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Profile of Statistical Problem-Solving Ability Based on The Mathematical Disposition

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Abstract. Problem-solving abilities and mathematical disposition are two crucial skills developed by students in inferential statistics material. The purpose of this study was to analyze the statistical problem-solving abilities of students in terms of mathematical disposition. The research method used is a qualitative descriptive method with the research subject being four students of mathematics education study program at Universitas Muria Kudus, Indonesia. Data collection techniques used in this study were tests, questionnaires, and interviews. The analysis technique used is data reduction, data presentation, and concluding. The results showed that the problem-solving ability profile of very high mathematical disposition students was classified as good. High mathematical disposition students were able to understand the problems and devise plan problem-solving strategies but were still experiencing the stage of problem-solving and looking back. Students with medium mathematical disposition can only complete with complete steps in one of the four questions given because they are running out of time. Students with low mathematical dispositions do not yet have all the indicators of problem-solving.

INTRODUCTION

Mathematics is a science that can develop the ability to think, discuss, communicate, and contribute to solving everyday problems and the world of work, as well as the development of science and technology [1][2][3][4][5]. Problem-solving is a fundamental skill needed today [6]. The most critical cognitive goal of education (formal and informal) in any educational context is problem-solving [7]. Problem-solving is the work of establishing a correlation between things given and requested [8].

Problem-solving ability is one of the goals of every material presented by lecturers because lecturers as educators are also encouraged to use more challenging tasks in teaching mathematics and are willing to teach mathematics through problem-solving [9][10][11]. A pre-service teacher-student also needs to understand and learn about the ability to design learning, implement learning and evaluate learning outcomes, especially to explore problem-solving so that later after becoming a teacher, they can learn well and professionally [12].

In the higher education curriculum of the Mathematics Education study program, Universitas Muria Kudus (UMK), the Inferential Statistics course is a compulsory subject with a weight of 3 credits. Inferential Statistics is a material that forms the basis for subsequent courses, such as an introduction to mathematical statistics course and

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educational research statistics course. This Inferential Statistics course is essential in testing the hypothesis of a problem and interpreting the test results for decision making**.**

Importance course inferential statistics is not in line with existing conditions. Based on the results of the problem-solving test, 78% of students scored below the minimum criteria. It shows the low problem-solving ability of students. The results of interviews with students, some said that the Inferential Statistics course is challenging because 1) Students cannot understand the problem given so that it is challenging to choose the type of statistical test to be used; 2) Students are not familiar with non-routine questions; 3) Students are not familiar with using statistical hypothesis testing steps, and; 4) Students have not been able to develop their ability to solve problems. The low problem-solving ability of students is also due to the lack of student curiosity in learning and lack of confidence in answering questions.

Learning is not only limited to developing the cognitive realm. Learning should contain and develop students' affective aspects, which are the critical components for their success in learning [13][14]. Problem-solving ability and mathematical disposition are two related things. In solving problems, students need to have a high mathematical disposition. Mathematical disposition is a tendency to think and act positively, which includes encouraging desire, awareness, and dedication in students to learn and carry out the mathematics learning process [15][16][17][18]. Mathematical disposition is one of the main factors in determining the success of learning mathematics [19][20][21][22]**.** Disposition needs to be developed in learning mathematics through collaboration between lecturers and students [23][24].

Mathematical disposition is a connection and appreciation of mathematics, namely the tendency to think and act positively [15]. This tendency is reflected by the student's interest and confidence in learning mathematics and the willingness to reflect on their own thinking. Mathematical disposition indicators include: 1) Self-confidence; 2) Flexibility in mathematics; 3) Persistent and tenacious in doing mathematical tasks; 4) Having curiosity; 5) Reflective of ways of thinking; 6) Appreciate the application of mathematic, and; 7) Appreciate the role of mathematics [25].

Seeing the importance of problem-solving ability and mathematical disposition, the researcher analyzes problem-solving ability in terms of mathematical disposition ability. The problem-solving steps used in this study use the Polya indicator, which consists of four phases of problem-solving, namely: 1) Understanding the problem; 2) Devising a plan; 3) Carrying out the plan, and; 4) Looking back at all the steps that have been done [26]. By knowing students' mathematical problem-solving abilities, lecturers can prepare special strategies for the development of better inferential statistics learning.

METHOD

The research method used is the descriptive qualitative method. This research was conducted in the mathematics education study program, Universitas Muria Kudus. The subjects of this study were four students who took courses in inferential statistics with different mathematical disposition criteria. Determination of the subject in this study begins with the provision of disposition questionnaires to 28 students. Yuniawati, Indrawan, and Setiawan [25] proposed the mathematical disposition questionnaire regarding disposition indicators. Then students are grouped into four categories based on the results of the questionnaire. The four categories that can be shown in Table 1 are students with very high, high, medium, and low mathematical disposition abilities. The grouping of the four categories refers to the rating scale [27].

TABLE 1. Mathematical disposition score criteria disposition.

Score	Criteria
$81.25 \leq$ disposition score 100	Very High
$62.5 \leq$ disposition score < 81.25	High
$43.75 \leq$ disposition score < 62.5	Medium
$25 \leq$ disposition score < 43.75	Low

Instruments used in this research are mathematical disposition questionnaire instruments, problem-solving test results documents, and interviews. The disposition questionnaire instrument consists of 30 questions. The test instrument is used to get the results of student work in solving mathematical problem-solving abilities. Problem-solving ability test questions consist of 4 subjective tests in the form of descriptions given codes (M1, M2, M3, and M4). Interviews were used for technical triangulation, namely comparing and re-checking the problem-solving

process carried out by students so that the credibility of the data was obtained. Data analysis techniques used include data reduction, data presentation, and concluding [28].

RESULT AND DISCUSSION

Student's Mathematical Disposition Questionnaire

The subject of the research was determined by giving a questionnaire to 28 students of the UMK Mathematics Education study program who took the inferential statistics course. Students' mathematical dispositions categories were very high, high, medium, and low based on the disposition questionnaire data obtained. Based on the mathematical disposition questionnaire, the results obtained: as many as four students belonging to the category of very high mathematical disposition, six students belonging to the category of high mathematical disposition, seven students belonging to the category of medium mathematical disposition, and as many as 11 students belonging to the category of low mathematical disposition. The results of the disposition questionnaire are presented in Table 2.

TABLE 2. Results of the questionnaire of mathematical disposition.

Category of Disposition	Many students
Very High	4
High	6
Medium	7
Low	11

Table 2 provides information that many students still fall into the category of low mathematical disposition. This low mathematical disposition causes students to look unconfident when working on problems, not confident in answering questions during learning, not confident when presenting the results of discussions, not setting targets in learning mathematics, and not caring about the math scores they get [29]. Meanwhile, students with a high mathematical disposition will have an uncompromising attitude, be responsible, persistent, have high motivation, and help individuals achieve their best results [30].

Profile of Problem-Solving Ability of Very High Mathematical Disposition Students

Subjects of very high mathematical disposition (S1) can understand M1, M2, M3, and M4 questions by writing down available information. S1 can write fluently and correctly what is known on the four questions. S1 can construct problem-solving by identifying the components of the problem that exist by directly integrating their new perceptions or experiences into the schemes in their minds.

In relation to understanding the problem in M2, the researcher conducted interviews with S1, summarizing the dialogue as follows.

R : *"How did you find out what was asked in the question?"*
S1 : *"By analyzing the problem."*
R : "*Can you make symbols from what is known and asked from the problem? and give an example!"*
S1 :" Yes, *x*."
R : *"What is meant by x."*
S1 : *"Average or mean?"*
R : *"Are you having difficulty understanding these elements?"*
S1 :*"No, because I am used to working on questions like this and am interested in working on questions. However, I forgot to write down the questions asked from the questions.*

In understanding the M1, M2, M3, and M4 problems, S1 analyzed the questions and made symbols from what they knew. S1 can present the information obtained from the questions in symbolic representations that involve systematic mathematical expressions. Even though they can write down information about the questions, S1 does not write down the purpose of solving the problem. Still, after confirmation, the problem-solving results obtained are constructed correctly. After reading and understanding the questions, the SIN subject is confident that he can solve

the given problem. S1 is also accustomed to working on non-routine problems because he is interested (high mathematical disposition).

The second step of solving the Polya model of mathematical problems is to devise a plan. S1 can write problem-solving techniques on M1, M2, and questions M3, but M4 did not do the planning. S1 uses information from M1 as a plan to solve M4 questions. The plan prepared by S1 on the matter is sufficient to be used as a guide to solving the problem. S1 can receive information from the four questions so that they can plan problem-solving.

In relation to planning problem-solving on M1 questions, the researcher conducted an interview with S1, summarizing the dialogue as follows.

R : "*Why is there a difference between grab and gojek in problem-solving*?"
SIN : "*To make it easier to do the problem."*
R : "*Are you working on the M1 problem? You immediately find the right strategy?"*
SIN :*"No, I'll try it first."*

In the third step in problem-solving, the SIN subject can carry out the problem-solving plan that has been prepared. S1 managed to answer the four questions correctly without experiencing significant obstacles. In solving the M1 problem, the S1 subject has also carried out an abstraction thinking process because the solution has used mental objects, namely some algebraic symbols. S1 subjects can perform calculations correctly on all questions.

The final step in the problem-solving process is to re-examine the answers. S1 subject can re-examine the answers smoothly but in the look back the answers through an existing system of equations. S1 is able to make inferences on the results of calculations that have been obtained according to the purpose of the question. S1 believes that the steps to solving the problems he has written are correct because they are systematic and in accordance with the problems of each question. The problem-solving ability profile of S1 is presented in Table 3.

TABLE 3. Problem-solving ability profile of very high disposition student.

No.	Steps for Solving Problems	Indicators
1.	Understanding the problem	a. Able to present information that is known from the problem in the form of symbols and mathematical expressions
		b. Not writing down the objectives or what is being asked of the problem
2.	Devising a Plan	a. Able to write formulas that are used sequentially
		b. Able to formulate settlement strategies in a coherent manner
		c. Able to use information from the step of understanding the problem
3.	Carrying out the plan	a. Able to carry out problem-solving according to the planned strategy
		b. Able to perform calculations correctly
4.	Looking back	a. Able to check the results
		b. Able to check the reasons put forward
		c. Able to make interpretation of the results by writing conclusions

S1 answers with a very high mathematical disposition can be seen. Students can represent what is known and what is asked in the form of symbols. Even in making a mathematical model of a problem in everyday life, students are able to answer correctly. Students with high mathematical dispositions are confident and confident in answering questions so that students' numeracy skills are very good, so that accurate and correct results are obtained [31]. At the completion stage, students re-examine the answers that have been done. It can be seen from the results obtained are correct and correct. This is reinforced by the results of interviews with students with high mathematical disposition categories who said they had no difficulty in solving problems and could understand the questions well. This was because students were used to non-routine questions. Problem-solving abilities can develop rapidly by getting them used to solve non-routine problems [32].

Profile of Problem-Solving Ability of High Mathematical Disposition Students

S2 subject is the subject with a high category of mathematical disposition. In understanding M1, M2, M3, and M4, NK is able to write down what they knew. S2 can write fluently and correctly what is known in M1 answers and use the information to understand M2, M3, and M4 problems. S2 can directly integrate their new perceptions or experiences into the schemes in their minds, so it can be said that NK carries out the thinking process. In relation to understanding the problem in the four questions, the researcher interviewed with M1 to summarize the dialogue below.

R : *"How do you find out what is known to be asked in the question?"*
S2 *: "Reread the questions until you understand."*
R *: "How many times have you read the questions so that you understand?"*
S2 *:" Three times"*
R *:" Do you know what was asked in questions M1, M2, M3, and M4?"*
S2 *: "Yes, I know. M1 was asked about the interval estimate of the actual average difference in the income of Gojek and Grab drivers with a degree of confidence of 90%. M2 is asked about the estimated interval for the actual average of GRAB drivers every day. M3 is the alleged income of GOJEK online motorcycle taxis of more than Rp. 80.000,00, and M4 is whether 35% of GRAB drivers earn a minimum of Rp. 85,000.*

S2 did not write down the objectives that were asked in the question. However, S2 understands what is being asked in the question. S2 rereads the questions until he knows the description of the problem presented by the question. S2 subject understands the problems expressed in the form of symbols and mathematical expressions.

The plan prepared by the S2 subject on the M3 question cannot be used as a guide to solving the problem. Although in writing the plan to solve the problem, the S2 subject did not write correctly, from the interviews, it was known that the NK subject had been able to plan well. The results of interviews between researchers and S2 are as follows.

R *: "What is the hypothesis used in the M3 question?"*
S2 *: "* $H_0 = \mu = 80$ *and* $H_0 = \mu > 80$ *"*
R *: "Are both* H_0 *?"*
S2 *: "One, that the other* $H_{a,}$*dijawaban slipshod write"*
R *: "Why is the test used a right hand?"*
S2 *: "Because what was asked about the alleged income of GOJEK online motorcycle taxis was more than Rp. 80.000,00, and there was a word more than that, the test used was the right-hand test."*

In the step of solving the problem, S2 can carry out problem-solving on the four questions. In answer M4, S2 constructs problem-solving by performing test statistics looking for z count. Then write down the test criteria and look for a z-table. However, in writing the criteria for testing S2 it is still not quite right.

At the look backstage, S2 is resolved by being able to prove the answer is correct. In connection with re-examining the answers to M2 questions, the researchers conducted interviews with NK subjects as follows.

R *: "Did you check all the questions above for the answers?"*
S2 *: "No"*
R *: "Are you sure your answer is correct?"*
S2 *: "Yes, I am sure."*

At this stage, S2 is sure that the answers to the completed test are correct, even though the answers are written are not correct. The step of interpreting the calculation results into the problem objective has also not been carried out by the S2 subject on M2, M3, and M4. The processing step stops after obtaining the calculation results. It means S2 has not carried out a complete re-check.

Students who have high dispositional abilities have a positive correlation with problem-solving abilities. Students with a high mathematical disposition will have higher mathematical problem-solving abilities, and vice versa [33]. Students who have a very high and high mathematical disposition will have high problem-solving abilities as well. Students with high mathematical dispositions have high confidence that they can solve all problems

correctly. Students have high curiosity, as evidenced by reading the questions repeatedly to understand the situation and the known elements of the questions. They are also thorough and systematic in planning problem-solving strategies. Students understand the learning material well to distinguish the characteristics of the questions and formulas used. Students with high mathematical dispositions are also persistent and never give up on completing calculations [31]. At the look backstage, students can re-examine the answers obtained and provide an interpretation of the results according to the purpose of the question. Table 4 represents the profile of S2 problem-solving abilities.

TABLE 4. Profile of problem-solving ability of high disposition student.

No.	Problem-Solving Steps	Indicator
1.	Understanding problem	a. Able to present information that is known from the problem in the form of symbols and mathematical expressions
		b. Unable to write down the purpose or what is being asked of the problem
2.	Devising a plan	a. Able to write formulas used sequentially
		b. Able to formulate settlement strategies in a coherent manner
		c. Not yet able to Prepare criteria for receiving Ho correctly.
		d. Not yet able to use information from the steps to understand the problem
3.	Carrying out the plan	a. Able to carry out problem-solving according to the planned strategy.
		b. Have not done calculations correctly
4.	Looking back	a. Have not been able to check the results completely.
		b. Able to give reasons for the answers put forward
		c. Have not interpreted the results but believe the answer is correct

Profile of Problem-Solving Ability of Medium Mathematical Disposition Students

The problem-solving ability profile of medium disposition students is presented in Table 5.

TABLE 5. Profile of problem-solving ability of medium disposition student.

No.	Problem-Solving Steps	Indicators
1.	Understanding the problem	a. Able to present information that is known from the problem in the form of symbols and mathematical expressions
		b. Unable to write down the purpose or what is being asked of the problem
2.	Devising a plan	a. Unable to write formulas correctly.
		b. Unable to develop strategies for all questions.
		c. Unable to compile criteria for acceptance of Ho correctly
		d. Not able to use information from steps to understand the problem
3.	Carrying out the plan	a. Not able to carry out problem-solving systematically
		b. Not able to do calculations correctly
4.	Looking back	a. Not able to check the results thoroughly.
		b. Able to give reasons for the answers put forward
		c. Have not interpreted the results and are not sure the answer is correct

S3 is the subject with the medium mathematical disposition category. At the stage of understanding the subject matter, S3 can represent what is known and what is being asked in the form of symbols. The following are the results of the researcher's interview with S3.

R : "*How do you understand the problem in the question*?"
S3 *:" Reread"*
R :" *Do you have difficulty understanding the questions?*
S3 : "*There are some questions that I don't understand, Question M4."*
R : *"In question M1, what is meant by* n_1 *and* n_2 *?"*
S3 *:"* n_1 *is the number of data grabs and* n_2 *is the number of gojek data "*

At the stage of understanding the problem, S3 wrote that what was known to questions M1, M2, M3 was correct, but tS3still had difficulty understanding the M4 problem. S3 cannot directly, or students need a process (such as rereading existing problems or so on) to write down what is known and what is asked in the problem. Reading ability is the main factor for students to understand the occurrence of problems [34].

S3 cannot directly or require a process to make a plan for solving a given problem according to what is known from the problem (such as making tables, trying to make plans on other papers, or making steps other work). At this stage, students perform a series of thinking processes in solving problems [35]. In planning the M1 questions, S3 planned by looking for the average grab data and the average data gojek, then looking for the t table. S3 was only able to plan half of the problem-solving strategies on M2, M3, and M4. S3 felt hampered in completing because they were confused in choosing a formula strategy. Difficulty in choosing the right strategy is due to a lack of good understanding of mathematical concepts [36].

At the carry out the planning stage, S3 is only able to complete M1 questions. However, the answer submitted by S3 is still wrong. This is due to incorrectly writing the standard deviation formula. S3 cannot solve problems M2, M3, and M4.

Below are the results of an interview with S3.

R :*"Are you able to solve the problem smoothly?"*
S3 :*"No, I'm having a hard time doing the questions."*
R *: "What kind of difficulties did you experience?"*
S3 *: "Confused, enter the formula."*

S3 is only able to interpret the results on M1 questions. S3 did not re-check the M2 and M3 questions because they had not completed all the calculation steps. S3 felt they lacked time to complete and were hampered in completing because they were confused about choosing strategies. The following are the results of the researcher's interview with the S3.

R *: "Did you check all the questions above for the answers?"*
S3 : "*No."*
R : "*Are you sure with your answer?"*
S3 *: "I'm not sure because it's really difficult."*

Profile of Problem-Solving Ability of Low Mathematical Disposition Students

The S4 subject is the subject with a low criterion mathematical disposition. In step understanding the problem, S4 can only identify known problems in a matter of M2. S4 subject has not been able to identify problems M1, M3, and M4. Another contributing factor was that S4 was unable to coordinate the information provided [37]. Students with low categories cannot process their data properly because students forget the material they have learned. S4 feels insecure because they have not been able to learn the subject matter to be tested. S4 found it difficult to understand the questions and gave up with simple answers. S4 did not have the persistence to find a solution because he didn't write anything for the M4 solution.

S4 has not understood the questions given, but they are still trying to work on it. It is in accordance with the research that has been done that students try to solve problems, even though they do not understand the questions given, which results in errors in answers [38]. As a result, they find it difficult and give up with modest answers. In other words, these students do not have the persistence to find solutions. Re-examining the problem that was originally in the form of a story into a mathematical model becomes a problem for students in solving problems [39].

The second step is to plan a solution to the problem. S4 could not proceed to the planning step because they did not understand the purpose of the questions. At this stage, the S4 had difficulty, indicated by the S4 only being able to plan strategies for M2 and M3 questions.

The following are the results of the researcher's interview with the S4 subject.

R :*"What is your strategy to answer the M1 question?"*
S4 :*"Dividing it into two grab and gojek."*
R *: "What difficulties did you experience?"*
S4 *: "The problem is difficult. I don't understand the situation in problem so I can't make the decide to use the right statistical test for the situation."*

S4 subject can only formulate a settlement plan. However, at the step of solving the problem, S4 had difficulty in doing calculations. It happened because the S4 subject had not identified the known elements, which resulted in S4 feeling in determining the formula used. Based on the interviews with S4, they said that they had difficulty understanding statistical material and were confused by the different use of hypothesis testing formulas for different cases. Most students are still confused when faced with different questions and cases [36]. Students who have difficulty in understanding concepts will have difficulty in solving [40].

The low mathematical disposition of students is very influential in solving problem-solving problems. Students with low mathematical dispositions will feel unsure of the answer [41]. This is also experienced by S4 subjects who are not sure of the truth of the results that have been obtained. It can even be said that S4 is desperate for answers to questions M3 and M4.

S4 subject is not sure of the truth of the results that have been obtained, so they did not check again. The weakness of students in solving problem-solving is at the stage of looking back at the answer [42]. Table 6 express the problem-solving ability of S4. According to Table 6, S4 cannot reach all problem-solving indicators.

TABLE 6. Problem-solving ability profile of low disposition student.

No.	Problem-Solving Steps	Indicators
1.	Understanding the problem	a. Unable to present information that is known from the problem in the form of symbols and mathematical expressions
		b. Unable to write down the purpose or what is asked of the problem
2.	Devising plan	a. Unable to write formulas correctly
		b. Unable to develop strategies for all questions.
		c. Have not been able to use information from the steps to understand the problem
3.	Carrying out the plan	a. Have not been able to carry out problem-solving systematically
		b. Unable to do calculations correctly
4.	Looking back	a. Not able to check the results completely.
		b. Able to give reasons for the answers put forward
		c. Have not made an interpretation of the results and are not sure the answer is correct

CONCLUSION

Based on the results and discussions in this study, the conclusions obtained are that students with very high mathematical dispositions are able to solve problem-solving well. At the stage of understanding the problem, the student does not write down the purpose of the problem but immediately solves the problem. Students with high mathematical dispositions are able to understand problems and plan problem-solving strategies. However, the student is still experiencing some problems in solving the problem, namely at the stage of problem-solving and re-checking. The student already feels confident with the answer, so that he does not re-check the results of the calculation and does not make conclusions. Students with medium mathematical dispositions are only able to solve one of the four questions given because they are running out of time. Students are only able to write elements that

are known from the other three questions. Students with low mathematical dispositions do not yet have all the indicators of problem-solving.

REFERENCES

1. D. P. Sari and Mahendra, "Developing instrument to measure mathematical reasoning ability," in *1st International Conference of Mathematics and Science Education (ICMSEd)* (Atlantis Press, Paris, France, 2016), pp. 30-33.
2. D. Muhtadi, Wahyudin, B. G. Kartasasmita, and R. C. I. Prahmana, J. Phys. Conf. Ser. **943**, 1-8 (2018).
3. R. Rahayu, H. Ulya, Kartono, Isnarto, and N. Kurniasih, Int. J. Eng. Technol. **7**, 413-417 (2018).
4. M. Genc, A. K. Erbas, Int. J. Educ. Math. Sci. Technol. **7,** 222–37 (2019).
5. A. K. Kenedi, Y. Helsa, Y. Ariani, M. Zainil, and S. Hendri, J. Math. Educ. **10,** 69-80 (2019).
6. R. Foshay, J. Kirkley, *Principle for Teaching Problem Solving*, (Learning Inc., Plato, 2003).
7. D. Jonassen, "Research issues in problem-solving," in *The 11th International Conference on Education Research* (IATED, Valencia, 2010).
8. M. Z. Aydogdu and C. A. Kesan, J. Educ. Instr. Stud. World **4**, 2146-7463 (2014).
9. M. K. Stein, R. A. Engle, M. S. Smith, and E. K. Hughes, Math. Think Learn **10**, 313-340 (2008).
10. J. Cheeseman, D. M. Clarke, A. Roche, and K. Wilson, "Teachers' views of the challenging elements of a task," In *Proceedings of MERGA 36 annual conference of the Mathematics Education Research Group of Australasia*, (MERGA, Melbourne, 2013).
11. J. Russo, Int. J. Innov. Sci. Math. Educ. **27**, 14-24 (2019).
12. A. A. Nugroho, D. Juniati, and T. Y. E. Siswono, Int. Conf. Math. Sci. Educ. Univ. Pendidik. Indones. **3**, 820-824 (2018).
13. A. Haryono and T. Benediktus, J. Honai Math. **1**, 127-138 (2018).
14. P. Rahmasantika, J. Honai Math. **1**, 81-92 (2018).
15. NCTM, *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, Reston VA, 2000).
16. L. G. Katz, J. Raths, Teach Teach Educ. **1**, 301-307 (2005).
17. U. Sumarmo, *Berpikir dan Disposisi Matematik: Apa, Mengapa, dan. Bagaimana Dikembangkan pada Peserta Didik* (UPI Press, Bandung, 2010).
18. H. Hendriana and U. Soemarmo, *Penilaian Pembelajaran Matematika* (PT Refika Aditama, Bandung, 2017).
19. D. T. Choridah, Infin. J. **2**, 194–202 (2013).
20. H. Sugilar, J. Ilm. Progr. Stud. Mat. STKIP Siliwangi Bandung **2**, 156-168 (2013).
21. M. Ikhsan, S. Rizal, J. Didakt. Mat. **1**, 71-82 (2014).
22. P. Akbar, A. Hamid, M. Bernard, and A. I. Sugandi, J. Cendekia **2**, 144-153 (2018).
23. R. Rahayu, H. Ulya, Kartono and Isnarto, J. Adv. Res. Dyn. Control Syst. **11**, 366-373 (2019).
24. H. Ulya and R. Rahayu, J. Medives **2**, 183-194 (2018).
25. R. P. Yaniawati, R. Indrawan, and G. Setiawan. Int. J. Instr. **12**, 693-654 (2019).
26. G. Polya, *How to Solve It? 2nd* (Princeton University Press, New Jersey, 1985).
27. R. Rahayu, H. Ulya, Kartono, and Isnarto, *Asesmen Kolaboratif pada Pembelajaran Etnomatematika untuk Mengukur Kemampuan Berpikir Matematis dan Disposisi* (Pena Persada, Banyumas, 2019).
28. M. B. Miles, A. M. Huberman, and J. Saldana, *Qualitative Data Analysis, A Methods Sourcebook, Edition 3,* (Sage Publication, USA, 2014).
29. M. S. Ramadhani and D. A. Tika. Elem Sch. Special Edition, 37-48 (2020).
30. N. Widyasari, J. A. Dahlan, and S. Dewanto, Fibonacci J. Pendidik Mat. Mat. **2,** 28-39 (2016).
31. E. Salmaniah, Yusmin, and A. Nursangaji, J. Pendidik dan Pembelajaran Khatulistiwa **5**, 1-3 (2016).
32. R. Utami and D. Wutsqa, J. Ris. Pendidik. Mat. **4**, 166-175 (2017).
33. R. Rahayu, Kartono, and Sulhadi, Int. J. Sci. Res. **3**, 1315-1318 (2014).
34. M. P. Carlson, B. Madison, and R. D. West, Int. J. Res. Undergrad. Math. Educ. **1**, 209-233 (2015).
35. J. Sukoriyanto, N. Toto, Subanji, and T. D. Chandra, Educ. Res. Rev. **11**, 1494-1499 (2016).
36. Sandie, Purwanto, Subanji, and E. Hidayanto, Int J. Humanit. Innov. **2**, 42-47 (2019).
37. M. P. Carlson, S. Jacobs, E. Coe, S. Larsen, and E. Hsu, J. Res. Math. Educ. **33**, 352 (2002).
38. H. D. Putra, A. Putri. A. N. Lathifah, and C. Z. Mustika, JNPM (Jurnal Nas. Pendidik Mat.) **2**, 48-61 (2018).
39. Masrurotullaily, Hobri, and Suharto, Kadikma **4**, 129-138 (2013).

40. H. Ulya and R. Rahayu, J. Phys. Conf. Ser. **1823,** 1-7 **(**2021).
41. Q. Aini, J Medives J. Math. Educ. IKIP Veteran Semarang **3**, 197-207 (2019).
42. J. Hermaini and E. Nurdin, JURING J. Res. Math. Learn **3**, 141-148 (2020).