PENINGKATAN KEMAMPUAN PEMECAHAN MASALAH DAN RESILIENSI MATEMATIS SISWA MELALUI PEMBELAJARAN DARING MODEL *PROJECT BASED LEARNING* DENGAN PENDEKATAN STEM (DARING PjBL STEM)

TESIS

**Diajukan untuk Memenuhi Sebagian dari Persyaratan Memperoleh
Gelar Magister Pendidikan
Program Studi Pendidikan Matematika**

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FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
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2020**

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LEMBAR PENGESAHAN

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ABSTRAK

Nurhayati. (2020). Peningkatan Kemampuan Pemecahan Masalah dan Resiliensi Matematis Siswa melalui Pembelajaran Daring Model *Project Based Learning* dengan Pendekatan STEM (Daring PjBL STEM)

Penelitian ini bertujuan untuk menganalisis peningkatan kemampuan pemecahan masalah dan resiliensi matematis siswa serta hubungan antara resiliensi matematis dengan kemampuan pemecahan masalah matematis. Penelitian ini merupakan penelitian kuantitatif dengan metode kuasi eksperimen dan *expost facto*. Penelitian ini dilaksanakan di salah satu SMA Negeri di Kabupaten Karawang pada tahun ajaran 2019/2020. Sampel yang digunakan sebanyak 69 siswa. Hasil penelitian ini menunjukan bahwa: 1) Terdapat perbedaan peningkatan kemampuan pemecahan masalah matematis yang signifikan antara siswa yang memperoleh pembelajaran daring PjBL STEM dan siswa yang memperoleh pembelajaran daring konvensional. Peningkatan kemampuan pemecahan masalah matematis siswa yang memperoleh pembelajaran daring PjBL STEM lebih baik daripada siswa yang memperoleh pembelajaran daring konvensional; 2) Terdapat perbedaan resiliensi matematis signifikan antara siswa yang memperoleh pmbelajaran daring PjBL STEM dan siswa yang memperoleh pembelajaran daring konvensional. Pencapaian resiliensi matematis siswa yang memperoleh pembelajaran daring PjBL STEM lebih baik daripada siswa yang memperoleh pembelajaran daring konvensional; 3) Terdapat hubungan antara resiliensi matematis dan kemampuan kemampuan pemecahan masalah matematis ysng signifikan antara siswa yang memperoleh pmbelajaran daring PjBL STEM dan siswa yang memperoleh pembelajaran daring konvensional. Besarnya presentase pengaruh resiliensi matematis terhadap kemampuan pemecahan masalah matematis siswa sebesar 34,5% dengan koefisien korelasi 0,578 termasuk kategori sedang.

Kata Kunci: Pembelajaran *Project Based Learning* dengan Pendekatan STEM (PjBL STEM), Pembelajaran Daring, Kemampuan Pemecahan Masalah Matematis, Resiliensi Matematis

ABSTRACT

Nurhayati. (2020). Improvement of Students' Mathematical Problem Solving Ability and Mathematical Resilience through *Online Learning* of *Project Based Learning* Model with STEM Approach (PjBL STEM Online)

The purpose of this research is to analyze students' improvement of mathematical problem solving ability and mathematical resilience as well as the relationship between mathematical resilience with mathematical problem solving abilities. This research employs a quantitive approach with quasi-experimental and expost-facto methods. This research conduct in one of SMAN Karawang regency in the academic year 2019/2020. The sample used 69 students .The instrument used was a test of mathematical problem solving ability and mathematical resilience scale questionnaire. Data analysis in this study used the Mann-Whitney and Correlation Pearson test. The results of this study indicate that: 1) There is a significant difference in the improvement of mathematical problem solving abilities between students who obtain PjBL STEM Online learning and students who obtain conventional online learning. Improving the mathematical problem solving ability of students online class PjBL STEM is higher than conventional online classes; 2) There is a significant difference in mathematical resilience between students who obtain PjBL STEM Online learning and students who obtain conventional online learning. Achievement mathematical resiliensce of students online class PjBL STEM is higher than conventional online classes ; and 3) There is a significant relationship between mathematical resilience and students' mathematical problem solving abilities with a Pearson Correlation value of 0.587 **.

Keywords: Project Based Learning with STEM Approach (STEM PjBL), Online Learning, Mathematical Problem Solving Ability, Mathematical Resilience.

DAFTAR ISI

BAB IV HASIL PENELITIAN DAN PEMBAHASAN

DAFTAR PUSTAKA

Abidin, Z. (2007). *Analisis Eksistensial*. Jakarta: Raja Grafindo

Abiola,T., & Udofia, O. (2011). Psychometric Assessment of theWagnild and Young's Resilience Scale in Kano, Nigeria. *BMC Research Notes* 4:509. doi: 10.1186/1756-0500-4-509

Allen, M. (2014). *Local Action on Health Inequalities: Building Children and Young People's Resilience in School.* Public Health England

Anne, J. (2017). *STEM BY Design: Strategy and Gctivities for grade 4-8. 1st edition*. [Online]. Diakses pada tanggal 29 november 2019 Tersedia di http://www.stem-by-design.com.

Arikunto, S. (2006). *Prosedur Penelitian, Suatu Pendekatan Praktik*. Jakarta: PT. Rineka Cipta.

Ashcraft, M.H. (2002). Math Anxiety: Personal, Educational, and Cognitive Consequences. *American Psychological Society*. Departement of Psychology, Cheveland State University, Cleveland, Ohio, hlm 181-185.

Baloglu, M., & Kocak, R. (2006). A Multivariate Investigation of the Differences in Mathematics Anxiety. *Personality an Individual Differences*, vol 40, hlm 1325-1335. Doi:10.1016/j.paid.2005.10.009

Baran, M., & Maskan, A. (2010). The Effect of Project-Based Learning on Pre-service Physics Teachers Electrostatic Achievements. *Journal of Educational Sciences*, 5(4), hlm 243–257.

Becker, K., & Park, K. (2011). Effects of Integrative Approaches Among Science, Technology, Engineering, and Mathematics (STEM) Subjects on Students' Learning: A Preliminary Meta-analysis. *Journal of STEM Education*, Volume 12 • Issue 5 **&** 6.

Bilfaqih, Y.,Qomarudin, M.N. (2015). *Esensi Pengembangan Pembelajaran Daring: Panduan Berstandar Pengembangan Pembelajaran Daring untuk Pendidikan dan Pelatihan*. Ed.1, Cet.1, Yogyakarta: Deepublish

Blanco, L., Barona, E.G., & Carrasco, A.N. (2013). Cognition and Affect in Mathematics Problem Solving with Prospective Teachers. *Journal The Mathematics Enthusiast*, vol 10 (15), No. 1&2.

Borman, G.D., & Overman, L.T. (2004). Academic Resilience in Mathematics Among Poor and Minority Students. *The Elementary School Journal*, Volume 104 (3), hlm 178-195.

Brown,R., Brown, J., Readon, K., & Merrill, C. (2011). Understanding STEM : Current Percenptions. *Journal Technology and Engineering Teacher*, 70(6), hlm 5-9.

Bybee, R.W. (2013). *The Case for STEM Education*: Challenges and Opportunity. Arlington: NTSA Press.

Caballero, A., Blanco, L.J., & Guerrero, E. (2011). Problem Solving and Emotional Education in Initial Primary Teacher Eduation. *Journal EURASIA* 7(4), hlm 281-292. SPAIN: Extremadura University.

Capraro, R. M., Capraro, M. M., Morgan, J. R., & Slough, S. W. (2013). *STEM Project-Based Learning: An Integrated Science, Technology, Engineering, and Mathematics (STEM) Approach*. *STEM Project-Based Learning an Integrated Science, Technology, Engineering, and Mathematics (STEM) Approach*. Rotterdam, The Netherlands: Sense Publishers. Diakses pada tanggal 28 Oktober 2019 tersedia di http://doi.org/10.1007/978-94-6209-143-6.

Cassidy, S. (2015). Resilience Building in Students: The Role of Academic Self-efficacy. *Psychology and Public Health*, University of Safford, Safford, UK. Doi: 10.3389/fpsyg.2015.01781.

Cheng, R., Lam, S., & Cha, J.S. (2008). When High Achievers and Low Achievers Work in the Same Group: The Roles of Group Heterogeneity and Processes in Project-Based Learning. *British Journal of Educational Psychology*, 78, hlm 205–221.

Cockcroft, W.H. (1982). *Mathematics Counts: Report of The Committee of Inquiry into the Teaching of Mathematics in School.* London: HMSO.

Creswell, J.W.(2013). *Research Design: Pendekatan kualitatif, kuantitatif, dan mixed.* Jogyakarta: Pustaka Pelajar.

Dennis, R.M. (2019, 27 Maret). "Kepala Badan Penelitian dan Pengembangan (Balitbang) Kementrian Pendidikan dan Kebudayaan (Kemendikbud) Totok Supriyatno mengatakan tingkat kesulitan soal Ujian Nasional (UN) tahun ini tidak berubah di bandingkan tahun lalu". [Online]. Diakses pada tanggal 23 November 2019 tersedia di http://kabar24.bisnis.com.

Domínguez, C. & Jaime, A. (2010). Database Design Learning: A Project-Based Approach Organized Through a Course Management System. *Journal Computers & Education*, 55(3), hlm 1312–1320.

Dopplet (2005). Assesment of Project Based Learning in a Mechatronicts Context. *Journal of Technology Education*. Volume 16 No.2, hlm 7-24. Springer.

Erdogan,N., Navruz ,B., Younes, R., & Capraro, M.R. (2016). Viewing How STEM Project-Based Learning Influences Students' Science Achievement Through the Implementation Lens: A Latent Growth Modeling. *Eurasia Journal of Mathematics, Science & Technology Education,* 2016, 12(8), hlm 2139-2154

Ernest, P. (1991). *The Philosophy of Mathematics Education*. London: Routledge Falmer

Furi, L.M.I., Handayani, S., Maharani, S. (2018). Eksperimen model pembelajaran project based learning dan project based learning terintegrasi STEM untuk meningkatkan hasil belajar dan kreativitas siswa pada kompetensi dasar teknologi pengolahan susu. *Jurnal Penelitian Pendidikan (JPP),* vol 35 (1).

Gok, T. (2014). Students' Achievement, Skill and Confidence in Using Stepwise Problem Solving Strategi. *Eurasia Journal of Mathematics, Science, and Technology Education*, vol 10 (6), hlm 617-624.

Grotberg, H. (2000). *Resilience for Today: Gaining Strength from Adversity.* (Rev.Ed). United State of America: Greenwood Publishing Group, Inc.

Hake, R.R. (1998). Interactive-engagement versus traditional methods: A six thousand student of mechanics test data for introductory phisycs course. *American Jurnal of physics*, 66(1), pp 64-74

Hake, R. (1999). *Analyzing change/gain scores area D-American educational research association's division D. measurement and research methodology.* [Online]. Diakses dari Http://www.Physic.indiana.edu/-sdi/analyzingchangegain.pdf.

Hamill,S.K. (2003). Resilience and Self-efficacy: The Importance of Efficacy Beliefs and Coping Mechanisms in Resilient Adolescents. *Colgate Univ.J.Sci.* vol 35, hlm 115–146.

Han, S., Capraro, R., & Margaret, M.C. (2014). How Science, Technology, Engineering, and Mathematics (STEM) Project Based Learning (PBL) Affects High, Middle, and Low Achievers Differently: The Impact of Student Factors on Achievement. *Internasional Journal of Science and Mathematics Education*. Taiwan: National Science Council. Doi:10.1007/s10763-014-9526-0.

Hendriana, H. & Utari, S (2014). *Penilaian Pembelajaran matematika* (Edisi revisi). Bandung: PT Refika Aditama

Hoffman, B. (2010). "I Think I Can, but I'm afraid to try": The Role od Self-Efficacy Beliefs and Mathematics Anxiety in Mathematics Problem-Solving Efficiency. *Learning and Differences*, 20, hlm 276-283.

Ivanitskaya, L., Clark, D., Montgomery, G., & Primeau, R. (2002). Interdisciplinary learning: Process and outcomes. *Innovative Higher Education, 27*,hlm 95-111.

Johnston-Wilder, S., and Lee, C. (2010). *"Developing Mathematical Resilience".* Dalam *BERA Annual Conference, 1-4 September 2010*. University of Warwick.

Johnston-Wilder, S., & Lee, C. (2010). Mathematical Resilience. *Journal Mathematics Teaching* 2018, hlm 38 – 41

Johnston-wilder et al. (2013). "Developing Coaches for Mathematical Resilience". Dalam *Proceeding of 8th International Conference of Education, Research and Innovation*. Seville, Spanyol 18-20 November 2013, hlm 2326-2333

Johnston-Wilder, S., Lee, C., Brindle, J., Garton, E. (2015). "Developing Mathematical Resilience in School-Student who have Experinced Repeated Failure". *ICERI 2015*

Kara. (2019). *The Resiliensi Center: "aku bisa bertahan dan bangkit kembali: resiliensi diri".* [Online]. Diakses pada tanggal 28 November 2019 tersedia di http://rimuu.wordpress.com.

Kathryn M., Connor, M.D., Jonathan R.T., & Davidson, M.D. (2003). Development of a New Resilience Scale: The Connor-Davidson resilience scale (CD-Risc). *Journal Depression and anxiety*, vol 18 hlm 76–82.

Kelley, T.R., & Knowles, J.G. (2016). A Conceptual Framework for Integrated STEM Educatin. *International Journal of STEM Education*. Spinger.

Kemendikbud. (2013). *Kerangka Dasar dan Struktur Kurikulum 2013*. Jakarta: Kemendikbud.

Kemendikbud. (2017). *Modul Implementasi Kurikulum 2013 Matematika SMA*. Jakarta: Kemendikbud.

Kemendikbud. (2019). *"Laporan hasil Ujian Nasional"*. [Online]. Diakses pada tanggal 23 November 2019 tersedia di http://hasilun.puspendik.kemdikbud.go.id/#2019!smp!capaian_nasional!99 &99&999!T&T&T&T&1&T!1!&.

Kemendikbud. (2020). *Surat Edaran Nomor 3 Tahun 2020 Tentang Pelaksanaan Pendidikan dalam Masa Darurat CoronaVirus (COVID-19)*.

Kooken, J., et.al. (2013). "Measuring Mathematical Resilience: An Application of the Construct of Resilience to the Study of Mathematics". Dalam *American Educational Research Association (AERA) 2013 Annual Meeting: Education*

and Poverty: Theory, Research, Policy and Praxis, 27 Apr - 1 May 2013, San Francisco, CA, USA.

Kurt, B., & Kyungsuk, P. (2011). Effects of integrative approaches among science, technology, engineering, and mathematics (STEM) subject on student' learning: A preliminary meta-analysis. Journal of STEM education. Vol 12 Issue 5 & 6 hlm 23 - 37

Lucas, G. (2005). *Instructional Module Project Based Learning*. [Online]. Diakses pada tanggal 29 November 2019 tersedia di http://www.edutopia.org/modules/PBL/whatpbl.php.

Luthar, S.S., Cicchetti, D., & Becker, B.(2000). The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work. *Journal Childern Development*, 71(3), hlm 543-562

Mullis, I.V.S., Martin, M.O., Foy, P., & Hooper, M. (2015). *TIMSS 2015 Internasional Result in Mathematics: Fourth Grade Mathematics*. TIMSS & PIRLS, Internasional Study Center, IEA.

Mullis, I.V.M., Marten, M.O., Foy, P., & Arora, A. (2011). *TIMSS 2011 Internasional Result in Mathematics*. TIMSS & PIRLS, Internasional Study Center, IEA.

Nardi, E., & Steward, S. (2003). Is Mathematics T.I.R.E.D? A Profile of Quiet Disaffection in the Secondary Mathematics Classroom. *British Educational Research Journal*, Vol. 29, No.3, hlm 345-367.

National Research Council. (2011). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington DC: The National Academies Press

Orton, A. (2004). *Learning Mathematics: Issues, Theory, and Classroom Practice. Third Edition.* New York: Continuum.

Ozturk, T., Guven, B. (2016). Evaluating Students' Belief in Problem Solving Process: A Case Study. *Eurasia Journal of Mathematics, Science, and Technology Education*, 12(2), hlm 411-429.

Permendikbud nomor 103 tahun 2014 tentang Pembelajaran pada Pendidikan Dasar dan Pendidikan Menengah.pdf. [Online]. Diakses pada tanggal 5 Desember 2019.

Permendikbud nomor 22 tahun 2016 tentang Standar Proses Pendidikan Dasar dan menengah.pdf. [Online]. Diakses pada tanggal 5 Desember 2019.

Phonapichat, P., Wongwanich, S. & Sujiva, S. (2014). "An Analysis of Elementary School Students' Difficulties in Mathematical Problem Solving". *Proceding - Social and Behavioral Sciences*, *116*, (hlm 316–317).

Polya, G. (1985). *How to Solve it (2nd edition)*. New Jersey: Pricenton University Press.

Pooley, J., & Cohen,L. (2010). Resilience: A Definition in Context. *Journal Aust.Commun. Psychol.* 22, hlm 30–37.

Reivich, K., & Shatte, A. (2002). The *Resilience Faktor; 7 Essential Skill for Overcoming Life's Inevitable Obstacle*. New York: Broodway Books.

Roberts, A., & Cantun, D. (2012). *Applying STEM Instructional Strategies to Design and Technology Curriculum*. Department of STEM Education and Proffesional Studies Old Dominion. University Norfolk, VA, USA.

Rohmah, M., Sutiarso, S. (2017). Analysis Problem Solving in Mathematical Using Theory Newman. *EURASIA Jurnal of Mathematics, Sience, and Technology Education*, volume 14(2), hlm 671-681, doi: 10.12973/ejtmste/80630

Sander, M. (2009). STEM, STEM Education, STEMmania. *Jornal The Technology Teacher*, 68(4), hlm 20-26.

Sani, A.R. (2014). *Strategi Pembelajaran Inovatif Kontemporer*. Jakarta: Bumi Aksara.

Schoenfeld, A.H. (1987). "Polya, Problem Solving, and Education". *Mathematics Magazine*, *60*(5), hlm 283–291.

Shakhman, L., & Barak, M. (2019). The Physics Problem Solving Taxonomy (PPST): Development and Application for Evaluating Student Learning. *Jounal EURASIA*, 15(11), hlm 1764.

Simamora, R.E., Saragih, S., Hasratuddin. (2019). Improving Students' Mathematical Problem Solving Ability and Self Efficacy Through Guided Discovery Learning in Local Culture Context. *IEJME,* Vol.14 No.1 hlm 61-72.

Slavin, R. E. (1987). Ability grouping and student achievement in elementary school: A best evidence synthesis. *Review of Educational Research*, 57 hlm 293-336.

Stinson, K., Harkness, SS., Meyer, H., & Sallworth, J. (2009). Mathematics and science integrations: Models and characterizations. School Science and Mathematics, 109, hlm 153-161

Sugiyono. (2012). *Statistik untuk Penelitiaan*. Bandung: Alfabeta .

Sugiyono. (2013). *Metode Penelitian Pendidikan : Pendekatan Kuantitatif, Kualitatif, and R&D*. Bandung: Alfabeta.

Sumaryanta., Priatna, N., & Sugiman. (2019). Pemetaan Hasil Ujian Nasional Matematika. *Indonesia Digital journal of Mathematics and Education*, Vol. 6 No. 1. Diakses pada tanggal 16 Desember 2019 Tersedia di http://p4tkmatematika.kemendikbud.go.id/journals/index.php/idealmathedu/.pdf.

Temur, O.D.(2012). Analysis of Prospective Classroom Teachers' Teaching of Mathematical Modeling and Problem Solving. *Journal Eurasia*, 8(2), hlm 83-93.

Thomas, J.W., Mergendoller, J.R., & Michaelson,A. (1999). *Project Based Learning: A Handbook for Middle and High School Teacher*. [Online]. Diakses pada tanggal 23 November 2019 Tersedia di :http://www.Bgsu.edu/organization/ctl/proj.html.

Thomas, J.W. (2000). *A Review of Research on Project Based Learning*. [Online]. Diakses pada tanggal 23 November 2019 Tersedia di http://www.bie.org/research/study/reviewofprojectbasedlearning2000.

Tseng, K., Chang, C.,Lou, S., & Chen, W. (2011). Attitudes Towards Science, Technology, Engineering and Mathematics (STEM) in a Project-Based Learning (PjBL) Environment. *Int J Technol Des Educ*, (2013) vol 23, hlm 87–102.

Vistro-Yu, C.P. (2009). "Using Innovation to Generate 'New' Problem". Dalam Kaur, B., Har, Y.B., & Kapur, M (Eds). *Mathematical Problem Solving Yearbook* (hlm 185-207). Singapore : World Scientific.

Winarni, J., Zubaidah, S., dan Koes, S.H. (2016). STEM: APA, MENGAPA, DAN BAGAIMANA. Dalam *Pros. Semnas Pend. IPA Pascasarjana UM*, Vol 1 hal 976-984.

Yeager, D.S. & Dweck, C.S. (2012). Mindsets that Promote Resilience: When Students Believe that Personal Characteristics Can be Developed. *Journal : Educational Psychologist*, Vol 47(4), hlm 302-314.

Zanthy, L.S. (2018). Kontribusi resiliensi matematis terhadap kemampuan akademik mahasiswa pada mata kuliah statistika matematika. *Jurnal Mosharafa*, vol.7, No.1 hlm 85-94