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Optimization of Mathematics Learning with Problem Based Learning and 3N (*Niteni, Nirokke, Nambahi*) to improve mathematical problem solving skills

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ABSTRACT

Learning mathematics is considered a difficult subject for students. Learning difficulties experienced by students often have an impact on the lack of awareness of the importance of mathematics in students' daily life. Optimization of learning mathematics with problem-based learning can be applied using the 3N teachings of Tamansiswa concepts, namely Niteni, Nirokke, Nambahi. This research is qualitative in the form of a literature review. This article describes how teachers can optimize PBL with Tamansiswa teachings in learning mathematics so that students become enjoy, more effortless, and responsive in applying mathematical concepts in daily life.

Keywords: Problem Based Learning, NIteni, Nirroke, Nambahi, Mathematical Problem Solving Ability

ABSTRAK

Pembelajaran matematika dianggap sebagai mata pelajaran yang sulit bagi siswa. Kesulitan belajar yang dialami siswa seringkali berimbas pada kurangnya kesadaran pentingnya matematika dalam kehidupan sehari-hari siswa. Optimalisasi belajar matematika dengan problem based learning dapat diterapkan dengan menggunakan 3N Ajaran Tamansiswa yaitu Niteni, Nirokke, Nambahi. Penelitian ini merupakan penelitian kualitatif berupa kajian literatur. Artikel ini menggambarkan bagaimana cara guru dapat mengoptimalisasikan PBL dengan ajaran Tamansiswa dalam pembelajaran matematika sehingga siswa menjadi lebih senang, merasa mudah dan tanggap dalam menerapkan konsep matematika dalam kehidupan sehari-hari.

Keywords: *Pembelajaran Berbasis Masalah, Niteni, Nirroke, Nambahi, Pemecahan Masalah Matematika,*

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INTRODUCTION

Education is a balanced process for humans to develop individual potential from physical, emotional, spiritual, intellectual, and social aspects (Effendi, 2016). Mathematics is a broad field of study consisting of numbers, algebra, geometry, and measurement (Ario, 2017; Zakiah, 2019). Everything is interconnected with one another. Indonesia's future human resources need quality human resources to master numeracy literacy. At various levels of education, both primary, secondary, and tertiary, students learn mathematics so that Indonesian human resources are able to compete and be adaptive to the times (Yuwono, 2016). Through mastery of mathematics, it is hoped that the Indonesian generation can develop knowledge, master technological developments, and communicate well (Astini, 2019).

Mathematics education contains many links to real life, which are presented verbally and visually with pictures, photos, diagrams, and other visualizations. The context is drawn from a broad spectrum of real-life areas, reflecting that mathematics can be found anywhere in society (Wijers & de Haan, 2020). However, mathematics is considered a complicated subject, full of formulas and numbers. Students also assume that mathematics is not related to their daily lives, so students' interest in learning mathematics is often in the low category (Pratama et al., 2018). Whereas mathematics is an important subject that needs to be studied because it underlies other subjects and plays an important role in all aspects of life, especially in improving human thinking (Indiyah et al., 2021).

Various kinds of problems in mathematics education often occur, especially the problems faced by students in finding knowledge related to mathematical concepts to solve mathematical problems related to everyday life. Student skills in solving problems still need to be improved. Students still need mentoring and teacher assistance in solving math problems, especially in the form of story questions (Puspita et al., 2018).

The last decade has seen the rapid development of problem-solving in educational research. Problem-solving has been the focus of reform in mathematics education for decades (Hourigan & Leavy, 2022). However, the general approach to mathematical problem solving adopted in almost all educational systems is considered only as an isolated activity and not an integral part of teaching and learning. Until now, the study and optimization of problem-based learning have not implemented the importance of niteni, nirokke adds to learning so that it has not helped students develop their thinking skills in solving mathematical problems in daily life.

METHODS

This research uses qualitative research with a Systematic Literature Review (SLR). Qualitative research is research that deals with a person's ideas, opinions, and perceptions and all of them cannot be measured by numbers (Sarma, 2015; Fraenkel et al, 2012; Creswell et al, 2007). SLR research is carried out for various purposes, including identifying, reviewing, evaluating, and interpreting all available research with topic areas of interest to phenomena, with certain relevant research questions (Triandini et al., 2019; Zheng 2015; Xiao & Watson, 2019). Systematically, researchers collect journal articles that can be downloaded from the search engine

google.scholar.com with the keywords mathematical problem solving skills, 3N (Niteni, Nirokke, and Nambahi), and problem based learning. The next step, articles related to Solving Indonesian Mathematics Problems are grouped into 4 discussions, namely mathematical learning problems, mathematical problem solving, 3N, and mathematical problem solving. Therefore, the discussion in this article is limited to these four things.

RESULTS AND DISCUSSION

Mathematics Learning Problems

Competencies and skills possessed by students through learning mathematics activities can be used in solving problems. Of course, teachers in teaching mathematics to students need to start with simpler concepts towards higher concepts with the ability and mindset of students. (Puspita et al., 2018). However, achieving these competencies is not easy. Difficulties in learning mathematics are often encountered at various levels of education, especially during online learning during the pandemic.

Problems in learning mathematics can come from teachers or students. Problems that come from teachers include learning mathematics that is still teacher-centered (Surya, 2017). The teacher has not provided direct experience and still rarely confronts students with contextual and concrete situations/problems as the basis for understanding the abstract. At the same time, the learning environment or the real world of students can be a means of applying concepts and developing students' creativity in building or forming concepts (Pratama et al., 2018). Learning that is still a textbook causes students to develop critical thinking skills, become less sensitive to problems in everyday life around them, and have difficulty and tend to avoid solving existing problems. In the process of learning mathematics carried out in schools, it was also found that when teaching the concept of mathematical material in class, the teacher had not taught it well. For example, the teacher explained the material without appreciating it. Minimalist teachers use media and learning models in explaining the concept of mathematical material, but students are given the task of working on problems (Mastika Yasa & Bhoke, 2019). The lack of teacher guidance in overcoming student difficulties has an impact on student learning outcomes which are often difficult to achieve the Minimum Completeness Criteria (KKM) set by the school.

Students also experience various problems in learning mathematics. Students are less able to be directed by the teacher to learn so students cannot concentrate and focus less on paying attention to the material presented by the teacher. Students' boredom in learning ultimately encourages students' negative behavior when learning in class. Students' skills in conducting group discussions still need to be trained because it is often found that only certain students are working on it and other students are enthusiastic to talk to themselves outside the context of mathematics. The problems faced can be seen from the descriptions of students' answers when working on questions and solving problems. Students turned out to be less able to pay attention to learning and had difficulty in analyzing the questions given by the teacher because they could not understand what was known from the question and what was asked of the question. (Puspita et al., 2018).

The teacher must be the only link of information that can be conveyed in the teaching process. Teachers use various ways of delivering information to students during learning, including language, speech, writing, and other audiovisual devices. Since students are recipients, they can easily hear, infer, evaluate, and modify the information in the message based on their knowledge and experience. After receiving the message, students will have a reaction or feedback: take notes, listen, comment, answer verbally, write, or attitude (surprised, confused, or disagree). There is an undeniable need for feedback in communication; it assists the source in identifying, correcting, or revising the message to make it more consistent with reality. The author also emphasizes that the communication process is dynamic, unstable, and constantly changing; the communication flow factor is always interactive. Communication is broken down into steps in teaching, and in that way, interactivity and contact make the communication process transparent. Mathematics teachers in Indonesia have demonstrated good mathematical understanding and skills. However, currently based on other research findings, it shows that the level of mathematical understanding ability possessed by mathematics teacher students is still in the medium category and learning outcomes related to students' mathematical understanding abilities are influenced by the learning approach and mathematical ability factors show less than optimal results. (Hidayat & Husnussalam, 2019). In addition, the mathematics learning achievement of Indonesian students, in general, is still low compared to other countries (Suryadi & Santoso, 2017). In addition, teachers find it difficult to design learning because it requires particular time so that they can carry out more optimal learning (Ermawati & Rochmiyati, 2020).

Mathematical problem Solving Skills

In everyday life a person will not be able to escape from a problem, and problems have become inseparable in human life. Problems cannot be seen as things that only burden humans, but must be seen as a means to bring up new discoveries. The birth of discoveries from experts that are now enjoyed by humans because of a problem.

A problem is a situation faced by a person, which requires resolution, and the steps to answer it are not immediately known (Posamentier & Krulik, 2009). When someone is faced with a problem, a person's cognition experiences a disequilibrium condition which is usually marked by questioning what exactly is the problem, how to solve the problem, or why it can happen that way, with disequilibrium it will lead to a process of accommodation and assimilation (Safrida et al., 2015).

Based on this, problems can occur if someone does not have certain rules that can be used to overcome the gaps in the current situation with the goals to be achieved. This gap can be a problem if someone does not have certain rules that can be used to overcome the gap. If someone has certain rules to overcome the gap, then that person can be said to have been able to solve the problem. If someone is able to directly integrate new information into an already formed schema or someone is able to change the old schema into a new schema to match the existing information, so that there is an equilibrium state, then that person has carried out the problem solving process.

In the world of mathematics education, math problems are usually in the form of questions or math problems that must be answered or done by students. Problems can be presented in the form of non-routine questions in the form of story questions, depictions of phenomena or events, illustrated

pictures or puzzles and contain mathematical concepts, the problem is called a mathematical problem. (Lidinillah, 2011), a problem is a mathematical problem, especially if it is associated with calculations and efficiency in everyday life (Darminto, 2013).

Not all math problems are problems. A math problem is a problem if the problem or question is challenging to be solved or answered and the procedure for solving it or answering it cannot be done routinely (Shadiq, 2004; Widjajanti, 2009). If a math problem is given to a student and it turns out that the student already knows the procedure for solving it, it can be solved correctly, then the question cannot be said to be a problem for the child (Shadiq, 2004; Suherman, 2003).

A question is a problem depending on the individual and the time, a question is a problem for students, but may not be a problem for other students (Rizkianto, 2013). It must be realized that in general students have difficulty in learning mathematics with different levels of difficulty (Widodo, 2013). This different level of difficulty causes that a math problem or question for each student will be a problem or not depending on each individual or the student himself.

In general, for junior high school students the question $1234:5$ cannot be categorized as a problem because junior high school students already know the procedure to solve the problem at the previous level. But the question "what is the unit digit of $2^{2^{2022}} - 5$ can be a problem or not depending on each individual (student) who faces it. The existence of a mathematical problem can be illustrated as student A the question "what is the unit number of $2^{2^{2022}} - 5$ can be a problem because student A does not yet have an idea to solve the problem or math question he is facing, in contrast to student B who already has an idea to solve the problem. the. Even though student A and student B are in the same condition and time.

Likewise, if students are faced with $3 + 4x5$ questions, elementary school students who have not yet obtained the concept of mathematical arithmetic operations can become a problem if the student has to solve them. But for high school students, facing $3 + 4x5$ questions is not categorized as a problem. This is because high school students have acquired the concept of arithmetic operations in mathematics.

The types of mathematical problems are translation problems, application problems, process problems, and puzzle problems (Lidinillah, 2011). Translation problems are everyday life problems which need to be translated from verbal form to mathematical form, from simple to complex (Lidinillah, 2008, 2011; Tarigan, 2015). The translation problem consists of simple translation problems such as “Mother buys 5 kg of sugar from the market and 1 kg of coffee, while the price of sugar is Rp. 3.800,-/kg and the price of coffee is Rp. 7.200,-/kg. How much rupiah do you have to pay to buy these materials?” and complex translation problems such as “Budi buys 5 kg of type A rice and 3 kg of type B rice. The price for each kg of type B rice is Rp. 500,- from type A. If the average price of the two types of rice is Rp. 3,000,- then calculate the price of each kg of type A rice, for example the price of each kg of type A rice is x rupiah” (Tarigan, 2015).

Application problems provide opportunities for students to solve problems using a variety of mathematical skills and procedures. Process problems, usually to develop steps to formulate specific patterns and strategies in solving problems. Application problems and process problems can train students' skills in solving problems, so that they become accustomed to using certain strategies.

Puzzle problems, often used for recreation and pleasure as a useful tool for affective purposes in learning mathematics (Tarigan, 2015).

In general, math problems in schools are divided into two, namely routine questions and non-routine questions. Routine questions are ordinary practice questions that include the application of a mathematical procedure that is the same or similar to what has just been learned and can be solved by the procedures learned in class, while non-routine or non-routine questions are questions whose solution requires further thought because the procedure does not require further thought. as clear as or not the same as the procedures learned in class (Aisyah, 2008; Direktorat Tenaga Kependidikan, 2008; Herman, 2000; Wahyudi & Budiyono, 2012).

Non-routine questions in the form of story questions, descriptions of phenomena or events, picture illustrations or puzzles (Indarwati et al., 2014). Giving non-routine questions to students means training them to apply various mathematical concepts in new situations, so that in the end they are able to use various scientific concepts they have learned to solve problems in everyday life. (Aisyah, 2008). It is undeniable that most mathematics teachers rarely give mathematics questions to their students in non-routine form, teachers are only fixated on routine questions which only train students mechanistically and are text books (Tandilling, 2012). Non-routine questions can be used as problem solving questions because they use various mathematical concepts, principles, and skills that have been or are being studied (Aisyah, 2008), but routine questions can also be a problem for students if students do not have certain rules that can be used to overcome the gaps in the current situation with the goals to be achieved even though the routine questions have been given to students.

Based on this, it can be concluded that problem solving ability is an activity to find solutions to the gaps obtained from a situation between expectations and reality. Because the problem in this case is a mathematical problem, the gap is obtained when students are faced with math problems and have not found a path to solve math problems.

3N Philosophical Foundations

Niteni, nirokke, and adding Tamansiswa teachings are educational teachings from Ki Hadjar Dewantara. The concept of the 3N approach is in line with the scientific approach, where this learning provides opportunities for students to actively observe, ask questions, collect data, and associate and communicate (Istiqomah et al., 2021).

Several studies have described the definition of Niteni, nirokke, and nambahi. The definition of niteni, nirokke and added as follows: Niteni is a student activity that is characterized by careful use of all five senses, where through these observations detailed/specific and in-depth information is obtained and is connected to the students' prior knowledge.(Damayanti & Rochmiyati, 2019). In this niteni activity, it is also a process of seeking and finding the meaning (nature, characteristics, procedures, truth) of a safety object from the five senses.

Nirokke is imitating examples of models/examples/examples that have been given by teachers/learning resources. This nirokke activity involves thoughts, niteni ways, feelings, and spiritual values integrally and harmoniously through imitating, demonstrating/practicing, and

presenting and, for Examples, imitating with writing, imitating through steps/procedures, imitating with simulations/experiments/practices, imitating by presenting and others. Nambahi is an innovative activity by adding, discovering new things or modifying what has been learned from niteni and nirokke activities to bring out students' creativity and ideas. In adding activities, students can be given freedom in learning, especially in discussion activities to convey various ideas related to the material being studied (Nisa et al., 2019).

The freedom of students to think, act and learn according to the nature of nature through the 3N teachings of Tamansiswa can give birth to creativity from what students have understood before. Through this process, new designs, ideas, or products can be obtained that can be useful for the community. In learning with 3N, students learn more systematically through the stages of niteni, nirokke and adding by recognizing the concept of the material being studied (Niteni), imitating the examples/models/teachers studied (Nirokke), and innovating from what has been learned (Nambahi) (Sibyan et al., 2019). (Siti Anafiah & Endang Hangestiningsih, 2019) added that the niteni activities could be in the form of listening to the teacher's explanation and conducting a literature review by identifying the contents of the reading through the 5W+1H formula. Niroke can be done by discussing doing assignments according to the material that has been listened to. Then, adding activities can be done by presenting the results of the discussion.

Alternative Mathematics Learning Using 3N

Learning mathematics is related to many concepts that are interconnected between one mathematical concept and another (Indiyah et al., 2021). Mastery of mathematical concepts is needed by students in everyday life in solving various problems. The types of skills required to solve a given problem will vary depending on the topic and the way the problem is framed (Adams et al., 2022). They need knowledge of mathematics and its application in real-life contexts to be able to recognize, interpret, determine patterns and relationships, and use mathematical tools to solve problems in their daily lives. (Nurwidodo, 2020). These results indicate that counting needs to be a concern for school teachers. To increase students' interests and attitudes towards learning mathematics, collaborative learning, problem-based learning, games, and other strategic techniques can be used (Mastika Yasa & Bhoke, 2019) (Al-harthy, 2019).

Teachers need to design learning using learning models that are in accordance with the natural nature of children so as to stimulate students' thinking skills to be able to find problems and be able to find solutions to problems related to the material being studied. One alternative learning that can be used is problem-based learning. Through PBL, mathematics learning is associated with everyday problems and all students can be actively involved in learning and developing thinking skills (Puspita et al., 2018).

Students actively involved in learning mathematics can feel the experience directly and are trained to find knowledge in a meaningful and holistic manner (Surya, 2017). Mathematics learning is carried out not only to develop core and essential competencies but also to assist students in improving mathematical competence as a basis for good subject studies and to promote important social skills, especially mathematical communication skills. (Uyen et al., 2022). Learning that is full

of educative interactions with teachers, discussions, small group work, or presentations to clarify the ideas found can provide opportunities for students to face problems, encourage them to actively express their ideas and discuss with people around them to communicate ideas. Mathematical ideas so that their understanding of mathematics is getting stronger (Uyen et al., 2022).

Rote learning is related to students' tendency to use sometimes inefficient and mathematically superficial imitative strategies rather than creating their solutions through reasoning (Sidenvall et al., 2015). The data shows that textbook theory and work examples are hardly used by students when completing textbook assignments (Sidenvall et al., 2015). Therefore, in conducting problem-based learning with the basis of 3N Niteni, Nirokke, and Nambahi students can be invited to use a variety of fun activities, contextual problems, and challenges. PBL Procedures in (Ariyana et al., 2018) by applying 3N can be implemented in the following way.

Tabel 1. Tamansiswa's 3N-Based PBL Syntax

PBL Syntax	Application of 3N
1st Stage Student orientation to problems	Niteni students raised contextual issues. These problems can be addressed from the teacher's direction and found by students themselves through reading materials or activity sheets, video media, demonstrations, and other learning resources.
2nd Stage Organizing students to learn	Students niteni assignments that are directed by the teacher orally or from worksheets, then share with each group member to understand each other's assignments.
3rd stage Guiding individual and group investigations	Students with the group nirokke examples of the modeling that has been given. Each student also revisits what was done from the nirokke process to find the knowledge learned during the investigation process
4th stage Develop and present the work	Students niteni what other friends said in the discussion. They can also supplement the discussion with data analysis and a literature review of the material. then nirokke in compiling a report can add to it by making/designing presentations/presenting works
5th Stage Analyze and evaluate the problem-solving process	Students niteni class discussions, nirokke by noting the newly discovered results, add from the analysis of class discussions to get a complete conclusion.

The approach of Niteni, Nirokke, and Nambahi (3N), assisted by learning media, will help students understand the concept of learning materials. The learning will be more interactive and meaningful because it can arouse curiosity, and stimulate active, interactive students. It is easier to describe a problem, a concept, a process or a procedure that is abstract and incomplete to be clearer and more complete. (Wijayanti et al., 2019). The 3N principle can help teachers overcome difficulties in teaching because this principle has the potential to develop competencies, creativity, and student activities more concretely. (Wijayanti, 2018). Problem-based learning by implementing niteni, nirokke, adding can help students in learning mathematics. At the PBL stage, 3N can be implemented. At the niteni stage, the teacher can provide descriptions, and examples of questions from the material and work together with students on various math problems (Daen et al., 2020).

Students pay close attention to the explanations/descriptions and examples of questions from the teacher about the concepts of the math material being taught. Then students pay attention to how to solve the examples of questions described and try to analyze the instructions in the student worksheets and also analyze the questions so that they are easy to understand.

Teachers can facilitate nirokke activities by first providing modeling. Students cannot find solutions to mathematical problems in their way but by imitating the examples given by the teacher (Puspita et al., 2018). Students can be invited to develop mathematical problem solving from previously identified concepts from the results of the niteni with the teacher's guidance. Addition activities can be facilitated by the teacher by inviting students to write, communicate and present various solutions to problems from the modifying process so that the solutions are easier to understand. Furthermore, concluding activities can be carried out with the teacher.

Student worksheets are provided as a form of written teacher assistance. This worksheet can help students' nirokke activities so that it is easier for them to build their knowledge. The results of the LKS can be seen from the level of student understanding or student success in doing niteni, nirokke, and adding in group discussions and the ability to remember the problem solving that has been given.

Cognitive activation is teaching that encourages active intellectual engagement with learning materials and networks of old and new knowledge (Spreitzer et al., 2022). This is obtained from challenging assignments, challenging class questions/discussions, activation of prior knowledge, and support through metacognition. The teacher plays an important role in setting the learning environment, exploring students' prior knowledge, and building it. Problem-solving is very important to building mathematical concepts so that it can develop students' reasoning and procedural fluency. Therefore, teachers need to provide various problems so that students are able to develop problem-solving competencies.

3N teaching can foster children's creativity by teaching students to recognize and capture the meaning of objects that are observed carefully, observe carefully, pay attention, compare, measure, touch, listen carefully and deeply, structurally, systematically, holistically and involve all the senses so that they are obtained—overall impression or perception. Learning is also done by imitating what is seen, heard, and felt followed by additional activities by completing, perfecting according to individual desires by processing, changing, modifying, innovating, improving, adding, subtracting, and creative thinking processes in order to bring out the principles novelty to cover the shortcomings of the object being observed and imitated(Nisa et al., 2019).

The Problem Based Learning model used in the learning process helps students, either individually or in groups to recognize and understand math problems that are used as problems (Mastika Yasa & Bhoke, 2019). Students are more challenged to be able to find their own way of solving problems from the given math problems. Therefore, teachers should be able to implement every PBL syntax based on niteni and nirokke add well so that learning can run effectively, efficiently and meaningfully. Mathematical concepts can be learned to be understood entirely even though it requires a longer process or time than classical learning. This process causes PBL to be able to

improve students' reasoning in solving problems faced, especially in solving math problems given either individually or in groups.

CONCLUSION

Learning mathematics is important to provide students with the basis for other subjects. The development of science and technology requires the active involvement of students in the future. Learning difficulties faced by students in mathematics require teacher innovation in teaching mathematics. Teachers need to prioritize the introduction of mathematical concepts through contextual problems in each mathematics learning material. Teaching mathematics in the future needs to teach students how to be (to be someone), how to know (how to know), how to do/act (how to do), how to live together (how to live together), and how to transform (how to changing rapidly). Through 3N-based problem-based learning, teachers can carry out various kinds of innovations to help students learn mathematics meaningfully in a fun, challenging and contextual way.

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REFERENCES

Adams, J., Resnick, I., & Lowrie, T. (2022). and geometry performance : Does spatial training transfer to mathematics achievement ? *Mathematics Education Research Journal*, *0123456789*. https://doi.org/10.1007/s13394-022-00416-y

Al-harthy, I. (2019). European Journal of Educational Research. *European Journal of Educational Research*, *8*(4), 91–101.

Ario, M. (2017). Profil penguasaan materi matematika sekolah mahasiswa pendidikan matematika semester VI. *Aksioma: Jurnal Program Studi Pendidikan Matematika*, *6*(3), 385-392.

Ariyana, Y., Pudjiastuti, A., Bestary, R., & Zamromi, Z. (2018). Buku Pegangan Pembelajaran Keterampilan Berpikir Tingkat Tinggi Berbasis Zonasi. In *Direktorat Jendral Guru dan Tenaga Kependidikan*.

Astini, N. K. S. (2019, August). Pentingnya literasi teknologi informasi dan komunikasi bagi guru sekolah dasar untuk menyiapkan generasi milenial. In *Prosiding Seminar Nasional Dharma Acarya* (Vol. 1, No. 1).

Aisyah, N. (2008). Pendekatan Pemecahan Masalah Matematika. In *Pembelajaran Matematika Sekolah Dasar* (pp. 1–34). UNY.

Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative research designs: Selection and implementation. *The counseling psychologist*, *35*(2), 236-264.

Daen, N., Istiqomah, I., & Arigiyati, T. A. (2020). Model Pembelajaran Group Investigation dengan Pendekatan 3N untuk Meningkatkan Motivasi dan Hasil Belajar Matematika. *UNION: Jurnal Ilmiah …*.

Damayanti, S., & Rochmiyati, S. (2019). Telaah Penerapan Tri-N (Niteni, Nirokke, Nambahi) Pada Buku Bahasa Indonesia Kelas Ix Smp. *Jurnal Muara Pendidikan*, *4*(2), 388–397. https://doi.org/10.52060/mp.v4i2.174

Darminto, B. P. (2013). Meningkatkan Kemampuan Pemecahan Masalah Matematis Improving The Ability Of Students ' Mathematical Problem Solving. *Jurnal Pendidikan Matematika Dan Sains*, *1*(2), 101–107

Direktorat Tenaga Kependidikan. (2008). *Strategi Pembelajaran MIPA*. Departemen Pendidikan

Nasional.
Effendi, M. (2016). Correlation between Adversity Quotient (AQ) with IQ, EQ and SQ Among Polytechnic Students Using Rasch Model. *Indian Journal of Science and Technology*, *9*(1), 1–8. https://doi.org/10.17485/ijst/2016/v9i47/108695
Ermawati, E., & Rochmiyati, S. (2020). Implementasi Tri-n (Niteni-nirokke-nambahi) dan Ppk (Penguatan Pendidikan Karakter) pada Perangkat Pembelajaran Teks Deskripsi Kelas VII di SMP. *Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, *9*(1), 8–13.
Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (Vol. 7, p. 429). New York: McGraw-hill.
Herman, T. (2000). *Strategi Pemecahan Masalah (Problem-Solving) Dalam Pembelajaran Matematika*. file.upi.edu/Direktori/FPMIPA/JUR._PEND._MATEMATIKA/196210111991011-TATANG_HERMAN/Artikel/Artikel14.pdf
Hidayat, W., & Husnussalam, H. (2019). The adversity quotient and mathematical understanding ability of pre-service mathematics teacher. *Journal of Physics: Conference Series*, *1315*(1). https://doi.org/10.1088/1742-6596/1315/1/012025
Hourigan, M., & Leavy, A. M. (2022). Elementary teachers ' experience of engaging with Teaching Through Problem Solving using Lesson Study. *Mathematics Education Research Journal*, *0123456789*. https://doi.org/10.1007/s13394-022-00418-w
Indarwati, D., Wahyudi, & Ratu, N. (2014). Peningkatan Kemampuan Pemecahan Masalah Matematika Melalui Penerapan Problembased Learning Untuk Siswa Kelas V SD. *Satya Widya*, *30*(1), 17–27
Indiyah, T., Afifah, D. S. N., Sujono, I. S. S. I., & Fitria, R. (2021). Problematic and Alternative Solution of Mathematics Study During Covid-19 Pandemic. *Proceedings of the 2nd Annual Conference on Social Science and Humanities (ANCOSH 2020)*, *542*(Ancosh 2020), 380–382. https://doi.org/10.2991/assehr.k.210413.088
Istiqomah, I., Agustito, D., Sulistyowati, F., Yuliani, R., & Irsyad, M. (2021). Pelatihan Pengembangan Media Pembelajaran Berbasis Sparkol Videoscribe untuk Meningkatkan Kemampuan 3N (Niteni, Nirokke, Nambahi). *Community Empowerment*, *6*(3), 464–471. https://doi.org/10.31603/ce.4425
Lidinillah, D. A. M. (2008). Strategi Pembelajaran Pemecahan Masalah di Sekolah Dasar. *Jurnal Pendidikan Dasar*, 1–10.
Lidinillah, D. A. M. (2011). Heuristik Dalam Pemecahan Masalah Matematika Dan Pembelajarannya Di Sekolah Dasar. *Jurnal Elektronik Universitas Pendidikan Indonesia*, 1–11.
Mastika Yasa, P. A. E., & Bhoke, W. (2019). Pengaruh Model Problem Based Learning Terhadap Hasil Belajar Matematika Pada Siswa Sd. *Journal of Education Technology*, *2*(2), 70. https://doi.org/10.23887/jet.v2i2.16184
Nisa, A. F., Prasetyo, Z. K., & Istiningsih, I. (2019). Tri N (Niteni, Niroake, Nambahake) Dalam Mengembangkan Kreativitas Siswa Sekolah Dasar. *El Midad*, *11*(2), 101–116.
Nurwidodo, N. M. A. I. I. S. S. (2020). European Journal of Educational Research. *European Journal of Educational Research*, *9*(3), 1089–1103.
Posamentier, A. S., & Krulik, S. (2009). *Problem Solving In Mathematics, Grades 3-6: Powerful Strategies To Deepen Understanding*. Corwin Press
Pratama, L. D., Lestari, W., & Jailani, J. (2018). Implementasi Pendekatan Saintifik Melalui Problem Based Learning Terhadap Minat dan Prestasi Belajar Matematika. *JMPM: Jurnal Matematika Dan Pendidikan Matematika*, *3*(1), 11. https://doi.org/10.26594/jmpm.v3i1.1051
Puspita, M., Slameto, S., & Setyaningtyas, E. W. (2018). Peningkatkan Hasil Belajar Matematika Siswa Kelas 4 Sd Melalui Model Pembelajaran Problem Based Learning. *Justek : Jurnal Sains Dan Teknologi*, *1*(1), 120. https://doi.org/10.31764/justek.v1i1.416
Rizkianto, I. (2013). Norma Sosiomatematik Dalam Kelas Matematika. *Prosiding Seminar Nasional Matematika Dan Pendidikan Matematika*, *November*, 978–979
Safrida, L. N., Susanto, S., & Kurniati, D. (2015). Analisis Proses Berpikir Siswa Dalam Pemecahan Masalah Terbuka Berbasis Polya Sub Pokok Bahasan Tabung Kelas Ix Smp Negeri 7 Jember. *Kadikma*, *6*(1), 25–38
Sarma, S. K. (2015). Qualitative research: Examining the misconceptions. *South Asian Journal of Management*, *22*(3), 176.
Shadiq, F. (2004). *Penalaran, Pemecahan Masalah dan Komunikasi dalam Pembelajaran Matematika*. P4TK MAtematika.
Sibyan, A. L., Setyawan, D. N., Ernawati, T., & Ayuningtyas, A. D. (2019). Implementasi Ajaran Ki Hadjar Dewantara (Niteni, Nirokke, Nambahi) Dalam Lembar Kerja Peserta Didik. *Indonesian Journal of Natural Science Education (IJNSE)*, *2*(2), 198–206.

https://doi.org/10.31002/nse.v2i2.700
Sidenvall, J., Lithner, J., & Jäder, J. (2015). Students' reasoning in mathematics textbook task-solving. *International Journal of Mathematical Education in Science and Technology*, *46*(4), 533–552.
Siti Anafiah, & Endang Hangestiningsih. (2019). Implementation of Learning Models Numbered Head Together Through Tamansiswa Teachings Niteni, Niroke, Nambahi in the Written Indonesian Language Skills Course Elementary School Teacher Education Study Program. *AKSIS: Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, *3*(2), 287–295. https://doi.org/10.21009/aksis.030206
Spreitzer, C., Hafner, S., Krainer, K., & Vohns, A. (2022). Effects of Generic and Subject-Didactic Teaching Characteristics on Student Performance in Mathematics in Secondary School: A Scoping Review. *European Journal of Educational Research*, *11*(2), 711–737. https://doi.org/10.12973/eu-jer.11.2.711
Suherman, E. (2003). *Strategi Pembelajaran Matematika Kontemporer* (UPI & IMSTEP (ed.)).
Surya, Y. F. (2017). Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Hasil Belajar Matematika Siswa Kelas IV SDN 016 Langgini Kabupaten Kampar. *Jurnal Pendidikan Matematika*, *1*(1), 38–53.
Suryadi, B., & Santoso, T. I. (2017). Self-Efficacy, Adversity Quotient, and Students' Achievement in Mathematics. *International Education Studies*, *10*(10), 12. https://doi.org/10.5539/ies.v10n10p12
Triandini, E., Jayanatha, S., Indrawan, A., Werla Putra, G., & Iswara, B. (2019). Metode Systematic Literature Review untuk Identifikasi Platform dan Metode Pengembangan Sistem Informasi di Indonesia. *Indonesian Journal of Information Systems*, 1(2), 63–77. https://doi.org/10.24002/ijis.v1i2.1916
Uyen, B. P., Tong, D. H., & Tram, N. T. B. (2022). Developing Mathematical Communication Skills for Students in Grade 8 in Teaching Congruent Triangle Topics. *European Journal of Educational Research*, *10*(3), 1075–1088.
Wijayanti, A. (2018). THE IMPLEMENTATION OF SIMULATION LECTURE BASED ON THE PRINCIPLE OF NITENI, NIROKKE, NAMBAHI (OBSERVE, IMITATE, INNOVATE) TO IMPROVE THE DISCUSSION SKILLS OF FUTURE MIDDLE SCHOOL TEACHER. *Unnes Science Education Journal*, *7*(3), 272–280.
Wijayanti, A., Widowati, A., Amalia, A., Sujatmika, S., Setuju, S., & Setiadi, B. (2019). The Improving of Productive Questioning Skills Through the 3N Approach Assisted by Learning Videos. *ICSTI*. https://doi.org/10.4108/eai.19-10-2018.2282532
Wijers, M., & de Haan, D. (2020). *Mathematics in Teams—Developing Thinking Skills in Mathematics Education*. https://doi.org/10.1007/978-3-030-33824-4_2
Xiao, Y., & Watson, M. (2019). Guidance on conducting a systematic literature review. *Journal of planning education and research*, *39*(1), 93-112.
Yuwono, A. (2016). Problem Solving Dalam Pembelajaran Matematika. *UNION: Jurnal Ilmiah Pendidikan Matematika*, *4*(1), 6–7. https://doi.org/10.30738/.v4i1.420
Zakiah, N. E. (2019). Matematika pada kompetensi teknik dan bisnis sepeda motor. *Jumlahku: Jurnal Matematika Ilmiah STKIP Muhammadiyah Kuningan*, *5*(1), 31-47.
Zheng, L. (2015). A systematic literature review of design-based research from 2004 to 2013. *Journal of Computers in Education*, *2*(4), 399-420.