

***PROFESSIONAL DEVELOPMENT PROGRAM  
UNTUK MEMBANGUN  
MATHEMATICAL KNOWLEDGE FOR TEACHING  
GURU PENDIDIKAN ANAK USIA DINI***

DISERTASI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar  
Doktor Kependidikan Program Studi Pendidikan Matematika



Promovenda

Mery Noviyanti  
NIM 1604798

**SEKOLAH PASCASARJANA  
UNIVERSITAS PENDIDIKAN INDONESIA  
2019**

***PROFESSIONAL DEVELOPMENT PROGRAM  
UNTUK MEMBANGUN  
MATHEMATICAL KNOWLEDGE FOR TEACHING  
GURU PENDIDIKAN ANAK USIA DINI***

Oleh  
Mery Noviyanti

Dr., Universitas Pendidikan Indonesia, 2019  
M. Pd., Universitas Negeri Semarang, 2011

Sebuah Disertasi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Doktor Pendidikan (Dr.) pada Sekolah Pascasarjana

© Mery Noviyanti 2019  
Universitas Pendidikan Indonesia  
Agustus 2019

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

MERY NOVIYANTI

**PROFESSIONAL DEVELOPMENT PROGRAM  
UNTUK MEMBANGUN  
MATHEMATICAL KNOWLEDGE FOR TEACHING  
GURU PENDIDIKAN ANAK USIA DINI**

Disetujui dan Disahkan oleh:



**Prof. Dr. H. Didi Suryadi, M. Ed.**  
Promotor Merangkap Ketua



**Siti Fatimah, M.Si., Ph.D.**  
Ko-promotor Merangkap Sekertaris



**Vina Adriany, M.Ed., Ph.D.**  
Ko-promotor Merangkap Anggota

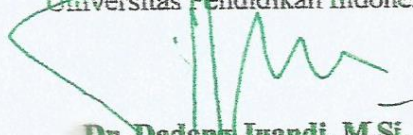


**Dr. H. Sufyani Prabawanto, M.Ed.**  
Anggota Penguji



**Prof. Dr. Cholis Sa'dijah, M.Pd., M.A.**  
Anggota Penguji

Mengetahui,  
Ketua Departemen Pendidikan Matematika  
Universitas Pendidikan Indonesia



**Dr. Dadang Juandi, M.Si.**  
NIP. 196401171992021001

## ABSTRAK

**Mery Noviyanti (2019).** *Professional Development Program* untuk Membangun *Mathematical Knowledge for Teaching* Guru Pendidikan Anak Usia Dini.

Penelitian ini bertujuan untuk 1) mengidentifikasi *learning obstacles* apa saja yang dialami guru pada saat kegiatan pengembangan matematika Pendidikan Anak Usia Dini (PAUD); 2) memperoleh desain *Professional Development Program* (PDP) untuk membangun *Mathematical Knowledge for Teaching* (MKT) guru PAUD; 3) memperoleh gambaran pelaksanaan PDP guru PAUD dalam membangun MKT; serta 4) memperoleh gambaran MKT guru PAUD pada kegiatan implementasi PDP. Subjek penelitian adalah lima orang guru Taman Kanak-Kanak (TK) di Kabupaten Sumedang, Jawa Barat dengan kriteria 1) guru yang mengajar TK (usia 5-6 taun); 2) memiliki pengalaman mengajar kurang lebih 10 tahun; 3) lulusan S1 pendidikan anak usia dini; 4) guru yang mengajar di sekolah PAUD negeri; 5) jumlah siswa di kelas kurang lebih 20 orang. Sedangkan waktu penelitian dilakukan pada bulan Juli 2018 sampai Januari 2019. Desain penelitian ini mengacu pada *Design Didactical Research* (DDR) dengan pengolahan data menggunakan analisis tematik. Hasil penelitian menunjukkan bahwa keterbatasan guru yang dihasilkan pada kegiatan identifikasi *learning obstacles* adalah 1) kepercayaan diri yang rendah dalam mengajar matematika; 2) keterbatasan pengetahuan matematika dasar; serta 3) keterbatasan pengetahuan perkembangan matematika anak. Untuk mengatasi keterbatasan tersebut, peneliti memilih model *Cognitively Guided Instruction* (CGI) yang dipadukan dengan metode pemberian rangkuman dengan melibatkan pengalaman guru pada seluruh kegiatan. Pada pelaksanaannya, model yang dikembangkan menjadi solusi terhadap keterbatasan responden. Model ini dinilai efektif karena *intervensi* melalui situasi didaktis yang diberikan dapat membangun pengetahuan baik secara materi dan pedagogis sehingga berdampak pada meningkatnya MKT responden.

Kata kunci: *Professional Development Program*, *Mathematical Knowledge for Teaching*, guru Pendidikan Anak Usia Dini (PAUD).

## **ABSTRACT**

**Mery Noviyanti (2019).** *Professional Development Program in Establishing Mathematical Knowledge for Teaching of Early Childhood Education Teachers.*

*This study aims 1) to identify learning obstacles experienced by teachers in mathematical development activities of Early Childhood Education (ECE); 2) to design the Professional Development Program (PDP) in establishing Mathematical Knowledge for Teaching (MKT) of ECE teachers; 3) to obtain an overview of PDP implementation of ECE teachers in establishing MKT; as well as 4) to obtain an overview of MKT of ECE teachers in PDP implementation activities. The subjects of this study are five kindergarten teachers in Sumedang, West Java with criteria of 1) kindergarten teachers (for 5-6-year-old children); 2) having approximately 10 years of teaching experience; 3) bachelor's in Early Childhood Education; 4) teachers of State ECE; and 5) the number of students in the class is approximately 20 children. The study was conducted from June 2018 to January 2019. This research design refers to Didactical Design Research (DDR) using thematic analysis in the data processing. The results from learning obstacles identification showed that teachers' limitations are 1) low confidence in teaching Mathematics; 2) limited knowledge of basic Mathematics; 3) limited knowledge of children's mathematical development. To overcome these limitations, researchers chose the Cognitively Guided Instruction (CGI) model integrated with a summary presentation method by involving the teachers' experience in all activities. In its implementation, the model developed becomes a solution for respondents' limitation. This model is considered effective because intervention through a didactical situation could establish knowledge both materially and pedagogically. Therefore, it impacts on increasing respondents' MKT.*

*Keywords: Professional Development Program, Mathematical Knowledge for Teaching, Early Childhood Education Program (ECE) Teachers.*

## DAFTAR ISI

LEMBAR PERSETUJUAN	i
PERNYATAAN	ii
KATA PENGANTAR	iii
ABSTRAK	vi
ABSTRACT	vii
DAFTAR ISI	viii
DAFTAR TABEL	x
DAFTAR GAMBAR	xi
DAFTAR LAMPIRAN	xii
BAB I PENDAHULUAN	1
1.1 Latar Belakang Masalah	1
1.2 Pertanyaan Penelitian	10
1.3 Tujuan Penelitian	11
1.4 Manfaat Penelitian	11
BAB II KAJIAN PUSTAKA	12
2.1 Konstruktivisme: Komparasi Teori Piaget dan Teori Vygotsky	12
2.2 Mathematical Knowledge for Teaching (MKT)	16
2.3 Matematika Anak Usia Dini (AUD)	24
BAB III METODE PENELITIAN	30
3.1 Paradigma Penelitian	30
3.2 Subjek dan Waktu Penelitian	33
3.3 Metode Pengumpulan Data	34
3.4 Desain Penelitian	38
3.5 Validitas dan Realibitas	48
3.7 Analisis Data	51
3.8 Etika Penelitian	60
BAB IV HASIL PENELITIAN DAN PEMBAHASAN	63

4.1	Identifikasi Learning Obstacles	63
4.2	Desain Professional Development Program (PDP)	81
4.3	Pelaksanaan Professional Development Program (PDP)	95
4.4	Implementasi Profesional Development Program (PDP)	108
BAB V KESIMPULAN, IMPLIKASI DAN REKOMENDASI		137
5.1	Kesimpulan	137
5.2	Implikasi	139
5.2	Rekomendasi	141
DAFTAR PUSTAKA		144

## DAFTAR PUSTAKA

- Anders, Y., & Rossbach, H.-G. (2015). Preschool Teachers' Sensitivity to Mathematics in Children's Play: The Influence of Math-Related School Experiences, Emotional Attitudes, and Pedagogical Beliefs. *Journal of Research in Childhood Education*, 29(3), 305-322.
- Aslan, D. (2013). A Comparison of Pre Service and In Service Preschool Teachers' Mathematical Anxiety and Beliefs about Mathematics for Young Children *Academic Research International*, 4(2), 225-235.
- Attorps, I. (2006). *Mathematics Teachers' Conceptions about Equations*. (Disertasi). University of Helsinki.
- Ball, D. L. (1990). The Mathematical Understandings That Prospective Teachers Bring to Teacher Education. *The elementary school journal*, 90(4), 449-466.
- Ball, D. L., & Bass, H. (2002). Toward a Practice-Based Theory of Mathematical Knowledge for Teaching. *Prosiding The 2002 Annual Meeting of The Canadian Mathematics Education Study Group* (hlm. 3-14). Edmonton Alberta.
- Ball, D. L., & Cohen, D. K. (1999). Developing Practice, Developing Practitioners: Toward a Practice-Based Theory of Professional Education. Dalam L. Darling-Hammond & G. Sykes (Eds.), *Teaching as The Learning Profession: Handbook of Policy and Practice 1* ( hlm. 3-22). San Francisco, CA: Jossey-Bass.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special?. *Journal of teacher education*, 59(5), 389-407.
- Baroody, A. J., Lai, M.-l., & Mix, K. S. (2006). The Development of Young Children's Early Number and Operation Sense and Its Implications for Early Childhood Education. Dalam Spodek, B., & Saracho, O. N. (Penyunting). *Handbook of Research on The Education of Young Children*, (hlm. 187-221), London: Routledge.
- Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., . . . Tsai, Y.-M. (2010). Teachers' Mathematical Knowledge, Cognitive Activation



- in The Classroom, and Student Progress. *American educational research journal*, 47(1), 133-180.
- Berger, M. (2005). Vygotsky's Theory of Concept Formation and Mathematics Education. *International Group for the Psychology of Mathematics Education*, 2, 153-160.
- Birman, B. F., Desimone, L., Porter, A. C., & Garet, M. S. (2000). Designing Professional Development that Works. *Educational leadership*, 57(8), 28-33.
- Blanton, M. L. (1998). *Prospective Teachers' Emerging Pedagogical Content Knowledge During The Professional Semester: A Vygotskian Perspective on Teacher Development*. (Disertasi). North Carolina State University.
- Borko, H., Eisenhart, M., Brown, C. A., Underhill, R. G., Jones, D., & Agard, P. C. (1992). Learning to teach hard mathematics: Do novice teachers and their instructors give up too easily? *Journal for research in mathematics education*, 1(1)194-222.
- Boyatzis, R. E. (1998). *Transforming Qualitative Information: Thematic Analysis and Code Development*. Los Angeles: Sage.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Journal Qualitative research in psychology*, 3(2), 77-101.
- Briggs, M. (2013). *Teaching and Learning Early Years Mathematics: Subject and Pedagogic Knowledge*. Northwich: Critical Publishing.
- Brousseau, G. (2006). *Theory of Didactical Situations in Mathematics*. Switzerland: Springer
- Campbell, F. A., Ramey, C. T., Pungello, E., Sparling, J., & Miller-Johnson, S. (2002). Early Childhood Education: Young Adult Outcomes from The Abecedarian Project. *Applied developmental science*, 6(1), 42-57.
- Carpenter, T. P., & Fennema, E. (1988). Research and Cognitively Guided Instruction. *Integrating Research on Teaching Learning Mathematics*, 4(1), 2-17.
- Carpenter, T. P., & Fennema, E. (1992). Cognitively guided instruction: Building on The Knowledge of Students and Teachers. *International Journal of Educational Research*, 17(5), 457-470.

- Carpenter, T. P., Fennema, E., & Franke, M. L. (1996). Cognitively Guided Instruction: A Knowledge Base for Reform in Primary Mathematics Instruction. *The elementary school journal*, 97(1), 3-20.
- Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (2000a). *Cognitively Guided Instruction: A Research-Based Teacher Professional Development Program for Elementary School Mathematics*. London: Heinemann.
- Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (2000b). Cognitively Guided Instruction: A Research-Based Teacher Professional Development Program for Elementary School Mathematics. Laporan Penelitian.
- Carpenter, T. P., Franke, M. L., Johnson, N. C., Turrou, A. C., & Wager, A. A. (2017). *Young Children's Mathematics: Cognitively Guided Instruction in Early Childhood Education*. London: Heinemann.
- Chairani, Z. (2015). Scaffolding dalam pembelajaran matematika. *Math Didactic: Jurnal Pendidikan Matematika*, 1(1), 116-123.
- Chalikandy, M. A. (2014). Reflection: A tool for professional development. *Researchers World*, 5(3), 117-127.
- Chong, S. N. Y., Wong, I. Y. F., & Quek, C. L. (2005a). *Pre-service Teachers Beliefs, Attitudes and Expectations: a Review of the Literature*. Diakses dari <https://repository.nie.edu.sg/bitstream/10497/138/1/2005a8.pdf>.
- Chung, K.-E. (1994). *Young Children's Acquisition of Mathematical Knowledge and Mathematics Education in Kindergarten*. (Disertasi), Iowa State University.
- Clements, D. H. (2007). Curriculum Research: Toward a Framework for Research-Based Curricula. *Journal for research in mathematics education*, 1, 35-70.
- Clements, D. H., Fuson, K. C., & Sarama, J. (2017). The research-based balance in early childhood mathematics: A response to Common Core criticisms. *Early Childhood Research Quarterly*, 40, 150-162.

- Clements, D. H., & Sarama, J. (2014). *Learning and teaching early math: The learning trajectories approach*. New York: Routledge.
- Clements, D. H., Sarama, J., & DiBiase, A.-M. (2003). *Engaging young children in mathematics: Standards for early childhood mathematics education*. New York: Routledge.
- Cobb, P., Confrey, J., DiSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational researcher*, 32(1), 9-13.
- Confrey, J. (1995). A theory of intellectual development. *Journal for the learning of mathematics*, 15(1), 38-48.
- Copley, J. V. (1999). *Mathematics in the early years*: National Association for the Education of Young Children.
- Copley, J. V., & Padron, Y. (1998). Preparing Teachers of Young Learners: Professional Development of Early Childhood Teachers in Mathematics and Science. *Prosiding Forum on Early Childhood Science, Mathematics, and Technology Education*, Washington, D.C.
- Creswell, J. W. (1996). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Bouston: SAGE Publication Inc.
- Creswell, J. W. (2007). Qualitative research designs: Selection and implementation. *The Counseling Psychologist*, 35(2), 236-264.
- Crotty, M. (1998). *The foundations of social research: meaning and perspective in social research*. London: Sage Publication Ltd.
- Dale, E. (1969). *Audiovisual methods in teaching*. New York: The Dryden Press.
- Darling-Hammond, L., & Ball, D. L. (1998). Teaching for High Standards: What Policymakers Need To Know and Be Able To Do. CPRE Joint Report Series.
- Davies, I. K. (2017). Instructional development as an art: One of the three faces of ID. *Performance and Instruction*, 20(7), 4-7.
- Derry, J. (2013). *Vygotsky-Philosophy and Education*. London: Wiley Blackwell.
- Desimone, L. M. (2009). Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures. *Educational researcher*, 38(3), 181-199.

- DeVries, R. (2000). Vygotsky, Piaget, and Education: A Reciprocal Assimilation of Theories and Educational Practices. *New Ideas in Psychology, 18*(2), 187-213.
- Duncan, G. J., Magnuson, K., Kalil, A., & Ziol-Guest, K. (2012). The Importance of Early Childhood Poverty. *Social Indicators Research, 108*(1), 87-98.
- Dunphy, E., Dooley, T., & Shiel, G. (2014). *Mathematics in Early Childhood and Primary Education (3–8 years) Definitions, Theories, Development and Progression*. Dublin: NCCA.
- Eckenrode, C. F. W. (2016). *Teaching Problem Solving In Mathematics: Cognitively Guided Instruction In Kindergarten*. (Disertasi), Hamly University
- Eisenhart, M., Borko, H., Underhill, R., Brown, C., Jones, D., & Agard. (1993). Conceptual Knowledge Falls Through the Cracks: Complexities of Learning to Teach Mathematics for Understanding. *Journal for research in mathematics education, 8*-40.
- Empson, S. B., & Levi, L. (2011). *Extending Children's Mathematics: Fractions and Decimals:[Innovations in Cognitively Guided Instruction]*. New York: Heinemann
- Ernest, P. (2013). *Philosophy Mathematics Educ.* New York: Routledge.
- Even, R., & Tirosh, D. (1995). Subject-Matter Knowledge and Knowledge About Students as Sources of Teacher Presentations of The Subject-Matter. *Educational Studies in Mathematics, 29*(1), 1-20.
- Fang, Z. (1996). A Review of Research on Teacher Beliefs and Practices. *Educational Researcher, 38*(1), 47-65.
- Fendler, L. (2003). Teacher Reflection in a Hall of Mirrors: Historical Influences and Political Reverberations. *Educational Researcher, 32*(3), 16-25.
- Fontana, A., & Frey, J. (2009). *The Handbook of Qualitative Research. The art of science*. London: SAGE.
- Gagné, M., & Deci, E. L. (2005). Self-Determination Theory and Work Motivation. *Journal of Organizational Behavior, 26*(4), 331-362.
- Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational Research: An Introduction*: Washington: Longman Publishing.

- Gardner, H. (2011). *Frames of mind: The Theory of Multiple Intelligences*. London: Hachette UK.
- Ginsburg, H. P., & Ertle, B. (2008). Knowing The Mathematics in Early Childhood Mathematics. *Contemporary Perspectives on Mathematics in Early Childhood Education*, 45-66.
- Guba, E. G., & Lincoln, Y. S. (1994). Competing Paradigms in Qualitative Research. *Handbook of qualitative research*, 2(163-194).
- Guba, E. G., & Lincoln, Y. S. (2009). Berbagai Paradigma yang Bersaing Dalam Penelitian Kualitatif In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research: Pustaka Pelajar*.
- Guerrero, J. E. (2014). *Cognitively Guided Instruction: a Professional Development Approach to Teaching Elementary Mathematics: A Case Study of Adoption and Implementation in Three Rural Elementary Schools*. (Disertasi), California State University.
- Hardy, J. K., & Hemmeter, M. (2014). *Systematic Instruction of Early Math Skills*. (Disertasi), Vanderbilt University.
- Hebe, H. N. (2017). Towards a Theory-driven Integration of Environmental Education: The Application of Piaget and Vygotsky in Grade R. *International Journal of Environmental and Science Education*, 12(6), 1525-1545.
- Hidayat, I. (2007). *Peranan Keyakinan Guru terhadap Hakikat dan Belajar Mengajar Sains dalam Pengembangan Profesionalisme*. Yogyakarta: Universitas Negeri Yogyakarta.
- Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of Teachers' Mathematical Knowledge for Teaching on Student Achievement. *American Educational Research Journal*, 42(2), 371-406.
- Ismail, M. I. (2011). Pemberian Rangkuman sebagai Strategi Pembelajaran. *Jurnal Formatif*, 1(1), 48-57.
- John-Steiner, V., & Mahn, H. (1996). Sociocultural Approaches to Learning and Development: A Vygotskian Framework. *Educational psychologist*, 31(3-4), 191-206.

- Johnson, N. O. (2013). *Kindergarten Students Solving Mathematical Word Problems*. (Disertasi), Florida State University.
- Jordan, N. C., Kaplan, D., Nabors Oláh, L., & Locuniak, M. N. (2006). Number Sense Growth in Kindergarten: A Longitudinal Investigation of Children at Risk for Mathematics Difficulties. *Child Development*, 77(1), 153-175.
- Kalk, K., Luik, P., Taimalu, M., Täht, K., & Sciences, S. (2014). Validity and Reliability of Two Instruments to Measure Reflection: A Confirmatory Study. *Journal of the Humanities*, 18(2), 121-134.
- Kansanen, P. (2003). Studying The Realistic Bridge Between Instruction and Learning an Attempt to A Conceptual Whole of the Teaching-Studying-learning process. *Educational Studies*, 29(2-3), 221-232.
- Kemendikbud. (2014). *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 137 Tahun 2014 Tentang Standar Nasional Pendidikan Anak Usia Dini*. Jakarta: Mendiknas.
- Kemendikbud. (2015). *Petunjuk Teknis Penyelenggaraan Taman Kanak-Kanak*. Jakarta: Direktorat Jenderal Pendidikan Anak Usia Dini, Formal dan Non-Formal, Kementerian Pendidikan dan Kebudayaan.
- Kilday, C. R., & Kinzie, M. B. (2008). An Analysis of Instruments that Measure the Quality of Mathematics Teaching in Early Childhood. *Early Childhood Education Journal*, 36(4), 365-372.
- Kilpatrick, J. (2001). Understanding Mathematical Literacy: The Contribution of Research. *Educational studies in mathematics*, 47(1), 101-116.
- Kim, I. H. (2013). *Preschool Teachers' Knowledge of Children's Mathematical Development and Beliefs about Teaching Mathematics*. (Disertasi), University of North Texas.
- Kohler, R. (2014). *Jean Piaget*. London: Bloomsbury Publishing.
- Kozulin, A., Gindis, B., Ageyev, V. S., & Miller, S. M. (2003). *Vygotsky's Educational Theory in Cultural Context*. London: Cambridge University Press.
- Lee, J. E. (2014). A Study of Pre-Kindergarten Teachers' Knowledge About Children's Mathematical Thinking. *Australasian Journal of Early Childhood*, 39(4), 29-35.

- Lee, J. S., & Ginsburg, H. P. (2009). Early Childhood Teachers' Misconceptions about Mathematics Education for Young Children in the United States. *Australasian Journal of Early Childhood*, 34(4), 37-46.
- Leong, K. E., Meng, C. C., Rahim, A., & Syrene, S. (2015). Understanding Malaysian Pre-Service Teachers Mathematical Content Knowledge and Pedagogical Content Knowledge. *Eurasia Journal of Mathematics, Science Technology Education*, 11(2), 363-370.
- Lidinillah, D. A. M. (2012). *Educational Design Research: a Theoretical Framework for Action*. Tasikmalaya: Universitas Pendidikan Indonesia Kampus Tasikmalaya.
- Lincoln, Y. S., & Guba, E. G. (2013). *The Constructivist Credo*. California: Left Coast Press.
- Linder, S. M., Powers-Costello, B., & Stegelin, D. A. (2011). Mathematics in Early Childhood: Research-Based Rationale and practical strategies. *Early Childhood Education Journal*, 39(1), 29-37.
- Lino, D. (2016). Early Childhood Education: Key Competences in Teacher Education. *Journal Plus Education*, 14(2), 7-15.
- Manno, G. (2006). *Embodiment and A-didactical Situation in The Teaching Learning of The Perpendicular Straight Lines Concept*. (Disertasi), Comenius University.
- Matondang, E. S. (2013). *Meningkatkan Kemampuan Anak Usia Dini dalam Mengenal Konsep Bilangan Melalui Pemanfaatan Multimedia Interaktif*. Bandung: Universitas Pendidikan Indonesia.
- McCool, J. K. (2009). *Measurement Learning Trajectories: A Tool for Professional development*. (Disertasi). Illinois State University.
- Midgett, C. W., & Eddins, S. K. (2001). NCTM's Principles and Standards for School Mathematics: Implications for Administrators. *NASSP Bulletin*, 85(623), 35-42.
- Morrison, G. R., Ross, S. M., Kalman, H. K., & Kemp, J. E. (2012). *Designing Effective Instruction*. Boston: Wiley.

- Muijs, D., Aubrey, C., Harris, A., & Briggs, M. (2004). How do they manage? A Review of The Research on Leadership in Early Childhood. *Journal of Early Childhood Research*, 2(2), 157-169.
- Mulyasa, E. (2005). *Menjadi Guru Profesional Menciptakan Pembelajaran Kreatif dan Menyenangkan*. Bandung: Remaja Rosdakarya.
- NAEYC. (2010). *Early Childhood Mathematics: Promoting Good Beginnings*. Washington: National Association for the Education of Young Children (NAEYC).
- NCTM. (2017). *Executive Summary Principles and Standards for School Mathematics*: Washington: National Council of Teachers of Mathematics (NCTM).
- Neuman, W. L. (2013). *Social Research Methods: Qualitative and Quantitative Approaches*. Washington: Pearson Education.
- Nguyen, T., Watts, T. W., Duncan, G. J., Clements, D. H., Sarama, J. S., Wolfe, C., & Spitler, M. E. (2016). Which Preschool Mathematics Competencies Are Most Predictive of Fifth Grade Achievement? *Early Childhood Research Quarterly*, 36, 550-560.
- Nickerson, S. D., & Sowder, J. T. (2002). What Factors Influence the Formation of Teachers' Professional Communities and Why Should We Care?. *Prosiding The Annual Meeting of the International Group for the Psychology of Mathematics Education*, Norwich, England.
- Novikasari, I. (2016). Matematika dalam Program Pendidikan Anak Usia Dini (PAUD). *Jurnal Pendidikan Anak Bunayya*, 3(1), 1-20.
- Noviyanti, M. (2018). An Analysis of Teachers' Pedagogical Content Knowledge on Number Sense Learning of Early Childhood. *American Journal of Humanities and Social Sciences Research (AJHSSR)*, 2(11), 137-142.
- NRC. (2001). *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Research Council.
- NRC. (2009). *Mathematics Learning in Early Childhood: Paths toward Excellence and Equity*. Washington, DC. National Research Council.



- Organization for Economic Cooperation and Development (OECD). (2018). *PISA 2015-PISA Result in Focus*. Diakses dari <https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf>
- Ojose, B. (2008). Applying Piaget's Theory of Cognitive Development to Mathematics Instruction. *The Mathematics Educator*, 18(1), 26-30.
- Oppermann, E., Anders, Y., & Hachfeld, A. (2016). The influence of preschool teachers' content knowledge and mathematical ability beliefs on their sensitivity to mathematics in children's play. *Teaching Teacher Education*, 58, 174-184.
- Public Broadcasting Service-Parents (PBS Parents). (2017). All Topics for Five-Year Olds. Diakses dari <http://www.pbs.org/parents/childdevelopmenttracker/five/approacheslearning.html>
- Peisner-Feinberg, E. S., Burchinal, M. R., Clifford, R. M., Culkin, M. L., Howes, C., Kagan, S. L., & Yazejian, N. (2001). The Relation of Preschool Child-Care Quality to Children's Cognitive and Social Developmental Trajectories Through Second Grade. *Child Development*, 72(5), 1534-1553.
- Pepper, K. L., & Hunting, R. P. (1998). Preschoolers' Counting and Sharing. *Journal for Research in Mathematics Education*, 164-183.
- Phelps, G., & Howell, H. (2016). Assessing Mathematical Knowledge for Teaching: The Role of Teaching Context. *The Mathematics Enthusiast*, 13(1), 52-70.
- Piaget, J. (1928). *Judgement and Reasoning in The Child*. London: Routledge.
- Piaget, J. (1966). *The Moral Judgment of The Child*. London: Routledge.
- Platas, L. M. (2008). *Measuring teachers' knowledge of early mathematical development and their beliefs about mathematics teaching and learning in the preschool classroom*. (Disertasi). University of California.
- Platas, L. M. (2014). Knowledge of Mathematical Development Survey: Testing the validity and reliability of the survey and interpreting its results. *NHSA Dialog*, 17(1-17).

- Platas, L. M. (2015). The Mathematical Development Beliefs Survey: Validity and Reliability of A Measure of Preschool Teachers' Beliefs about The Learning and Teaching of Early Mathematics. *Journal of Early Childhood Research, 13*(3), 295-310.
- Plomp, T. (2013). Educational Design Research: An Introduction. *Educational Design Research, 1*(1), 11-50.
- Puspendik. (2016). *Trends in International Mathematics and Science Study, Result From TIMSS 2015*. Jakarta: Pusat Penilaian Pendidikan Badan Penelitian dan Pengembangan.
- Reigeluth, C., & Stein, R. (1983). Elaboration Theory. *Journal Instructional-Design Theories, 335-381*.
- Sarama, J., & Clements, D. H. (2009). *Early Childhood Mathematics Education Research: Learning Trajectories for Young Children*. London: Routledge.
- Sarama, J., DiBiase, A.-M., Clements, D. H., & Spitler, M. (2004). *The Professional Development Challenge in Preschool Mathematics*. London: Routledge.
- Sarantakos, S. (2012). *Social research*. London: Macmillan International Higher Education.
- Sbaragli, S., Arrigo, G., D'Amore, B., Fandiño Pinilla, M. I., Frapolli, A., Frigerio, D., & Villa, O. (2011). Epistemological and Didactic Obstacles: The Influence of Teachers' Beliefs on The Conceptual Education of Students. *Mediterranean journal for research in mathematics education, 10*, 61-102.
- Schwandt, T. A. (1994). Constructivist, Interpretivist Approaches to Human Inquiry. *Handbook of qualitative research, 1*, 118-137.
- Schwandt, T. A. (2009). Pendekatan Konstruktivis-Interpretivis Dalam Penelitian Manusia. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research*. Jakarta: Pustaka Pelajar.
- Seldin, T. (2007). *How to Raise an Amazing Child: The Montessori Way to Bring Up Caring, Confident Children*. London: Dorling Kindersley.
- Seo, K. H., & Ginsburg, H. P. (2004). What is developmentally appropriate in early childhood mathematics education? Lessons from new research. In

- Engaging young children in mathematics: Standards for early childhood mathematics education* (pp. 91-104). Mahwah: Lawrence Erlbaum Associates.
- Shabani, K. (2016). Applications of Vygotsky's sociocultural approach for teachers' professional development. *Cogent education*, 3(1), 1252177.
- Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational researcher*, 15(2), 4-14.
- Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard educational review*, 57(1), 1-23.
- Slavin, R. E., & Davis, N. (2012). *Educational Psychology: Theory and Practice, Tenth Edition*. Boston: Allyn & Bacon.
- Stanberry, K. (2016). Early Math Matters. Preparing Preschoolers to Succeed. Diakses dari <http://www.getreadytoread.org/early-learning-childhood-basics/early-math/early-math-matters-preparing-preschoolers-to-succeed>.
- Stipek, D. (2013). Mathematics in Early Childhood Education: Revolution or Evolution? *Early Education & Development*, 24(4), 431-435.
- Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education*, 17(2), 213-226.
- Sujiono, Y. N., Zainal, O. R., Rosmala, R., & Tampiomias, E. L. (2014). *Metode pengembangan kognitif*. Jakarta: Universitas Terbuka.
- Suryadi, D. (2010a). *Didactical Desain Research (DDR) dalam Pengembangan Pembelajaran Matematika*. Paper presented at the Seminar Nasional Pembelajaran MIPA, Universitas Negeri Malang (UM).
- Suryadi, D. (2010b). *Metapedadidaktik dan Didactical Design Research (DDR): Sintesis Hasil Pemikiran Berdasarkan Lesson Study*. Paper dipresentasikan pada FMIPA UPI, Bandung.
- Suryadi, D. (2019). *Landasan Filosofis Penelitian Desain Didaktis ((DDR)*. Bandung: Pusat Pengembangan DDR Indonesia.
- Suryadi, D., Yulianti, K., & Junaeti, E. (2010). Model Antisipasi dan Situasi Didaktis Dalam Pembelajaran Matematika Kombinatorik Berbasis Pendekatan Tidak Langsung. Bandung: Universitas Pendidikan Indonesia.

- Trend in International Mathematics and Science Study (TIMSS) . (2018). TIMSS 2015 International Results in Mathematics. Diakses dari <http://timssandpirls.bc.edu/timss2015/international-results/wp-content/uploads/filebase/full%20pdfs/T15-International-Results-in-Mathematics.pdf>
- Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher–student interaction: A decade of research. *Educational psychology review*, 22(3), 271-296.
- Van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (2006). *Educational design research*. London: Routledge.
- Van Der Stuyf, R. R. (2002). Scaffolding as a teaching strategy. *Adolescent learning and development*, 52(3), 5-18.
- Verenikina, I. (2003). Understanding Scaffolding and The ZPD in Educational Research. *Prosiding pada The International Education Research Conference (AARE - NZARE)*, Auckland, New Zealand.
- Von Glasersfeld, E. (2012). A Constructivist Approach to teaching. Dalam *Constructivism in education* (pp. 21-34). London: Routledge.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard university press.
- Vygotsky, L. S. (1986). *Thought and language-Revised edition*. London: Cambridge, Mass.
- Vygotsky, L. S. (1989). Concrete human psychology. *Soviet Psychology*, 27(2), 53-77.
- Watts, T. W., Duncan, G. J., Siegler, R. S., & Davis-Kean, P. E. (2014). What’s past is prologue: Relations between early mathematics knowledge and high school achievement. *Educational researcher*, 43(7), 352-360.
- Wigfield, A., & Eccles, J. S. (2002). *Development of Achievement Motivation*. San Diego: Academic Press.
- Wilson, P. H., Sztajn, P., & Edgington, C. (2013). Designing professional learning tasks for mathematics learning trajectories. *PNA*, 7(4), 135-143.
- Wilson, P. H., Sztajn, P., Edgington, C., & Confrey, J. (2014). Teachers’ Use of Their Mathematical Knowledge for Teaching in Learning a Mathematics

Learning Trajectory. *Journal of Mathematics Teacher Education*, 17(2), 149-175.

Winkel, W. (1989). *Psikologi pengajaran*. Jakarta: Gramedia.

Worden, D. (2015). The Development of Content Knowledge through Teaching Practice. *Ilha do Desterro*, 68(1), 105-119.

Yohanes, R. S. (2011). Kontribusi Pendidikan Matematika dalam Pembentukan Karakter Siswa. *Prosiding Seminar Nasional dan Pendidikan Matematika*, Universitas Negeri Yogyakarta.

Zacharos, K., Antonopoulos, K., & Ravanis, K. (2011). Activities in Mathematics Education and Teaching Interactions. The Construction of The Measurement of Capacity in Pre-Schoolers. *European Early Childhood Education Research Journal*, 19(4), 451-468.

Zhang, Y. (2015). *Pedagogical Content Knowledge in Early Mathematics: What Teachers Know and How it Associates with Teaching and Learning*. (Disertasi), Loyola University

