

**SITUASI DIDAKTIS PEMBELAJARAN SKALA
PADA SISWA SEKOLAH MENENGAH PERTAMA**

TESIS

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar
Magister Pendidikan Matematika



Oleh:

Desta Martha Sua Diba
NIM 1706608

**PROGRAM STUDI
PENDIDIKAN MATEMATIKA
SEKOLAH PASCASARJANA
UNIVERSITAS PENDIDIKAN INDONESIA
2019**

**SITUASI DIDAKTIS PEMBELAJARAN SKALA
PADA SISWA SEKOLAH MENENGAH PERTAMA**

Oleh:

Desta Martha Sua Diba

Sebuah tesis yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Magister Pendidikan pada Program Studi Pendidikan Matematika, Sekolah Pascasarjana

© Desta Martha Sua Diba 2019
Universitas Pendidikan Indonesia
Mei 2019

Hak Cipta dilindungi undang-undang.
Tesis ini tidak boleh diperbanyak seluruhnya atau sebagian, dengan dicetak ulang, difotokopi,
atau cara lainnya tanpa ijin dari penulis.

DESTA MARTHA SUA DIBA

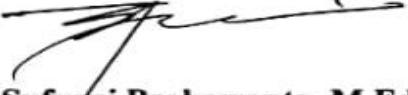
**SITUASI DIDAKTIS PEMBELAJARAN SKALA
PADA SISWA SEKOLAH MENENGAH PERTAMA**

disetujui dan disahkan oleh pembimbing:

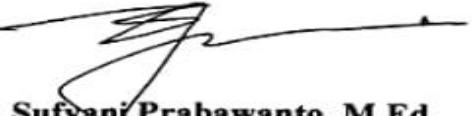
Pembimbing I


Prof. Dr. H. Didi Suryadi, M.Ed.
NIP. 195802011984031001

Pembimbing II


Dr. H. Sufyani Prabawanto, M.Ed.
NIP. 196008301986031003

**Mengetahui,
Ketua Program Studi Pendidikan Matematika**


Dr. H. Sufyani Prabawanto, M.Ed.
NIP. 196008301986031003

ABSTRAK

Desta Martha Sua Diba. (1706608). Situasi Didaktis Pembelajaran Skala pada Siswa Sekolah Menengah Pertama.

Konsep perbandingan merupakan konsep yang digunakan tidak hanya untuk menyelesaikan masalah matematika, namun juga untuk konsep lainnya. Berdasarkan penelitian terdahulu dan studi pendahuluan yang telah dilakukan, selama pembelajaran perbandingan khususnya skala ditemukan adanya *learning obstacle*. Selama ini penelitian cenderung menganalisis *learning obstacle* siswa melalui pemberian tes atau mengembangkan desain pembelajaran dan tidak memfokuskan pada observasi pembelajaran. Observasi pembelajaran dengan perspektif teori situasi didaktis terhadap proses pembelajaran yang berlangsung dapat membantu memahami fenomena yang terjadi selama proses pembelajaran termasuk *learning obstacle* yang mungkin muncul. Tujuan dari penelitian ini adalah untuk menganalisis situasi didaktis selama proses pembelajaran skala dan menganalisis *learning obstacle* yang mungkin muncul selama pembelajaran. Hasil analisis ini nantinya dijadikan dasar dalam menyusun desain didaktis pembelajaran skala. Teori situasi didaktis merupakan teori utama yang digunakan dalam penelitian ini dan didukung teori belajar lain seperti teori Piaget dan Vygotsky. Penelitian ini merupakan penelitian kualitatif dengan subjek yang terdiri dari dua sekolah di Kabupaten Bandung Barat. Observasi, wawancara, dan tes dilakukan sebagai data pendukung. Hasil dari penelitian ini adalah pada proses pembelajaran skala di dua sekolah tidak tercipta situasi aksi, formulasi, validasi, dan institusionalisasi. Adanya *learning obstacle* yang muncul berupa *epistemological obstacle* diantaranya hambatan siswa dalam menyelesaikan masalah yang melibatkan pecahan, adanya keterbatasan konteks terkait skala dan skala dimaknai sama untuk semua konteks. *Didactical obstacle* ditandai dengan tidak terciptanya situasi aksi, formulasi, validasi, dan institusionalisasi dalam pembelajaran, siswa tidak diberikan kesempatan untuk mengetahui cara yang beragam dalam menyelesaikan masalah dan guru tidak memperhatikan seluruh respon siswa. *Ontogenic obstacle* yang ditandai dengan adanya kesenjangan antara ekspektasi guru dengan kemampuan siswa. Dari hasil ini disusun desain didaktis pembelajaran skala. Hasil penelitian ini dapat dijadikan referensi dalam mengimplementasikan pembelajaran skala.

Kata kunci : Situasi Didaktis, *Learning Obstacle*, Skala

ABSTRACT

Desta Martha Sua Diba. (1706608). Didactical Situation in Scale Learning at Junior High School Students.

The concept of ratio and proportion is a concept used not only to solve mathematical problems, but also for other concepts. Based on previous research and preliminary studies that have been conducted, during the learning of ratio and proportion in particular the scale was found the existence of learning obstacle. So far, research has tended to analyze student learning obstacle through giving tests or developing learning designs and not focusing on learning observation. Observation of learning with the perspective of theory of didactical situation on the learning process can help to see the phenomena that occur during the learning process, including learning obstacles that may arise. The purpose of this study was to analyze the discussions of didactical situation during the learning process of the scale and evaluation of learning obstacle that might arise during learning. The results of this analysis make the basis for designing didactic scale learning. The theory of didactical situation is the main theory used in this study and supported by other learning theories such as Piaget's and Vygotsky's theories. This research is a qualitative research with a subject consisting of two junior high schools in West Bandung Regency. Observations, interviews, and tests were carried out as supporting data. The results of this study are that the scale learning process in two schools does not create situations of actions, formulations, validations, and institutionalization. The existence of the learning obstacle that emerged in the form of epistemological obstacle included the students' obstacles in solving problems involving fractions, the limited context regarding the scale and scale interpreted equally for all contexts. The didactical obstacle is characterized by the absence of an action situation, formulation, validation, and institutionalization in learning, students are not given the opportunity to know various ways to solve problems and the teacher does not pay attention to all student responses. The ontogenetic obstacle is characterized by a gap between teacher expectations and student abilities. From these results design didactic about scale was developed. The results of this study can be used as a reference in implementing scale learning.

Keywords: Didactical Situation, Learning Obstacle, Scale

DAFTAR ISI

	Halaman
PERNYATAAN	i
ABSTRAK.....	ii
KATA PENGANTAR.....	iv
UCAPAN TERIMAKASIH.....	v
DAFTAR ISI.....	vi
DAFTAR TABEL.....	viii
DAFTAR GAMBAR.....	ix
DAFTAR LAMPIRAN	xii
BAB I PENDAHULUAN.....	1
A. Latar Belakang Masalah.....	1
B. Rumusan Masalah.....	9
C. Tujuan Penelitian	9
D. Manfaat Penelitian	9
BAB II KAJIAN PUSTAKA.....	11
A. Kajian Teori.....	11
1. Perbandingan.....	11
2. <i>Learning Obstacle</i>	13
3. Teori yang Berkaitan dengan Situasi Didaktis.....	14
a. Kompleksitas Situasi Didaktis	19
B. Penelitian yang Relevan.....	21
BAB III METODE PENELITIAN	24
A. Desain Penelitian.....	24
B. Prosedur Penelitian	24
C. Subjek Penelitian.....	25
D. Instrumen Penelitian	26
E. Pengumpulan Data.....	26
F. Analisis Data	27

BAB IV HASIL PENELITIAN DAN PEMBAHASAN	29
A. Hasil Penelitian.....	29
1. Rencana Pembelajaran Pra-Observasi.....	29
a. Rencana Pembelajaran Pra-Observasi di Sekolah A.....	29
b. Rencana Pembelajaran Pra-Observasi di Sekolah B.....	32
2. Hasil Observasi Pembelajaran.....	34
a. Hasil Observasi Pembelajaran di Sekolah A.....	34
b. Hasil Observasi Pembelajaran di Sekolah B	52
3. <i>Learning Obstacle</i>	59
a. <i>Learning Obstacle</i> di Sekolah A.....	60
b. <i>Learning Obstacle</i> di Sekolah B	73
B. Pembahasan	80
BAB V KESIMPULAN, IMPLIKASI DAN REKOMENDASI.....	98
A. Kesimpulan.....	98
B. Implikasi.....	99
C. Rekomendasi	100
DAFTAR PUSTAKA.....	101
LAMPIRAN-LAMPIRAN	
DAFTAR RIWAYAT HIDUP	

DAFTAR TABEL

	Halaman
Tabel 4.1	Prediksi Respon Siswa terhadap Pertanyaan 1 pada LKS 1 89
Tabel 4.2	Prediksi Respon Siswa terhadap Pertanyaan 2 pada LKS 1 90
Tabel 4.3	Prediksi Respon Siswa terhadap Pertanyaan 3 pada LKS 1 92
Tabel 4.4	Prediksi Respon Siswa terhadap Pertanyaan 4 pada LKS 1 92
Tabel 4.5	Prediksi Respon Siswa terhadap Pertanyaan 1 dan 2 pada LKS 2... 93
Tabel 4.6	Prediksi Respon Siswa terhadap Pertanyaan 3 pada LKS 2 94
Tabel 4.7	Prediksi Respon Siswa terhadap Pertanyaan pada LKS 3 96

DAFTAR GAMBAR

	Halaman
Gambar 1.1 Soal dan Contoh Jawaban Siswa	3
Gambar 1.2 Soal yang Diberikan Kepada Siswa	4
Gambar 1.3 Contoh Jawaban Siswa	5
Gambar 1.4 Contoh Jawaban Siswa	6
Gambar 2.1 Situasi pada Tahap Aksi	15
Gambar 2.2 <i>Zone of Proximal Development (ZPD)</i>	19
Gambar 4.1 Respon Siswa terhadap Permasalahan 2 Kegiatan 1	39
Gambar 4.2 Respon Siswa terhadap Permasalahan 2 Kegiatan 2	41
Gambar 4.3 Respon Siswa terhadap Permasalahan 2 Kegiatan 2	43
Gambar 4.4 Respon Siswa terhadap Permasalahan 2 Kegiatan 2	43
Gambar 4.5 Respon Siswa terhadap Permasalahan 2 Kegiatan 2	44
Gambar 4.6 Respon Siswa terhadap Permasalahan 1 Kegiatan 3	47
Gambar 4.7 Respon Siswa terhadap Permasalahan 1 Kegiatan 3	48
Gambar 4.8 Respon Siswa terhadap Permasalahan 2 Kegiatan 3	50
Gambar 4.9 Respon Siswa terhadap Permasalahan 3 Kegiatan 3	51
Gambar 4.10 Respon Siswa terhadap Permasalahan 5 Kegiatan 3	51
Gambar 4.11 Respon Siswa terhadap Permasalahan 1	54
Gambar 4.12 Respon Siswa terhadap Permasalahan 1	56
Gambar 4.13 Respon Siswa terhadap Permasalahan 2	56
Gambar 4.14 Respon Siswa terhadap Permasalahan 2	57
Gambar 4.15 Respon Siswa (Benar) terhadap Pertanyaan Nomor 1.A	60

Gambar 4.16	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	61
Gambar 4.17	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	61
Gambar 4.18	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	62
Gambar 4.19	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	63
Gambar 4.20	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	63
Gambar 4.21	Respon Siswa (Benar) terhadap Pertanyaan Nomor 1.B.....	64
Gambar 4.22	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	64
Gambar 4.23	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	65
Gambar 4.24	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	66
Gambar 4.25	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	67
Gambar 4.26	Respon Siswa (Benar) terhadap Pertanyaan Nomor 2	68
Gambar 4.27	Respon Siswa (Salah) terhadap Pertanyaan Nomor 2	68
Gambar 4.28	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.A	69
Gambar 4.29	Respon Siswa (Benar) terhadap Pertanyaan Nomor 3.B.....	70
Gambar 4.30	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.B	71
Gambar 4.31	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.B	72
Gambar 4.32	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.B	72
Gambar 4.33	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	74
Gambar 4.34	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	74
Gambar 4.35	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.A	74
Gambar 4.36	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	75
Gambar 4.37	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	75
Gambar 4.38	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	76
Gambar 4.39	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	76

Gambar 4.40	Respon Siswa (Salah) terhadap Pertanyaan Nomor 1.B	77
Gambar 4.41	Respon Siswa (Benar) terhadap Pertanyaan Nomor 2	77
Gambar 4.42	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.A	78
Gambar 4.43	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.A	78
Gambar 4.44	Respon Siswa (Salah) terhadap Pertanyaan Nomor 3.B	79
Gambar 4.45	<i>Learning Trajectory</i> Perbandingan	87
Gambar 4.46	<i>Learning Trajectory</i> Skala.....	87

DAFTAR PUSTAKA

- Adinawan, M. C., (2016). *Buku Matematika Jilid 1B SMP Kelas VII Semester 2.* Jakarta: Erlangga.
- Alam, S. (2016). Some Mathematical Mistakes on Ratio and Proportion (Algebraic Treatment). *International Journal of Mathematical Archive.* 7 (10).
- Amoah, P. (2015). Effects of Group Size on Students Mathematics Achievement in Small Group Settings. *Journal of Education and Practice,* 6(1), 119–122.
- Andini, W & Jupri, A. (2017). *Students Obstacle in Ratio and Proportion Learning.* Journal of Physics: Conf. Ser. **812** 012048.
- Arias, F & Araya, A. (2009). Analysis of the didactical contracts in 10th grade math classes, Quardeni di Ricerca in Didattica (Matematica), *Supplemento 4 al n19 GRIM.*
- Arican, M. 2015. *Exploring Preservice Middle and High School Mathematics Teachers' Understanding of Directly and Inversely Proportional Relationships.* The University of Georgia.
- As'ari, A. R., dkk. (2016). *Matematika SMP/MTs Kelas VII Semester 2 (Edisi Revisi).* Jakarta: Kemdikbud.
- Aydin, M., Bak, A., & Yildiz, C. (2012). *THE ROLE OF THE STUDENT IN LEARNING MATHEMATICS : THE TEACHER VIEWS.*
- Baranek, L. K. (1996). The Effect of Rewards and Motivation on Student Achievement. Thesis. Grand Valley State University.
- Battista, M.T. 2011. *Conceptualizations and issues related to Learning Progression, Learning Trajectories, and Level of Sophistication.* *The Mathematics Enthusiast:* Vol.8: No.3, Article 5.
- Baki, A., Lu, H, C & Birgin, S. C. O. (2009). Conceptions of high school students about mathematical connections to the real-life. *Procedia Social and Behavioral Sciences* 1 (2009) 1402–1407.
- Bhattacharjee, J. (2015). Constructivist Approach to Learning—An Effective Approach of Teaching Learning. *International Research Journal of Interdisciplinary & Multidisciplinary Studies (IRJIMS)* Volume-I, Issue VI, July 2015, Page No. 65-74.

- Boston M D, Smith M S and Hillen A F. 2003. *Building on Students' Intuitive Strategies to Make Sense of Cross Multiplication* vol 9 no 3 (The National Council of Teachers Mathematics, Inc. www.nctm.org) p 150.
- Brousseau, G. (2002). *Theory of Didactical Situation in Mathematics*. New York: Kluwer Academic Publisher.
- Brousseau, G., & Otte, M. (1991). The Fragility of knowledge. In: Bishop A.J., Mellin-Olsen S., Van Dormolen J. (eds) *Mathematical Knowledge: Its Growth Through Teaching*. Mathematics Education Library, Vol 10. Springer: Dordrecht.
- Brousseau, G., Sarrazy, B & Novotna, J. (2014). Didactic contract in mathematical education. In Lerman (Ed.), *Encyclopedia of Mathematics Education* (pp.153-159). Springer: Dordrecht.
- Brown, S. A. (2008). Exploring epistemological obstacles to the development of mathematics induction. *Proc of the 11th for Research on Undergraduates Mathematics Education*.
- Çalışıcı, H. (2018). Middle School Students' Learning Difficulties in the Ratio-proportion Topic and a Suggested Solution: Envelope Technique. *Universal Journal of Educational Research*. 6(8).
- Chaim D B, Keret Y and Ilany B S. (2012). *Ratio and Proportion Research and Teaching in Mathematics Teachers' Education (Pre- and In- Service Mathematics Teachers of Elementary and Middle School Classes)*. Rotterdam: Sense Publisher.
- Clements, D.H & Sarama, J. (2009). *Learning and Teaching Early Math (The Learning Trajectories Approach)*. New York: Routledge.
- Denhere, C., Chinyoka, K., & Mambeu, J. (2014). Vygotsky's Zone of Proximal Development Theory: What are its Implications for Mathematical Teaching? *Greener Journal of Social Sciences*, 3(7), 371–377.
- Dougherty, B., dkk. (2017). Helping Students With Mathematics Difficulties Understand Ratios and Proportions. *TEACHING Exceptional Children*, Vol. 49, No.2, pp. 96-105.
- Francisco, J. M. (2013). The mathematical beliefs and behavior of high school students: Insights from a longitudinal study. *Journal of Mathematical Behavior* 32 (2013) 481–493.
- Fuadiah, N, F., (2017). Analyzing Phenomena of Teaching Mathematics Trough Perspective of Didactical Contract. *Internationa Conference on Education and Science (ICONS 2017)*. pp. 909-915.

- Fuady, R. (2014). Desain Didaktis Konsep Perbandingan Senilai dan Berbalik Nilai pada Pembelajaran Matematika SMP untuk Meningkatkan Kompetensi Matematika. Skripsi. UPI: Tidak Diterbitkan.
- Godino, J. D., & Batanero, C. (1998). Clarifying the meaning of mathematical objects as a priority area for research in mathematics education. In *Mathematics education as a research domain: A search for identity* (pp. 177-195). Springer, Dordrecht.
- Harel, G. (2008). What is mathematics? A pedagogical answer to a philosophical question. *Proof and other dilemmas: Mathematics and philosophy*.
- Harel, G. (2008). DNR perspective on mathematics curriculum and instruction, Part I: focus on proving. *ZDM*, 40(3), 487-500.
- Hamilton, R & Ghatala, E. (1994). *Learning and Instruction*. USA: McGraw-Hill.
- Heriyati, H. (2017). Pengaruh Minat Dan Motivasi Belajar Terhadap. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 7(1), 22–32.
- Hock, E. L. (1961). Classroom Grouping for Effective Learning. *Educational Leadership*, 1, 420–424.
- Ingram, J., Sammons, P. P., & Lindorff, A. (2018). *Observing effective mathematics teaching : a review of the literature*.
- Kemdikbud. (2016). *Soal Ujian Nasional Matematika SMP/MTS*. Jakarta: Kemdikbud.
- Kemdikbud. (2017). *Kurikulum 2013: Kompetensi Dasar Siswa Sekolah Dasar (SD)/Madrasah Ibtidaiyah (MI)*. Jakarta: Kemdikbud.
- Kemdikbud. (2017). *Kurikulum 2013: Kompetensi Dasar Siswa Sekolah Menengah Pertama (SMP)/Madrasah Tsanawiyah (MTs)*. Jakarta: Kemdikbud.
- Kemdikbud. (2017). *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 17 Tahun 2017 Tentang Penerimaan Peserta Didik Baru Pada Taman Kanak-Kanak, Sekolah Dasar, Sekolah Menengah Pertama, Sekolah Menengah Atas, Sekolah Menengah Kejuruan, atau Bentuk Lain yang Sederajat*. Jakarta: Kemdikbud.
- Kang, W., & Kilpatrick, J. (1992). Didactic Transposition in Mathematics Textbooks. *For the Learning of Mathematics*, 12(1), 2–7.
- Koçak, Z. F., Bozan, R., & Işık, Ö. (2009). The importance of group work in mathematics. *Procedia - Social and Behavioral Sciences*, 1(1), 2363–2365.

- Kusmanto, S. B. (2014). *Pengaruh Penggunaan Lembar Kerja Siswa Terhadap Prestasi Belajar Matematika Siswa Kelas VII Smp N 2 Girisubo Gunungkidul Tahun Pelajaran 2013 / 2014*. 2(3), 327–332.
- Kusuma, N. F., Subanti, S., & Usodo, B. (2018). High-Capability Students' Difficulties in Problem Solving on The Concept of Ratio. In *IOP Conference Series: Materials Science and Engineering* (Vol. 296, No. 1, p. 012021). IOP Publishing.
- Labayle, M., Gibel, P., Bloch, I., & Lévi, L. (2018). A TDS Analytical Framework to Study Students' Mathematical Activity. *INDRUM*, 234.
- Lamon, S. J. (2005). *Teaching Fractions and Ratios for Understanding: Essential Content Knowledge and Instructional Strategies for Teachers 2nd Ed.* USA: Lawrence Erlbaum Associates, Inc.
- Lee, K. P. (2010). A guide to writing mathematics. *Retrieved September, 12, 2010.*
- Mahlabela, P.T. (2012). *Learner Errors and Misconception in Ratio and Proportion (A case study of grade 9 learners from a rural KwaZulu-Natal school)*. Tesis. Universitas Kwazulu-Natal.
- Marshall, C & Rossman, G.B. (2016). *Designing Qualitative Research (Sixth Edition)*. Thousand Oaks, California: Sage Publications, Inc.
- Moleong, L.J. (2015). *Metodologi Penelitian Kualitatif (Edisi Revisi)*. Bandung: PT Remaja Rosdakarya.
- Monteiro, C. (2003). *Prospective Elementary Teachers' Misunderstanding in Solving Ratio and Proportion Problems*. Escola Superior de Educacao de Lisboa, Portugal.
- Moustakas, C. (1994). *Phenomenological Research Methods*. Thousand Oaks, California: Sage Publications, Inc.
- Mulia,A, Edrizon, dan Niniwati. (2016). *Analisis Kesalahan Siswa dalam Menyelesaikan Soal Matematika Kelas VII SMP Negeri 7 Padang*. FKIP Universitas Bung Hatta.
- Musa, S. M. (2016). *Fundamentals of Technical Mathematics*. Academic Press.
- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, and B. Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics. (2013). *Ratio and Proportion Research Clip*. Reston, VA: NCTM.
- Neumann, M. D. (2014). *Mathematics Teaching : Interpreting and Responding to Children's Thinking*. 6(3), 1–28.
- Novotna, J. & Hospesova, A. (2007). What is The Prize of Topaze. In Woo, J. H., Lew, H. C., Park, K. S. & Seo, D. Y. (Eds.). *Proceedings of the 31st Conference of the International Group for the Psychology of Mathematics Education*, Vol.4, pp. 25-32. Seoul: PME.
- Ojose, B. (2015). Proportional Reasoning and Related Concepts: Analysis of Gaps and Understanding of Middle Grade Students. *Horizon Research Publishing*.
- Prabawanto, S., Suryadi, D., Mulyana, E., Ratnasari, D., & Dewi, F. (2018). Didactical design of integers: An elementary school teachers creation viewed from didactical situation perspective. *Journal of Physics: Conference Series*, 1040(1).
- Prabawanto, S. (2019). Students' validations on their solution in mathematical problem solving. *Journal of Physics: Conference Series*, 1157, 042111.
- Pritchard, A. (2009). Ways of learning: Learning theories and learning styles. New York:Routledge
- Protheroe, N. (2007). What Does Good Math Instruction Look Like?. *Principal*, 87(1), 51-54.
- Putra, Z. H. (2016). *Didactica Contracts in Realistic Mathematics Education Teaching Practice in Indonesia: A lesson on addition*. Paper presented at International Seminar on Education, Ponorogo, Indonesia.
- Quealy, C. (2014). The Importance of Writing in Mathematics: Why writing allows for a deeper understanding of the mathematical content. *The Review: A Journal of Undergraduate Student Research*, 15(1), 19-22.
- Raharjanti, M, Nusantara, T, dan Mulyati, S. (2016). *Kesalahan Siswa dalam Menyelesaikan Permasalahan Perbandingan Senilai dan Berbalik Nilai*. Prosiding ISSN: 2502-6526.
- Ramanujam, R, dkk. (2006). *Position paper national focus group on teaching of mathematics*. New Delhi: National Council of Educational Research and Training.

- Ramlah, R., Bennu, S., & Paloloang, B. (2017). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Penjumlahan Dan Pengurangan Pecahan Di Kelas VII SMPN Model Terpadu Madani. *JIPMat*, 1(2).
- Ruiz, E.F & Lupianes, J.L. (2009). Detecting Psychological Obstacle to Teaching and Learning the Topics of Ratio and Proportion in Sixth Grade Primary Pupils.s. *Electronic Journal of Research in Educational Psychology*. Vol 7 (1), 2009, pp: 397-224.
- Rusnock, P., & Thagard, P. (1995). Strategies for conceptual change: ratio and proportion in classical Greek mathematics. *Studies In History and Philosophy of Science Part A*, 26(1), 107-131.
- Ruthven, K., dkk. (2009). Design Tools in Didactical Research: Instrumenting the Epistemological and Cognitive Aspects of the Design of Teaching Sequences. *Educational Researcher*, Vol. 38, No. 5, pp. 329–342.
- Salmons, J. (2015). *Qualitative Online Interviews*. Thousand Oaks, California: Sage Publications, Inc.
- Santrock, J. W. (2012). *Life-span development: Perkembangan masa-hidup*. Jakarta: Erlangga.
- Schunk, D. H. (2010). *Learning theories: An educational perspektif*. Yogyakarta: Pustaka pelajar.
- Semeradova, S. (2015). Didactical Situation in Building Children's Ideas About Mathematical Concepts. *Annals of The Polish Mathematical Society 5th Series: Didactica Mathematicae*. 37.
- Sen, C dan Guler, G. (2017). Effect of Strategy Teaching For the Solution of Ratio Problems on Students' Proportional Reasoning Skills. *Malaysian Online Journal of Educational Sciences*. 5(2).
- Sofroniou, A., & Poutos, K. (2016). Investigating the Effectiveness of Group Work in Mathematics. *Education Sciences*, 6(4), 30.
- Suryadi, D. (2010). *Menciptakan Proses Belajar Aktif: Kajian dari Sudut Pandang Teori Belajar dan Teori Didaktik*. Makalah Semnas UNP 2010.
- Suryadi, D. (2014). Sinergi untuk kemandirian pendidik. Dalam D, Suryadi & T, Suratno (Eds), *Kemandirian pendidik: Kisah pendidik reflektif dan profesional pembelajaran* (pp. 133-149). Bandung: Sekolah Pascasarjana UPI

Suryadi, D., Mulyana, E., Suratno, T., Dewi, D.A.K., & Maudy, S.Y. (Eds), *Monograf: Didactical Design Research* (pp. 140-151). Bandung: Rizqi Press.

Urquhart, V. (2009). Using Writing in Mathematics to Deepen Student Learning. *Mid-continent Research for Education and Learning (McREL)*.

Vries, R. D. (2000). Vygotsky, Piaget, and education: a reciprocal assimilation of theories and educational practices. *New Ideas in Psychology* 18 (2000) 187-213.

Wahyuningrum, A.S, Suryadi, D, Turmudi. (2017). *Epistemological Obstacles on the Topic of Ratio and Proportion among Junior High School Students*. IOP Conf. Series: Journal of Physics: Conf. Series **895** (2017) 012066.

Wahyuningrum, A. (2017). *Desain Didaktis Konsep Perbandingan*. Tesis. UPI: Tidak Diterbitkan.

Ward, B. (1987). Instructional Grouping in the Classroom. *School Improvement Research Series*, 1–12.

Williams, N. B., & Wynne, B. D. (2012). *Writing in the Mathematics a Beginner 'S Classroom* : 93(2), 132–135.

Wilson, P.H., Mojika, G.F. & Confrey, J. (2013). Learning trajectories in teacher education: Supporting teachers'understandings of students' mathematical thinking. *Journal of Mathematical Behavior* 32 (2013) 103–121.

Wisdom, N.J. (2014). *Meta-Didactical Slippages: A Qualitative Case Study of Didactical Situations in a Ninth Grade Mathematics Classroom*. Dissertation. Georgia State University.