarta: Pustaka Belajar.
- Darwin, Rusdin, D., Mukminatien, N., Suryati, N., Laksmi, E. D., & Marzuki. (2023). Critical thinking in the AI era: An exploration of EFL students' perceptions, benefits, and limitations. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186X.2023.2290342>
- Day, S. B., Motz, B. A., & Goldstone, R. L. (2015). The cognitive costs of context: The effects of concreteness and immersiveness in instructional examples. *Frontiers in Psychology*, 6(1876). <http://dx.doi.org/10.3389/fpsyg.2015.01876>
- Delic, H. & Becirovic, S. (2016). Socratic Method as an Approach to Teaching. *European Researcher Series A*, 111(10), 511-517, <https://doi.org/10.13187/er.2016.111.511>
- Dindyal, J. (2007). High School Students' Use of Patterns and Generalisations. *Proceedings of the 30th Annual Conferences of the Mathematics Education Research Group of Australasia* (236-245). Australia: Merga Inc
- Dreyfus, T. (1991). Advanced Mathematical Thinking Processes. In D. Tall (Ed.), *Advanced Mathematical Thinking* (25-41). Boston: Kluwer Academic Publishers
- Dwyer, C. P. (2023). An evaluative review of barriers to critical thinking in educational and real-world settings. *Journal of Intelligence*, 11(105). <https://doi.org/10.3390/jintelligence11060105>
- Ellis, A. B. (2011). Generalizing-Promoting Actions: How Classroom Collaborations Can Support Students' Mathematical Generalizations. *Journal for Research in Mathematics Education*, 42(4), 308-345.

<https://doi.org/10.5951/jresematheduc.42.4.0308>

- Emanet, E. A., & Kezer, F. (2021). The effects of student-centered teaching methods used in mathematics courses on mathematics achievement, attitude, and anxiety: A meta-analysis study. *Participatory Educational Research*, 8(2), 240-259. <https://doi.org/10.17275/per.21.38.8.2>
- Amin, S. A & Lukito, A. (2018). Profil Generalisasi Berdasarkan Perspektif Semiotik Siswa Operasional Konkret dan Operasional Formal. *Jurnal Ilmiah Pendidikan Matematika*, 3(2), 99-106.
- Fahriza Fuadiah, N. (2017). Hypothetical Learning Trajectory pada Pembelajaran Bilangan Negatif Berdasarkan Teori Situasi Didaktis di Sekolah Menengah. *Mosharafa: Jurnal Pendidikan Matematika*, 6(1), 13-24. <https://doi.org/10.31980/mosharafa.v6i1.425>
- Farida, N. (2015). Analisis kesalahan siswa SMP kelas VIII dalam menyelesaikan masalah soal cerita matematika. *Aksioma: Jurnal Pendidikan Matematika FKIP Universitas Muhammadiyah Metro*, 4(2), 42-52. <http://dx.doi.org/10.24127/ajpm.v4i2.306>
- Fauzi, I. & Suryadi, D. (2020). Didactical Design Research untuk Mengembangkan Kompetensi Pedagogik Guru di Sekolah Dasar. *Inventa : Jurnal Pendidikan Guru Sekolah Dasar*, 4(1), 58-68, <https://doi.org/10.36456/inventa.4.1.a2207>
- Fauzi, A. H. N., & Masduki, M. (2022). Student's Anomaly Reasoning in Solving Number Pattern in Terms of Gender. *Jurnal Didaktik Matematika*, 9(2), 328-342, <https://doi.org/10.24815/jdm.v9i2.27146>
- Fauzia, T. A., Juandi, D., & Purniati, T. (2020). Desain Didaktis Konsep Barisan dan Deret Aritmetika Pada Pembelajaran Matematika Sekolah Menengah Atas. *Journal on Mathematics Education*, 1(2)
- Firdaus, A. M., Murtafiah, W., Lukitasari, M., Lestari, N. D. S., Ernawati, T., & Widodo, S. A. (2023). Generalization of patterns drawing of high-performance students based on action, process, object, and schema theory. *European Journal of Educational Research*, 12(1), 421-433. <https://doi.org/10.12973/eu-jer.12.1.421>
- Firdaus, A. N., Juniati, D., Wijayanti, P. (2020). Number Pattern Generalization Process by Provincial Mathematics Olympiad Winner Students. *Journal for The Education of Gifted Young Scientists*, 8(3), 991-1003, <https://dx.doi.org/10.17478/jegys.70498>
- Fitriani, N., Kadarisma, G., & Amelia, R. (2020). Pengembangan desain didaktis untuk mengatasi learning obstacle pada materi dimensi tiga. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 9(2), 231-241. <https://doi.org/10.24127/ajpm.v9i2.2686>
- Frey, R. F., McDaniel, M. A., Bunce, D. M., Cahill, M. J., & Perry, M. D. (2020). Using students' concept-building tendencies to better characterize average performing student learning and problem-solving approaches in general

- chemistry. *CBE—Life Sciences Education*, 19(3).
<https://doi.org/10.1187/cbe.19-11-024>
- Fykaris, I. (2023). Descriptive and Categorical Delimitation of The Theories of Didactics. *Journal of Studies in Education*. 13(3), 89-107,
<https://doi.org/10.5296/jse.v13i3.21173>
- Glaser, R., & Strauss, R. (1967). *The discovery of grounded theory*. Chicago: Aldine Transaction
- Guner, P., Uygun, T., & Ersoy, E. (2013). 7th and 8th Grade Students' Generalization Strategies of Patterns. *Internasional Journal of Global Education*, 2(4), 37-54
- Hanggara, Y., Sa'dijah, C., & Qohar, A. (2023). Theory and practice of constructive approaches in mathematics learning. *Jurnal Cahaya Pendidikan*, 9(1), 27-34.
<https://doi.org/10.33373/chypend.v9i1.5127>
- Harel, G. (2008). What is Mathematics? A Pedagogical Answer to a Philosophical Question. In B. Gold & R.A. Simons (Eds.): *Proof and other Dilemmas: Mathematics and Philosophy* (265-290). The Mathematical Association of America
- Hariyomurti, B., Prabawanto, S., & Jupri, A. (2020). Hambatan Belajar Siswa dalam Pembelajaran Barisan dan Deret Aritmetika. *Journal for Research in Mathematics Learning*, 3(3), 283. <https://doi.org/10.24014/juring.v3i3.10118>
- Hartri, L. & Hakim, D. L. (2023). Kemampuan Generalisasi Matematis Siswa SMP pada Materi Segiempat dan Segitiga. *Jurnal Pendidikan dan Konseling*, 5(2), 3082-3092. <https://doi.org/10.31004/jpdk.v5i2.13606>
- Hasan, N. F. (2022). Desain Didaktis Materi Barisan dan Deret Geometri pada Pembelajaran Matematika di SMK (*Tesis, Universitas Pendidikan Indonesia*, 2022). <http://repository.upi.edu/id/eprint/86550>
- Hayati, F., Saragih, S. D., & Gunarto, B. (2024). Analisis Kesulitan Belajar Siswa Pada Materi Barisan dan Deret Menggunakan Metode Problem Based Learning. *Innovative: Journal Of Social Science Research*, 4(2), 3335–3346.
<https://doi.org/10.31004/innovative.v4i2.9727>
- Hayuningrat, S. & Rosnawati, R. (2022). Development of Learning Tools Based on Realistic Mathematics Approach that Oriented to High School Students' Mathematical Generalization Ability. *Jurnal Riset Pendidikan Matematika*, 9(2), 191-200, <https://doi.org/10.21831/jrpm.v9i2.52197>
- Hendriyanto, A., Suryadi, D., Dahlan, J. A., & Juandi, D. (2023). Praxeology Review: Comparing Singaporean and Indonesian Textbooks in Introducing The Concept of Sets. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(2), 1-13, <https://doi.org/10.29333/ejmste/12953>
- Hermawan, V., & Andrianto. (2018). Analisis kesulitan siswa terhadap pokok bahasan pangkat rasional dan bentuk akar di kelas X SMA Bina Dharma 2 Bandung. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*, 3(2), 116-124. <https://doi.org/10.23969/symmetry.v3i2.1320>
- Irsandi, E. O. (2019). Desain Didaktis Pembelajaran Matematika pada Konsep pola

- Bilangan, Barisan dan Deret Aritmatika di Sekolah Menengah Kejuruan (Skripsi, UIN Syarif Hidayatullah Jakarta, 2019). <http://repository.uinjkt.ac.id/dspace/handle/123456789/45161>
- Iwata N. (2019). Plato on Knowledge and Truth. *The Classical Review*, 69(1), 56-58, <https://doi.org/10.1017/S0009840X18003037>
- Jeheman, A. A., Gunur, B., & Jelatu, S. (2019). Pengaruh Pendekatan Matematika Realistik terhadap Pemahaman Konsep Matematika Siswa. *Mosharafa: Jurnal Pendidikan Matematika*, 8(2), 191–202. <https://doi.org/10.31980/mosharafa.v8i2.552>
- Jelahu, R. A., Son, A. L., Bete, H., Garcia, J., Sudirman, S., & Alghadari, F. (2023). Profile of Middle School Students' Mathematical Literacy Ability in Solving Number Pattern Problems. *International Journal of Science Education and Cultural Studies*, 2(1), 1–14. <https://doi.org/10.58291/ijsecs.v2i1.72>
- Jonsson, B., Granberg, C., & Lithner, J. (2020). Gaining mathematical understanding: The effects of creative mathematical reasoning and cognitive proficiency. *Frontiers in Psychology*, 11(574366). <https://doi.org/10.3389/fpsyg.2020.574366>
- Juniati, D., & Siswono, T. Y. E. (2018). Profiles Quantitative Reasoning and Students' Generalization Ability on Topic of Direct Proportion. *The Sixth Seminar Nasional Pendidikan Maetamtika Universitas Ahmad Dahlan, Indonesia*
- Jurow, A. S. (2004). Generalizing in interaction: Middle school mathematics students making mathematical generalizations in a population-modeling project. *Mind, Culture, and Activity*, 11, 279–30
- Kaput, J. J. (1999). Teaching and Learning a New Algebra. In E. Fennema & T. Romberg (Eds.), *Mathematics Classrooms that Promote Understanding* (133-155). Washington DC: Lawrence Erlbaum Associates
- Kaivanpanah, S., Alavi, S. M., & Sepehrinia, S. (2012). Preferences for interactional feedback: Differences between learners and teachers. *The Language Learning Journal*. <https://doi.org/10.1080/09571736.2012.705571>
- Kusmaryono, I., Aminudin, M., Ubaidah, N., & Chamalah, E. (2024). The bridging understanding of language and mathematical symbols between teachers and students: An effort to increase mathematical literacy. *Infinity*, 13(1), 251-270. <https://doi.org/10.22460/infinity.v13i1.p251-270>
- Kusumaningtyas, S. I., Junianti, D. & Lukito, A. (2017). Pemecahan Masalah Generalisasi Pola Siswa Kelas VII SMP Ditinjau Dari Gaya Kognitif Field Independendt Dan Field Dependent. *Kreano Jurnal Matematika Kreatif-Inovatif*, 8(1), 76-84. <http://dx.doi.org/10.15294/kreano.v8i2.6994>
- Lannin, J. K. (2005). Generalization and Justification: The Challenge of Introducing Algebraic Reasoning Through Patterning Activities. *Mathematical Thinking and Learning*, 7(3), 231-258, https://doi.org/10.1207/s15327833mtl0703_3

- Lannin, J., Barker, D., & Townsend, B. (2006). Algebraic Generalisation Strategies: Factors Influencing Student Strategy Selection. *Mathematics Education Research Journal*, 18(3), 3-18
- Lee, L. (1996). *Approaches to algebra: Perspectives for research and teaching*. Boston: Kluwer Academic Publishers
- Lodge, J. M., Kennedy, G., Lockyer, L., Arguel, A., & Pachman, M. (2018). Understanding difficulties and resulting confusion in learning: An integrative review. *Frontiers in Education*, 3(49). doi: 10.3389/feduc.2018.00049
- Maria Hutasoit, L. I. ., & Gultom, S. . (2023). Pengembangan Bahan Ajar Berbasis Media Interaktif menggunakan Aplikasi Macromedia Flash untuk Meningkatkan Kemampuan Komunikasi Matematis di SMP Gema Buwana. *Jurnal Pendidikan Tambusai*, 7(1), 543–551. <https://doi.org/10.31004/jptam.v7i1.5329>
- Martelli, M. (2018). The making of pupils: Institutionalized education in Romanian high schools. *Studia UBB Sociologia*, 63(1), 113-133. <https://doi.org/10.2478/subbs-2018-0007>
- Marzano, J. (1988). *Dimensions of Thinking: A Framework for Curriculum and Instruction*. Virginia: Association for Supervision and Curriculum Development
- Masjudin. (2016). Pembelajaran kooperatif investigatif untuk meningkatkan pemahaman siswa materi barisan dan deret. *Jurnal Edukasi Matematika dan Sains (JEMS)*, 4(2), 76-84. <https://doi.org/10.25273/jems.v4i2.687>
- Mason, J. (1996). Expressing Generality and Roots of Algebra. In A. J. Bishop (Managing Ed.), N. Bednarz, C. Kieran, & L. Lee (Vol. Eds.), *Mathematics education library*. Dordrecht : Kluwer
- Moguel, S. L. E., Landa, A. E., & Sanchez, C.G. (2019). Characterization of Inductive Reasoning in Middle School Mathematics Teachers in a Generalization Task. *International Electronic Journal of Mathematics Education*, 14(3), 563–581. <https://doi.org/10.29333/iejme/5769>
- Mulligan, J., & Mitchelmore, M. (2009). Awareness of Pattern and Structure in Early Mathematical Development. *Mathematics Education Research Journal*, 21(2), 33–49, <https://doi.org/10.1007/BF03217544>
- Mulwa, E.C. (2015). Difficulties Encountered by Students in the Learning and Usage of Mathematical Terminology: A Critical Literature Review. *Journal of Education and Practice*, 6(27-37)
- Munaji, & Setiawahyu, M. I. (2020). Profil kemampuan matematika siswa SMP di kota Cirebon berdasarkan standar TIMSS. *Teorema: Teori dan Riset Matematika*, 5(2), 249–262. <https://doi.org/10.26877/teorema.v5i2.3732>
- Musa, R. N., Monoarfa, J. F., & Regar, V. E. (2024). Pemahaman konsep matematis siswa dalam menyelesaikan soal cerita materi barisan dan deret kelas X. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 8(2), 1040-1048. <https://doi.org/10.31004/cendekia.v8i1.3031>

- Nathan, M. J., & Kim, S. (2007). Pattern Generalization with Graphs and Words: A Cross-Sectional and Longitudinal Analysis of Middle School Students' Representational Fluency. *Mathematical Thinking and Learning*, 9(3), 193–219. <https://doi.org/10.1080/10986060701360886>
- Ngwenya, J. C., & Mbili, S. H. (2020). Exploring accounting teachers' views on the quality of accounting prescribed textbooks in South Africa. *International Journal of Learning, Teaching and Educational Research*, 19(6), 353-369. <https://doi.org/10.26803/ijlter.19.6.21>
- Ningsih, S. (2014). Realistic mathematics education: Model alternatif pembelajaran matematika sekolah. *Jurnal Pendidikan Matematika IAIN Antasari*, 1(2), 73-94. <https://doi.org/10.18592/jpm.v1i2.97>
- Novita, N., Sumarni, S., & Riyadi, M. (2022). Student Concept Understanding Analysis In Number Pattern Material During Distance Learning (DL): Analisis Pemahaman Konsep Siswa Dalam Materi Pola Bilangan Selama Pembelajaran Jarak Jauh (PJJ). *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, 7(1), 19–39. <https://doi.org/10.31943/mathline.v7i1.241>
- Ozturk, N. (2021). *Teach Like Socrates: Guiding Socratic Dialogues and Discussions in The Classroom*. Newyork: Routledge
- Pertiwi, A. D. ., Nurfatimah, S. A. ., & Hasna, S. . (2022). Menerapkan Metode Pembelajaran Berorientasi Student Centered Menuju Masa Transisi Kurikulum Merdeka. *Jurnal Pendidikan Tambusai*, 6(2), 8839–8848. <https://doi.org/10.31004/jptam.v6i2.3780>
- Piaget, J. (1952). "The Origins of Intelligence in Children." New York: International Universities Press.
- Pritchard, D. (2023). *What is this think called knowledge?*. London: Routledge
- Puspita, E., Suryadi, D., & Rosjanuardi, R. (2023). The Effectiveness of Didactic Designs for Solutions to Learning-Obstacle Problems for Prospective Mathematics Teacher Students: Case Studies on Higher-Level Derivative Concepts. *Mathematics Teaching Research Journal*, 15(3), 5-18
- Putra, Z. H., & Witri, G. (2017). Anthropological Theory of The Didactic (ATD) a New Research Perspective on Didactic Mathematics in Indonesia. *Jurnal Pendidikan Guru*, 2(1), 221-227
- Raco. J. R. (2010). *Metode Penelitian Kualitatif Jenis, Karakteristik, dan Keunggulan*. Jakarta: Grasindo
- Radford, L. (2001). Factual, Contextual and Symbolic Generalizations in Algebra. *Proceedings of The 25th Conference of The Internasional Group for The Psychology of Mathematics Education* (81-89). Netherlands
- Rangkuti, A. N. (2014). Representasi matematis. *Forum Paedagogik*, 6(1), 110-127. <http://dx.doi.org/10.24952/paedagogik.v6i01.168>
- Rathert, S., & Cabaroğlu, N. (2022). Theorising textbook adaptation in English language teaching. *CEPS Journal*, 12(2), 169–188.

<https://doi.org/10.26529/cepsj.1287>

- Risdiyanti, I., & Prahmana, R.C. (2020). The Learning Trajectory of Number Pattern Learning Using Barathayudha War Stories and Uno Stacko. *Journal on Mathematics Education*, 11, 157-166. <https://doi.org/10.22342/jme.11.1.10225.157-166>
- Rusmawati, K. L. (2021). Analysis of Student Learning Difficulties on Number Pattern Material Reviewed from Student Learning Independence. *Mathematics Education Journals*, 5 (2), 132-144, <https://doi.org/10.22219/mej.v5i2.17089>
- Ruthven, K. Laborde, C. Leach, J. & Thibergien, A. (2009). Design Tools in Didactical Research: Instrumenting the Epistemological and Cognitive Aspects of the Design of Teaching Sequences. *Educational Researcher* 38(5), 329-342
- Schneider, U. (2007). Coping with the Concept of Knowledge. *Management Learning*, 38(5), 613-633, <https://doi.org/10.1177/1350507607083396>
- Setiawan, M., Pujiastuti, E., & Susilo, B. (2021). Tinjauan Pustaka Systematik: Pengaruh Kecemasan Matematika Terhadap Kemampuan Pemecahan Masalah Siswa. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama*, 13(2), 239-256. <https://doi.org/10.37680/qalamuna.v13i2.870>
- Setiawan, Y.E., Purwanto, Parta, I.N., & Sisworo. (2020). Generalization Strategy of Linear Patterns from Field Dependent Cognitive Style. *Journal on Mathematics Education*, 11(1), 77-94. <http://doi.org/10.22342/jme.11.1.9134.77-94>
- Seyedi, G. (2012). The Think-Aloud Method In EFL Reading Comprehension. *International Journal of Scientific & Engineering Research*, 3(9), 1-9
- Sidik, G. S., Suryadi, D., & Turmudi, T. (2021). Learning obstacle on addition and subtraction of primary school students: Analysis of algebraic thinking. *Education Research International*, 2021, Article ID 5935179. <https://doi.org/10.1155/2021/5935179>
- Siemon, D. (2021). Learning Progressions/Trajectories in Mathematics: Supporting Reform at Scale. *Australian Journal of Education*, 65(3), 227-247. <https://doi.org/10.1177/000494412111045745>
- Somasundram, P., Akmar, S. N., & Eu, L. K. (2019). Pattern Generalisation by Year Five Pupils. *Internasional Electronic Journal of Mathematics Education*, 14(2), 353-362. <https://doi.org/10.29333/iejme/5719>
- Spangenberg, E. D., & Pithmajor, A. K. (2020). Grade 9 Mathematics Learners' Strategies in Solving Number-Pattern Problems. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(7). <https://doi.org/10.29333/EJMSTE/8252>
- Sriraman, B. (2003). Mathematical Giftedness, Problem Solving, and The Ability to Formulate Generalizations: The Problem-Solving Experiences of Four Gifted Students. *Journal of Secondary Gifted Education*, 14(3), 151-165,

<https://doi.org/10.4219/jsge-2003-425>

Stacey, K. (1989). Finding and Using Patterns in Linear Generalising Problems. *Educational Studies in Mathematics*, 20(2), 147–164., <https://doi.org/10.1007/BF00579460>

Sudaryono (2016). *Metode Penelitian Pendidikan*. Jakarta: Kencana

Sukarma, I. K., Isnawan, M. G., & Alsulami, N. M. (2024). Research on nonroutine problems: A hybrid didactical design for overcoming student learning obstacles. *Human Behavior and Emerging Technologies*, 2024, Article 5552365. <https://doi.org/10.1155/2024/5552365>

Sulistiawati, Suryadi, D., & Fatimah, S. (2015). Desain Didaktis Penalaran Matematis untuk Mengatasi Kesulitan Belajar Siswa SMP pada Luas dan Volume Limas. *Jurnal Matematika Kreatif-Inovatif*, 6(2), 135-146, <https://doi.org/10.15294/kreano.v6i2.4833>

Sundayana, R. (2016). Kaitan antara gaya belajar, kemandirian belajar, dan kemampuan pemecahan masalah siswa SMP dalam pelajaran matematika. *Mosharafa: Jurnal Pendidikan Matematika*, 5(2), 75-84. <https://doi.org/10.31980/mosharafa.v5i2.372>

Suryadi, D. (2018). *Ontologi dan Epistemologi dalam Penelitian Desain Didaktis (DDR). Makalah Bahan Diskusi di Lingkungan Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Bandung*

Suryadi, D. (2019). *Landasan Filosofis Penelitian Desain Didaktis (DDR)*. Bandung: Gapura Press

Suryadi, D., Dasari, D., Juandi, D., & Junaedi, I. (2022). Learning Obstacles in the Making of Lesson Plans by Prospective Mathematics Teacher Students. *Education Research Internasional*, 2022, 1-15, <https://doi.org/10.1155/2022/2896860>

Suryadi, D. (2023). *Jalan Epistemik Menghasilkan Pengetahuan melalui Didactical Design Research (DDR)*. Pusat Pengembangan DDR Indonesia (PusbangDDRIndo)

Sutarto, S., Nusantara, T., Subanji, S., Dwi Hastuti, I., & Dafik, D. (2018). Global Conjecturing rocess in Pattern Generalization Problem. *Journal of Physics: Conference Series*. IOP Publishing

Swokowski, E. W., & Cole, J. A. (2009). *Algebra and Trigonometry with Analytic Geometry*. Pacific Grove: Cengage Learning

Tias, A. A. W., & Wutsqa, D. U. (2015). Analisis kesulitan siswa SMA dalam pemecahan masalah matematika kelas XII IPA di Kota Yogyakarta. *Jurnal Riset Pendidikan Matematika*, 2(1), 28-39. <http://journal.uny.ac.id/index.php/jrpm>

Tikekar, V. G. (2009). Deceptive Patterns in Matematics. *International Journal of Mathematical Science Education*, 2(1), 13–21

Toheri, & Winarso, W. (2020). Where exactly for enhance critical and creative

- thinking: The use of problem posing or contextual learning. Dalam *Proceedings of the 1st International Conference on Recent Innovations (ICRI 2018)* (hlm. 698-705). SCITEPRESS – Science and Technology Publications. <https://doi.org/10.5220/0009914806980705>
- Tyrina, M. & Kulikova, L. (2020). Diagnosing the Results of Educator's Didactic Culture Development in the Conditions of Innovative Education. *Proceedings of Internasional Scientific and Practical Conference on Education, Health, and Human Wellbeing* (145-148). Dordrecht: Atlantis Press
- Umah, U., Asari, A. R., Sukoriyanto, S., & Sisworo. (2023). Students' inquisitive questions predict their understanding of mathematics texts. *Acta Scientiae*, 25(6), 29-59. <https://doi.org/10.17648/acta.scientiae.7466>
- Utami, N. S., Prabawanto, S., & Suryadi, D. (2023). How students generate patterns in learning algebra? A focus on functional thinking in secondary school students. *European Journal of Educational Research*, 12(2), 913-925. <https://doi.org/10.12973/eu-jer.12.2.913>
- Vogel, R. (2005). Patterns a Fundamental Idea of Mathematical Thinking and Learning. *International Journal on Mathematics Education*, 37(5), 445–449. <https://doi.org/10.1007/s11858-005-0035-z>
- Vygotsky, L. S. (1978). "Mind in Society: The Development of Higher Psychological Processes." Cambridge, MA: Harvard University Press.
- Wilson, P. H, Gemma, F., Mojica, Confrey, J. (2013). Learning Trajectories in Teacher Education: Supporting Teachers' Understandings of Students' Mathematical Thinking. *The Journal of Mathematical Behavior*, 32(2), 103-121, <https://doi.org/10.1016/j.jmathb.2012.12.003>
- Yildiz, D. G. & Durmaz, B. (2021). A Gifted High School Student's Generalization Strategies of Linear and Nonlinear Patterns via Gauss's Approach. *Journal for the Education of the Gifted*, 44(1) 56–80. <https://doi.org/10.1177/0162353220978295>
- Yin, R. K. (2016). *Qualitative Research From Start to Finish: Second Edition*. New York: The Guilford Press
- Yuniarti, T. (2014). Desain Didaktis Teori Peluang SMA. *Jurnal Pendidikan MIPA*, 15(1), 15-20
- Zazkis, R., & Liljedahl, P. (2002). Generalization of Patterns: The Tension Between Algebraic Thinking and Algebraic Notation. *Educational Studies in Mathematics*, 49, 379-402, <https://doi.org/10.1023/A:1020291317178>
- Zoanetti, N. (2021). Interpreting Learning Progress Using Assessment Scores: What is There to Gain?. *Proceedings of Research Conference 2021 Excellent Progress for Every Student* (1-12). Melbourne: Australian Council for Educational Research