

THE LEARNING TRAJECTORY OF SOCIAL ARITHMETIC CONTENT USING PMRI APPROACH WITH A ZAKAT MAAL CONTEXT

Deanisa Noviana Lukmana¹, Mika Desrifa Dwi Rahmawati², Nida Mardhiyah³

¹ SMA Al-Bidayah Batujajar, Indonesia
deanisanovianalukmana@gmail.com

² SMP Plus Manbaul Falah, Indonesia
mikadesrifa4141@gmail.com

³ SMP Inovatif Al-Ibda', Indonesia
nidamardhiyah16@gmail.com

Article Info

Article History

Received: 03-02-2023

Revised: 28-02-2023

Accepted: 15-03-2023

Keywords

Social Arithmetic;

PMRI;

Zakat Maal

Corresponding Author

Nida Mardhiyah,

SMP Inovatif Al-Ibda'

Kab. Bandung, Indonesia

nidamardhiyah16@gmail.com

Abstract

This research aims to improve students' understanding of social arithmetic material and its role in the real world. This research uses a design research method that designs social arithmetic material with the PMRI approach and Learning Trajectory for class VII using the concept of zakat maal. The results of the study found that learning social arithmetic in the context of zakat helps students to relate arithmetic concepts to the real world and understand the role of arithmetic in zakat management. Students can see how arithmetic is used in calculating the amount of zakat, distributing zakat to mustahik, and managing zakat funds effectively.

How to Cite:

Lukmana, D. N., Rahmawati, M. D. D., & Mardhiyah, N. (2023). The learning trajectory of social arithmetic using PMRI approach with a zakat maal context. *Pi-Radian Journal*, 1(1), 1-10.

INTRODUCTION

Social arithmetic plays a crucial role in our daily lives, enabling us to navigate social interactions effectively. This importance stems from its application of mathematical concepts like addition, subtraction, multiplication, and division to the complexities of social interactions.

Social arithmetic helps us learn how to interact in mutually beneficial ways. Learning these skills will equip students with tools to solve everyday problems in the future (Nuraeni et al., 2020). Understanding social arithmetic allows us to build effective communication, resolve conflicts, and foster trust, ultimately creating an inclusive and sustainable society. By applying its principles, we can build strong, mutually beneficial relationships within individuals, groups, and communities.

One example of a social arithmetic concept in daily life is zakat, which plays a role in distributing wealth towards those who are financially disadvantaged or struggling (Balwi & Halim, 2008; Faridah, 2016). In essence, wealth-based zakat, one of the pillars of Islam mentioned alongside prayer (Fakhruddin, 2012; Zakaria, 2014), is an obligation for Muslims exceeding a certain wealth threshold (nishab) as a form of social responsibility. This concept has a deep influence in creating social balance and reducing economic disparities in society.

Therefore, social arithmetic and zakat maal share a close relationship, both aiming to manage resources in the context of social relations and empower communities. While social arithmetic applies mathematical principles to guide social interactions, zakat maal focuses on calculating and distributing wealth for social welfare purposes.

While learning mathematics through stories can facilitate mathematical thinking Rahmawati in Dewi & Mariana (2020), students often face difficulties in solving word problems. Studies (Arifah & Saefudin, 2017; Dila & Zanthi, 2020; Handayani & Aini, 2019; Suryapuspitarini et al., 2018) highlight their tendency to memorize formulas without grasping the underlying concepts. This is further confirmed by Utari et al. (2020), who found that many students struggle with understanding the meaning and concepts within story problems, formulating them into mathematical models, and choosing the appropriate solution (Damayanti & Kartini, 2022; Dwidarti et al., 2019; Utami et al., 2022).

In light of these challenges, it's crucial to enhance students' understanding of social and natural arithmetic material within the context of zakat in class VII SMP. This responsibility lies with teachers. Leveraging their core competencies, they must effectively package learning implementation by preparing diverse materials and teaching resources delivered through appropriate methods, learning models, and resources tailored to students' specific characteristics. One promising approach involves the Learning Trajectory Design method using PMRI.

Building on this, a learning trajectory provides a structured pathway for students to develop mathematical thinking competence. This tiered framework, where each level must be mastered before progressing to the next, fosters gradual growth in their mathematical abilities. (Zaman & Hunaifi, 2017). Akker (Saputri et al., 2016) identifies three stages in design research. The first stage aims to create a hypothetical learning trajectory (HLT) and design instruments to improve the learning process. The second stage tests learning activities designed in the first stage through experimentation and teaching. The third stage involves analyzing data from the teaching experiment, then refining and developing activities based on the findings, and comparing the HLT to actual student learning conditions to inform further refinement.

A promising approach to developing students' critical thinking skills in mathematics is the Indonesian Realistic Mathematics Education (PMRI) approach. As researchers like Meirisa et al. (2018) highlight, the PMRI approach positions reality and student experiences as the foundation for learning. This problem-solving approach encourages creativity by its very nature, making it suitable for achieving this goal in addition to its other suitable principles and characteristics. For example, PMRI activities often involve students collaboratively tackling real-world problems, fostering critical thinking and

creative solutions. However, the question remains: how effectively can this approach be implemented in the actual classroom to maximize its creativity-boosting potential.

A study by Wibawa et al. (2022) demonstrates that using a learning trajectory within the Badung market context significantly increases students' interest in learning. Additionally, it enhances their comprehension of concepts and problem-solving skills related to buying and selling prices, profits, losses, and percentages. This involvement, including engaging with the context, deepening understanding of concepts, collaborating on problem-solving, and drawing conclusions, triggers several benefits. These benefits include linking prior experiences to the topic at hand, solidifying conceptual understanding and formula application, and successfully tackling entrepreneurial arithmetic problems based on the Badung Market case study.

METHOD

This study, employing a Design Research approach, developed social arithmetic materials for students in one of the junior high schools in Bandung Regency, West Java Province, during the even semester of the 2022/2023 academic year. The study utilizes student LKPDs tailored to the PMRI approach. The research follows the three stages of design research methodology: preliminary design, design experiment, and retrospective analysis.

The first stage, the Preliminary Design phase, involved a literature review on the connections between social arithmetic, zakat maal, and PMRI. Researchers then collaborated with teachers to discuss class conditions, research needs, and the research schedule and implementation. They designed a hypothetical learning trajectory (HLT), which was then translated into learning activities based on hypothetical learning materials and concept maps outlining the concepts students would encounter during the learning process. This resulted in a hypothesis about how students would learn social arithmetic within the context of zakat, to be tested in a single meeting.

The second stage is the Design Experiment, which consists of two phases: a preliminary teaching experiment and a Teaching Experiment. In the preliminary phase, researchers test the designed HLT with small groups of 4 students outside the main research class. This pilot experiment allows them to collaborate with the mathematics teacher, leveraging their insights into student strengths and challenges, to refine the initial HLT design and ensure the learning objectives are achievable. The Teaching Experiment then tests the improved HLT on the actual research class, with the mathematics teacher leading the instruction as the researcher observes student learning and communication activities. Learning activities are documented, student work is collected for analysis, and researchers interview a selection of student participants.

Retrospective analysis is a research method where existing data is analyzed to uncover relationships, patterns, or insights within the data. This analysis examines existing data to draw conclusions about what happened or why it happened. Researchers utilize descriptive statistics to explore the data and interpret the findings. Finally, they draw conclusions based on the analyzed data.

RESULTS AND DISCUSSION

Based on the designed learning trajectory, students gain a deeper understanding of the concept of social arithmetic as it relates to zakat maal through engaging with the zakat maal context in learning activities. The students' responses largely align with the predicted learning trajectory, as evidenced by their answers on the LKPD.

Activity 1 starts with the teacher providing a brief explanation of zakat maal, focusing on savings assets. The teacher then divides the students into three groups of four. These contextual social arithmetic problems, presented in the LKPD, focus on raising awareness of the importance of paying zakat. This real-world context aims to inspire students to find purpose in their math learning. Through group discussions and sharing their understanding, students work together to solve the problems. Notably, Groups 2 and 3 (mention specific observations), while Group 1 (mention specific observation).

AKTIVITAS 1

Penggunaan Konteks

Perhatikan Permasalahan Berikut !

Pak Agus selama 1 tahun penuh memiliki harta yang tersimpan yaitu emas senilai Rp 100.000.000. Dalam islam, zakat yang harus dikeluarkan senilai 2,5% dengan nishab 1 tahun dari berbagai mazhab yaitu sebesar 83, 85 atau 90 gram. Namun Pak Agus bingung untuk mengeluarkan nominal zakatnya. Bantu pak Agus untuk menyelesaikan permasalahannya.

Apa yang dapat kalian pahami terhadap situasi diatas ?

Pak Agus bingung dgn brp yg harus dizakatkan dari hartanya

Figure 1. Results of student work on the used contexts

Next is when implementing the progressive mathematics model, students complete the provided statements, encouraged to identify and connect with mathematical concepts encountered in earlier problems. Although each group uses a different nishab (mention the significance of nishab within this context), nearly all manage to solve the problem correctly, providing clear justifications.

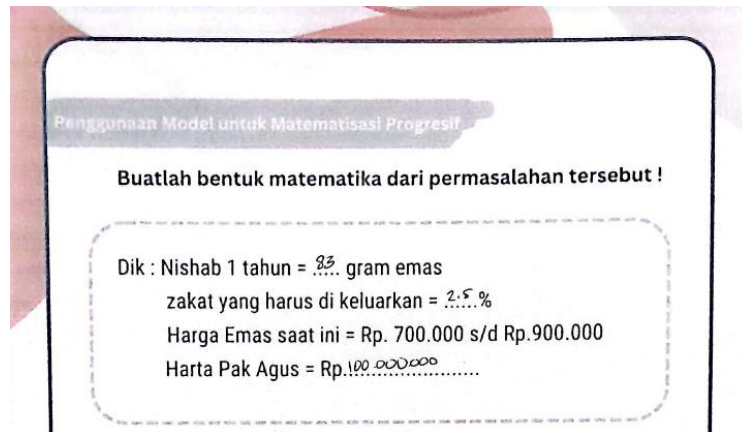


Figure 2. Results of student work on the used model progressive mathematization

Building upon the student-generated solutions, students work through the researcher-provided answers step-by-step to facilitate problem-solving. During this process, each group discusses the flow of zakat distribution among members, deciding on the nishab value and calculating the zakat amount.

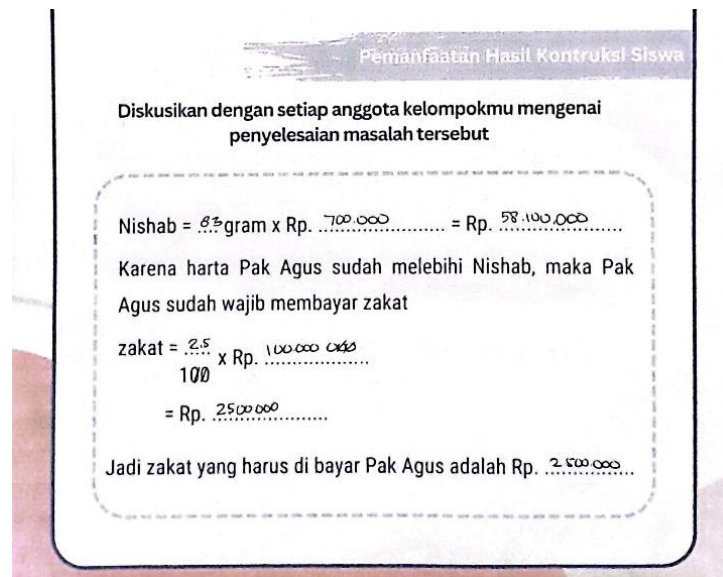


Figure 3. Results of student work on the use of student construction results

Building on the provided answers, students can identify relevant concepts, like applying the notion of tax to calculate zakat amounts. Through interactive discussions, they share their group analyses and findings with the class, highlighting the key differences in their approaches. This exchange broadens their understanding and fosters confidence, perseverance, and critical thinking skills for tackling real-life math problems.

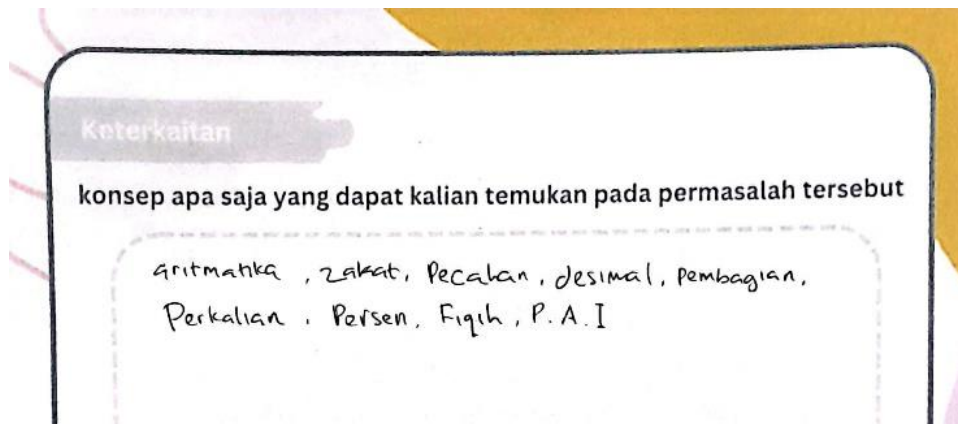


Figure 4. Results of student work on interactivity and interconnectedness

Activity 2 presents students with a demanding challenge: calculating both agricultural and rikaz zakat. For these intricate problems, prior knowledge of number operations and weight units is crucial. Faced with this added complexity, students find the problems more challenging.

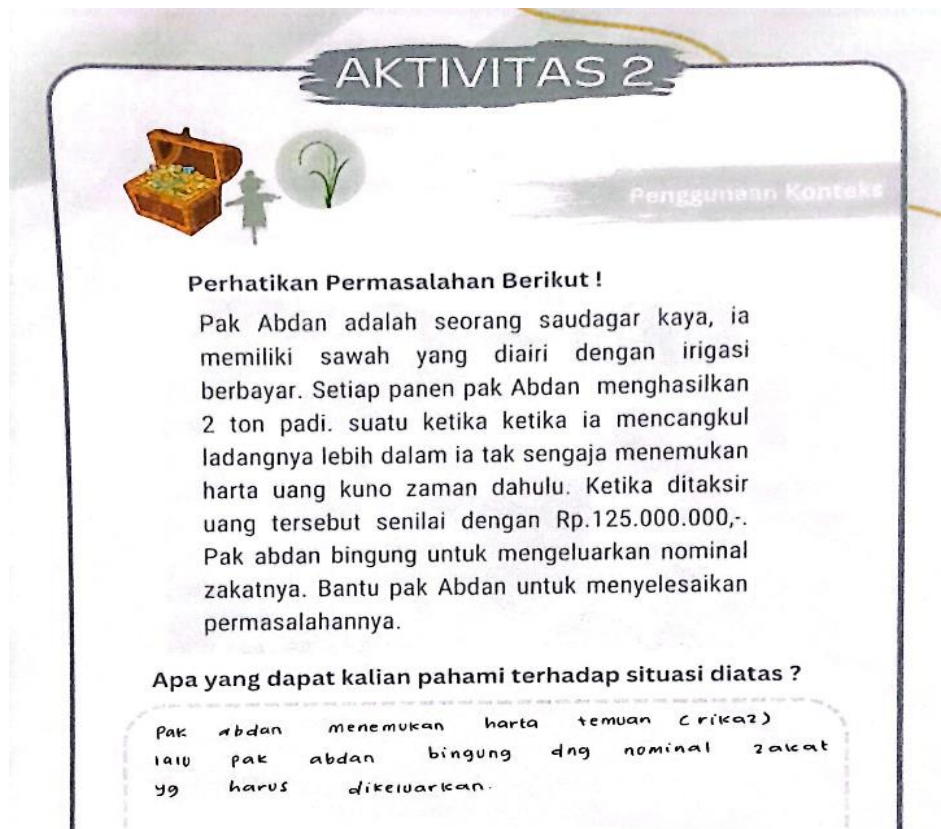


Figure 5. Results of student work on the use of context

Applying progressive math models in activity 2, students work through the provided statements. Each group then determined the found item's price, unit weight, and relevant zakat type based on the previous problem. Initially, one group encountered some confusion regarding the weight unit, but through group discussion and module references, they successfully rectified their answer.

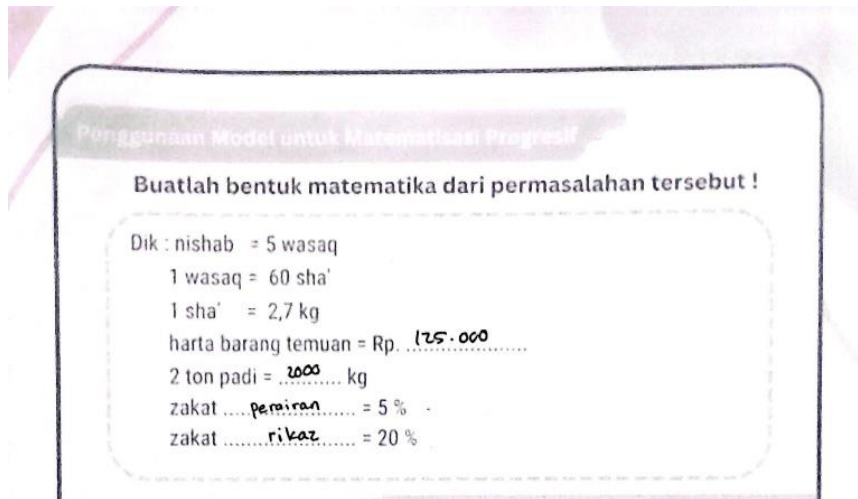


Figure 6. Results of student work on the use of models for progressive mathematization

Similarly to activity 1, activity 2 facilitates problem-solving through progressive construction of student-generated solutions. During this process, each group discusses local rice prices per kilogram, then calculate both agricultural and rikaz zakat to determine the total zakat owed.

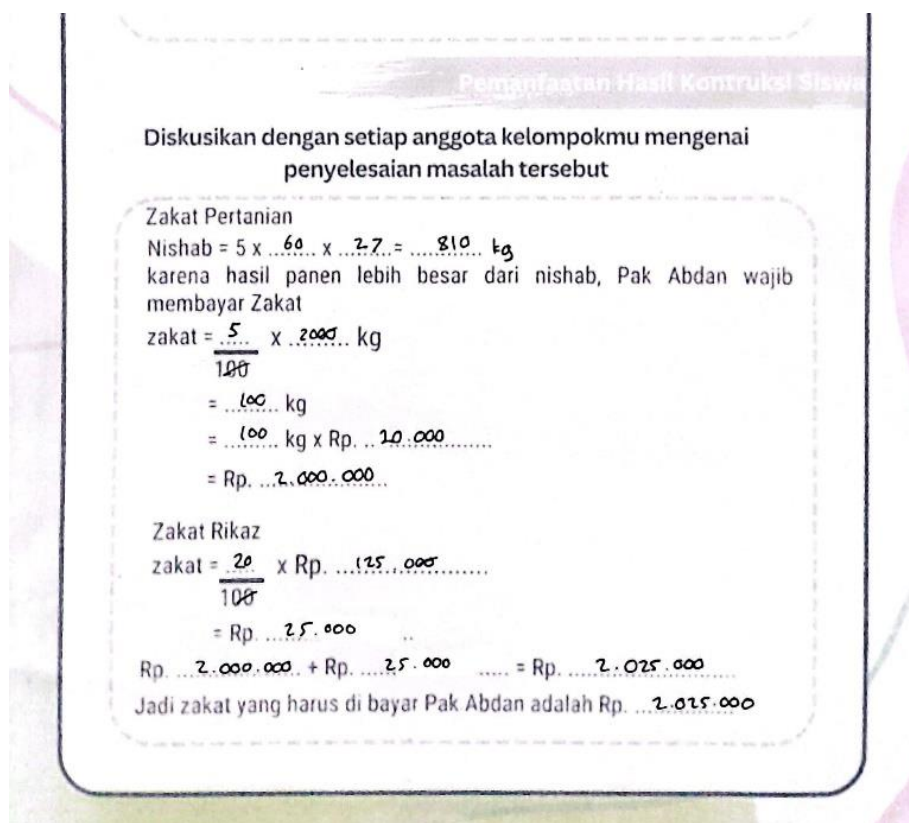


Figure 7. Results of student work on the use of student construction results

In the connection in activity 2, students can also determine what concepts can be found such as the concept of addition, multiplication or taxes that can be applied in calculating the amount of zakat that must be issued or other concepts in the problem. The interactivity in activity 2 is the same as the interactivity 1. Where students exchange ideas

and the results of group discussions with other groups in front of the class and conclude the differences in each group.



Figure 8. Discussion and Presentation session

Activities 1 and 2 demonstrate the effectiveness of using contextual problems to develop students' complex thinking patterns. These real-world contexts, supported by clear LKPD stages, help them overcome challenges by providing well-defined steps (Anggo, 2011; Maryati, 2018; Satiti et al., 2019). The initial step of translating story problems into mathematical form poses the greatest challenge, requiring careful calculations. However, clearly presented steps guide students towards a deeper understanding of social arithmetic.

Framing social arithmetic within the context of zakat helps students bridge the gap between abstract concepts and real-world applications, showcasing arithmetic's role in managing zakat. They witness arithmetic's practical applications in calculating zakat amounts, ensuring equitable distribution to mustahik recipients, and effective zakat fund management. Ultimately, they grasp the impact of strong arithmetic skills on ensuring fair and equitable zakat distribution, maximizing benefits for recipients.

Through this lesson, students delve into the practical application of arithmetic concepts such as calculating percentages, performing basic mathematical operations, and effectively grouping numbers. They witness how meticulous calculations based on these principles ensure that zakat is distributed precisely, both proportionally and according to the specific needs of each mustahik recipient.

Enlightens students about the critical role arithmetic plays in managing social funds like zakat. This fosters their interest in broader mathematical studies by showcasing its concrete applications and relevance in managing financial obligations within religious frameworks. By integrating social arithmetic within the context of zakat, students not only refine their mathematical skills but also gain a nuanced perspective on its crucial role in ethical financial management within religious frameworks.

CONCLUSION

The research demonstrates that the Progressive Mathematicization and Rigorous Inquiry (PMRI) approach plays a crucial role in learning trajectories by enabling students to bridge the gap between existing knowledge and new social arithmetic concepts within

zakat maal material. Based on these findings, it's recommended that schools integrate the PMRI approach into various lessons, particularly in mathematics. Additionally, can develop learning trajectories focused on social arithmetic material in islamic context, offering alternative engaging activities.

REFERENCES

- Anggo, M. (2011). Pemecahan masalah matematika kontekstual untuk meningkatkan kemampuan metakognisi siswa. *Edumatika*, 1(2), 35–42. <https://online-journal.unja.ac.id/index.php/edumatika/article/view/182>
- Arifah, U., & Saefudin, A. aziz. (2017). Menumbuh kembangkan kemampuan pemahaman konsep matematika dengan menggunakan model pembelajaran guided discovery. *UNION: Jurnal Ilmiah Pendidikan Matematika*, 5(3), 263–272. <https://doi.org/10.30738/v5i3.1251>
- Balwi, M. A. W. F. M., & Halim, A. H. A. (2008). Mobilisasi zakat dalam pewujudan usahawan asnaf: Satu tinjauan. *Jurnal Syariah*, 16(3), 567–584. <https://sare.um.edu.my/index.php/JS/article/view/22758>
- Damayanti, N., & Kartini, K. (2022). Analisis kemampuan pemecahan masalah matematis siswa sma pada materi barisan dan deret geometri. *Mosharafa: Jurnal Pendidikan Matematika*, 11(1), 107–118. <https://doi.org/10.31980/mosharafa.v11i1.1162>
- Dewi, I. S., & Mariana, N. (2020). Literasi zakat pada pembelajaran matematika di sekolah dasar melalui dilemma story pedagogy. 8(4), 767–778. <https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/35817>
- Dila, O. R., & Zanthi, L. S. (2020). Identifikasi kesulitan siswa dalam menyelesaikan soal aritmatika sosial. *teorema: teori dan riset matematika*, 5(1), 17–26. <https://doi.org/10.25157/teorema.v5i1.3036>
- Dwidarti, U., Mampouw, H. L., & Setyadi, D. (2019). Analisis kesulitan siswa dalam menyelesaikan soal cerita pada materi himpunan. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 3(2), 315–322. <https://doi.org/10.31004/cendekia.v3i2.110>
- Fakhrudin. (2012). Membumikan zakat: dari taabbudi menuju taaqquli. *Jurisdictie*, 2(1), 95–102. <https://doi.org/10.18860/j.v0i0.1730>
- Faridah, A. (2016). Zakat fitrah dan beberapa permasalahannya. *Al-Mabsut: Jurnal Studi Islam Dan Sosial*, 10(1), 1–7. <http://ejournal.iaingawi.ac.id/index.php/almabsut/article/view/109>
- Handayani, Y., & Aini, I. N. (2019). Analisis kemampuan pemahaman konsep matematis siswa pada materi peluang. *Prosiding Sesiomadika*, 2(1), 575–581. <https://doi.org/10.31949/dm.v4i1.2010>
- Maryati, I. (2018). Peningkatan kemampuan penalaran statistis siswa sekolah menengah pertama melalui pembelajaran kontekstual. *Mosharafa: Jurnal Pendidikan Matematika*, 6(1), 129–140. <https://doi.org/10.31980/mosharafa.v6i1.300>

- Meirisa, A., Rifandi, R., & Masniladevi, M. (2018). Pengaruh pendekatan pendidikan matematika realistik indonesia (pmri) terhadap keterampilan berpikir kritis siswa SD. *Jurnal Gantang*, 3(2), 127–134. <https://doi.org/10.31629/jg.v3i2.508>
- Nuraeni, R., Ardiansyah, S. G., & Zanthi, L. S. (2020). Permasalahan matematika aritmatika sosial dalam bentuk cerita: bagaimana deskripsi kesalahan-kesalahan jawaban siswa? *Teorema: Teori Dan Riset Matematika*, 5(1), 61–68. <https://doi.org/10.25157/teorema.v5i1.3345>
- Saputri, N. Y., Putri, R. I. I., & Santoso, B. (2016). Desain pembelajaran hubungan sudut pusat, panjang busur, dan luas juring lingkaran menggunakan pemodelan martabak. *Prosiding Seminar Matematika Dan Pendidikan Matematika.*, 566–578. <https://jurnal.fkip.uns.ac.id/index.php/snmpm/article/view/10882>
- Satiti, W. S., Zulkardi, & Hartono, Y. (2019). Pola pikir relatif (*relative-thinking*) siswa kelas 5 dalam menyelesaikan masalah kontekstual. *Journal of Education and Management Studies*, 2(2), 61–70. <http://www.ojs.unwaha.ac.id/index.php/joems/article/view/114>
- Suryapuspitarini, B. K., Wardono, & Kartono. (2018). Analisis soal-soal matematika tipe *higher order thinking skill* (HOTS) pada kurikulum 2013 untuk mendukung kemampuan literasi siswa. *Prisma, Prosiding Seminar Nasional Matematika*, 1, 876–884. <https://journal.unnes.ac.id/sju/index.php/prisma/article/view/20393>
- Utami, L. W., Hidayanto, E., & Sisworo, S. (2022). Kesulitan peserta didik dalam menyelesaikan soal program linear pada pembelajaran daring. *Mosharafa: Jurnal Pendidikan Matematika*, 11(2), 257–268. <https://doi.org/10.31980/mosharafa.v11i2.1395>
- Utari, D. R., Wardana, M. Y. S., & Damayani, A. T. (2020). Analisis kesulitan belajar matematika dalam menyelesaikan soal cerita. *Jurnal Ilmiah Sekolah Dasar*, 3(4), 534–540. <https://doi.org/10.31943/mathline.v5i2.162>
- Wibawa, K. A., Payadnya, I. P. A. A., Yasa, I. G. U., & Prahmana, R. C. I. (2022). *The learning trajectory of entrepreneurship arithmetic content using a traditional market. Mathematics Teaching-Research Journal*, 14(3), 144–169.
- Zakaria, S. (2014). Pemahaman muzakki tentang zakat maal (studi kasus masjid al-magfirah kelurahan karama kecamatan singkil kota manado). *Jurnal Ilmiah Al-Syir'ah*, 12(1), 1–19. <https://doi.org/10.30984/as.v12i1.275>
- Zaman, W. I., & Hunaifi, A. A. (2017). *Learning trajectory* dalam mengembangkan kompetensi berfikir matematika. *Jurnal Pendidikan Surya Edukasi (JPSE)*, 3(November), 34–41. <http://ejournal.umpwr.ac.id/index.php/surya/article/view/4337>.