AKSIOMA: Jurnal Program Studi Pendidikan Matematika
Volume 11, No. 3, 2022, 2555-2566

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

MATHEMATICS SOFTSKILL: THE LEVEL OF MATHEMATICS PRE-SERVICE TEACHER STUDENT IN PROBLEM SOLVING

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Received 15 July 2022; Received in revised form 27 August 2022; Accepted 28 September 2022

Abstrak

Kemampuan memecahkan masalah matematika merupakan salah satu tujuan dalam pembelajaran matematika yang perlu dicapai, sehingga butuhn ditekankan sebagai pencapaian kompetensi pembelajaran matematika. Penelitian ini bertujuan untuk mengetahui kategori tingkat kemampuan pemecahan masalah matematis siswa saat pembelajaran menggunakan e-learning. Jenis penelitian ini merupakan penelitian deskriptif dengan metode kuantitatif. Sumber data diperoleh dari nilai tes kemampuan pemecahan masalah matematika yang dikerjakan oleh 32 mahasiswa program studi Pendidikan matematika. Teknik analisis data yang digunakan adalah analisis deskriptif untuk mengkategorikan kemampuan pemecahan masalah matematis siswa. Hasil Penelitian ini menunjukkan bahwa kategori kemampuan pemecahan masalah siswa pada tes matematika dalam pembelajaran online termasuk dalam kategori cukup. Untuk indikator mengidentifikasi unsur-unsur yang diidentifikasi, ditanyakan, dan kecukupan rincian yang dibutuhkan sangat tinggi. Kemudian, aspek merumuskan masalah matematika atau menyusun model matematika termasuk dalam kategori tinggi. Namun sebaliknya, hasil penelitian menunjukkan bahwa siswa yang menerapkan strategi untuk memecahkan masalah, termasuk dalam kategori rendah untuk indikator yang menjelaskan atau menginterpretasikan hasil pemecahan masalah.

Kata kunci: pemecahan masalah, e-learning, level kemampuan, kompetensi matematika.

Abstract

The ability to solve mathematical problems is one of the goals in learning mathematics that needs to be achieved, so it needs to be emphasized as the achievement of mathematics learning competencies. This study aims to determine the category of students' mathematical problem-solving ability levels when learning using e-learning. This type of research is descriptive research with quantitative methods. The data source was obtained from the test scores of mathematical problem-solving abilities carried out by 32 students in the Mathematics Education study program. The data analysis technique used is descriptive analysis to categorize students' mathematical problem-solving abilities. The results of this study indicate that the category of students' problem-solving abilities on mathematics tests in online learning is included in the excellent category. For indicators to identify the elements identified, asked, and the adequacy of the required details is very high. Then, the aspect of formulating a mathematical problem or compiling a mathematical model is included in the high category. On the contrary, the study results show that students who apply strategies to solve problems are included in the low category for indicators that explain or interpret problem-solving results.

***Keywords**: problem soving, e-learning, level skill, mathematics competencies*

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

INTRODUCTION

Learning in higher education also aims to hone students' problem-solving skills. It is no less important than developing students' mathematical soft skills. Linear programming course did not use as a medium to develop students' problem-solving and soft mathematical skills. Through the problem material in linear programming, students were expected to be able to perform an analysis related to the existence of constraints and the optimal point of a function or problem-solving goal (Arfiana & Wijaya, 2018). Indirectly, the lecture material could be used by students to implement mathematical concepts and strategies in marketing activities. This activity can provide students with the experience to develop soft skills after graduation.

In the current digitalization era, the scope of work from various fields of study can be considered superior human resources. Soft skills can be seen from various aspects because the attributes that accompany them are a person's characteristics (Cimatti, 2016). Therefore, a person's soft skills can be seen because they have been possessed at different amounts and levels. In developing these soft skills, everyone must continue to hone and practice them through learning activities and the person wants to develop their soft skills (Murni et al., 2013). The soft mathematical skills students possess can be obtained from the experience of their activities through learning mathematics during lectures. It was because these soft skills prioritize self-awareness through self-confidence, self-assessment, character and emotional awareness, and social awareness, as seen in cooperation, teamwork, utilizing diversity, and synergism (Sujadi et al., 2018). When students practice linear programming learning, students will practice solving problems with specific constraints and achieving optimal objective functions.

Graduates of the Mathematics Education study program prepare students to be able to become mathematics teachers and also be able to work in their fields even though they are not teachers (Murtafiah et al., 2018). Therefore, lectures in the Mathematics Education study program teach students to communicate effectively, work together in teams, carry out assignments disciplined, work hard, think critically, have creativity, and be confident. The learning experience that facilitates the above will make the graduates of Mathematics Education students with superior knowledge abilities in the field of their competencies. Because someone called a quality human resource is not only required to have hard skills but also soft skills that continue to develop (Susan et al., 2013).

Based on Indonesian government rules on national education objectives, one of the goals of mathematics is that students can have the ability to solve problems that include the ability to understand issues, mathematical design models, solve models and interpret the solutions obtained (Estriyanto et al., 2017) Problem-solving ability is the ability of students to solve routine and non-routine problems in the field of mathematics. To determine the skills of students, the teacher uses the results of student work. Then, they analyzed to find out their ability to understand the information presented on the questions. Also, what is asked, solve contextual problems through mathematical concepts and principles, and conclude

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

and argue in interpreting solutions (Ismail & Al Allaq, 2019).

Routine problems are problems that the procedure for solving is algorithmic repetition. Students' mathematical abilities at level 1 or necessary are described as answering questions in a familiar context with all relevant and needed information presented (Unal & Unal, 2017).

The questions in the questions are clearly defined. Furthermore, they can carry out routine procedures in the resolution process with direct instructions on explicit problems (OECD, 2013). While non-routine issues are problems for which the method of solving requires reasoning, guessing, or prediction, looking for a simple formula to find a solution (Tang & Venkataraman, 2016).

Even though the ability to think critically, have creativity, self-direction, and innovation (Sujadi et al., 2019) are not new things in the 21st century. There needs to be a fine-tuning of abilities. All these abilities will be relevant to the needs of the times if non-routine work is not only valued (Azreen & Mohamed, 2015). however, the work can be expected as a basis of need. The result is a superior ability (Hobri et al., 2020).

Soft skills can be divided into two categories: intrapersonal and interpersonal. one of the attributes of intrapersonal skills includes soft skills (Ismail & Al Allaq, 2019), as seen from proactivity, conscience, time/source management, trust, worthiness, self-control, and improvement. The other attribute is self-awareness in terms of emotional awareness, trait & preference, self-assessment, and self-confidence. Interpersonal attributes are seen in social awareness, which is seen by political awareness, developing others, leveraging diversity, service orientation, empathy, and social skills (leadership, influence, communication, conflict management, cooperation, teamwork, and synergy) (Zhang, 2012).

Another opinion states that soft skills are also known as skills in controlling personality, such as ethics, interacting with others, listening, and engaging in communication/talk (Kim et al., 2019). In other words, soft skills are a person's interpersonal behavior that maximizes humanistic performance and skills related to other people through cooperation or communication. Things that help someone in developing their soft skills are communication skills, vision, being accustomed to working in groups, daring to take risks, honesty and punctuality, responsibility, and obedience to worship (Susan et al., 2013).

Based on the description above, this study aims to determine the level and category of students' mathematical problem-solving abilities with soft skills characteristics by adjusting mathematics generative learning strategies, including communication skills, teamwork, creativity, critical thinking, self-confidence, and problem-solving in math problems (Tican & Deniz, 2019). With learning planned, directed, and supported through learning experiences, students will have the endurance and enthusiasm to work hard (Meutia et al., 2018). In addition, learning independence will also be honed by having a responsive, confident, and initiative attitude. Responsiveness means that students are responsive to problems involving themselves and the environment.

ISSN 2089-8703 (Print)
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METHOD

This type of research is descriptive research with a quantitative approach method. The results of quantitative data analysis are used to determine students' problem-solving abilities in the Mathematics Education study program. The data was obtained from the results of the problem-solving ability test in the linear programming course. The design used in quantitative research is Post-test-Only Control-Group Design. The achievement of learning outcomes is that students can show the results of solving linear program problems by reflecting all indicators of problem-solving ability assessment. These are namely identifying the elements that are known, asked, and the adequacy of the components needed (A), formulating mathematical problems or compiling mathematical models (B), implementing strategies to solve problems (C), and explaining or interpreting problem-solving results (D). Technical analysis of quantitative data is descriptive statistics using tables and percentages to categorize mathematical problem-solving abilities. The research subjects in this study were 32 students of the Mathematics Education study program in the 7th semester of the 2020/2021 academic year. Data collection techniques used in this research are documentation and tests. Documentation is used to obtain data on student names and competencies obtained by students in prerequisite courses before the linear program, which is required as research data. The test method is used to get the value of students' problem-solving ability in the research class.

Data collection techniques used in this study are Problem Solving Ability Test and documentation. Students did tests individually to determine the extent of students problem-solving abilities with the linear programming material. Documentation is used to obtain visual data, photographs of data, and student grades. The documentation results are used to complete the data needed to support the research results.

The data from the test results of students' mathematical problem-solving abilities were analyzed with the following criteria for trial-solving scores. This score distribution is arranged by the frequency of the distribution Table 1-2, which must find the difference between the minimum and maximum datum, a sum of the category, and should be measured in the class interval or per category.

Table 1. Problem Solving Ability level interval judging by student grades

Interval	Category
75 < X ≤ 100	Very High
58,3 < X ≤ 75	High
41,67 < X ≤ 58,3	Enough
25 < X ≤ 41,67	Low
0 < X ≤ 25	Very low

Table 2. Total Interval of Each Indicator of Problem Solving Ability

Interval	Category
6,75 < X ≤ 9	Very High
5,25 < X ≤ 6,75	High
3,75 < X ≤ 5,25	Enough
2,25 < X ≤ 3,75	Low
0 < X ≤ 2,25	Very low

RESULTS AND DISCUSSION

This research was conducted to determine the instrument's quality for the test of mathematics pre-service students' problem-solving ability in the 2020/2021 academic year, which consisted of 4 questions in TM (Mathematics Test). The TM instrument was tested online because, at that time, there was a Covid-19 pandemic. The

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

device used had passed the validation stage from the validator lecturer, who was then tested on 7th grade of mathematics education student in Universitas PGRI Yogyakarta. The instrument was analyzed using the IBM SPSS 20 and Microsoft Excel programs to determine the items' quality based on validity, reliability, differentiation, and difficulty level. It also aims to assess the ability of students to solve math problems tested directly online.

Furthermore, in the analysis used to determine the students' mathematical problem-solving abilities, the researchers calculated each indicator and the average achievement of the mathematics problem-solving ability steps, namely the average value of the TM of mathematical problem-solving skills. The results of students' math problem-solving abilities are in such a way:

Table 3. The categorization of troubleshooting capabilities

No. Question	Indicators	Score	Category
1	A	54,54	Enough
	B	59,09	High
	C	45,45	Enough
	D	11,36	Very low
2	A	54,54	Enough
	B	60,00	High
	C	45,45	Enough
	D	11,36	Very low
3	A	45,45	Enough
	B	90,90	Very high
	C	59,09	High
	D	31,81	Low
4	A	54,54	Enough
	B	93,18	Very high
	C	89,39	Very high
	D	72,72	High

Table 4. The average per aspect

Mathematical Problem Solving Indicators	Average	Category
A	52,26	Enough
B	75,79	Very high
C	59,84	High
D	31,81	Low

Mathematical Problem-Solving Indicators consist of four items that symbolized by A, B, C, D. The explanation of them are (A) identifying the elements that are known, asked, and the adequacy of the components needed, (B) formulating mathematical problems or compiling mathematical models, (C) implementing strategies to solve problems, (D) explaining or interpreting problem-solving results.

Based on the data from the research results above in Table 4, it is known that on math test number 1, on

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

indicator A some students have written down the elements that are known and asked. However, some students do not write them down on indicator B; most of them are wrong in formulating problems. It resulted in the C indicator, so that most students were wrong in implementing the problem-solving strategy. In contrast, in the D indicator, there were still many students who did not explain or interpret problem-solving results.

Then, regarding Table 3, in math test number 2, on indicator A, some students have written down the known elements and asked, but some students do not write them down. Then, on indicator B, most students formulate the problem wrong. It resulted in the C indicator, so that most students were wrong in implementing the problem-solving strategy. In contrast, in the D indicator, there were still many students who did not explain or interpret problem-solving results.

Also, in math test number 3, on indicator A, some students have written down the known elements and asked, but some students do not write them down. On indicator B, most of the students are correct in formulating the problem. In contrast, on the C indicator, most students are not precise in implementing the problem-solving strategies. Then, there are still many students who do not explain or interpret problem-solving results in the D indicator.

Furthermore, in math test number 4, on indicator A some students have written down the known elements and asked. Still, some students do not write them down. On indicator B, the students are correct in formulating the problem, so that on indicator C, most students are correct in implementing the problem-solving strategies. In contrast, in indicator D, most students have explained or interpreted the results of problem-solving.

Based on the results of data analysis and discussion, several things, among others, are still found aspects of indicators that have low categories means that many students even do not use the completion procedure correctly. There are categorization stages to organize and position objects or objects into a class when clarifying the research results (Qiong, 2017). Also, there is no significant difference in categorization between tests conducted directly and those conducted online compared to their score on the previous test before conducting the research. This research is intended to know the extent of students' ability (Son et al., 2020) to solve problems with the correct procedures and the evaluation materials of educators to maximize the way of teaching problem-solving skills so that students' abilities are evenly distributed and in the expected categories (Sumirattana et al., 2017). It agrees with the presentation delivered by Sihadi, Sofia, Yuliani, and Agus. Students will obtain several benefits in knowledge and skills, namely decision-making, assessment, imagination, problem-solving, classification, and consideration. All the things mentioned above are mental processes felt by students (Sihadi et al., 2017).

Analysis of students' mathematical problem-solving skills is categorized based on the calculation of each indicator. Discussion of the TM instrument as follows:

a. The results of research number 1 show that online student responses, this question is easy to understand by 44.8% and students sufficiently understand 44.8%. For indicator A

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

with a value of 54.54 with useful categorization from the data obtained. Some students write down identifying elements. The elements that are known and asked are those who do not write them down, indicator B with a value of 59.09 with a high category is obtained from the data that many students write mathematical problem formulations. However, it is still not correct. Indicator C, with a value of 45.45 with a high category, is obtained from partial data. A large number of students have not been accurate in implementing strategies in solving problems. Simultaneously, the D indicator with a value of 11.36 with a low category is known from the data that many students do not explain the results of trial solving. In the process of interpreting mathematical problems in contextual form, it can be done by breaking down each question into as many separate elements as possible (Danishvar et al., 2020).

b. The results of research number 2 show student responses online. This question is easy to understand by 55.2%, indicator A with a value of 54.54 with good category from the data obtained. Some students write to identify elements that are known and asked those who do not. Please write it down, indicator B with a value of 60.00. A high category is obtained from the data that many students write mathematical problem formulations, but it is still incorrect. Indicator C, with a value of 45.45 with a high category, is obtained from the data that most students have not correctly implemented strategies in solving the problem. In contrast, the D indicator with a value of 11.36 with a low category shows that many students do not explain the results of problem-solving. The problem-solving process will help students develop their ability to think creatively (ÜLTAY & Ultay, 2020).
c. The results of research number 3 show that the response to this question is easy to understand by 48.3%. Students sufficiently understand it by 48.3%. For indicator A with a value of 45.45 with a suitable category from the data obtained, some students wrote down identifying the known elements and asked some do not write it down. Indicator B with a value of 90.00 with a very high category is obtained from the data that many students correctly write mathematical problem formulations. Indicator C, with a value of 59.09 with a great variety, is obtained from the data that most students have not correctly implemented to solve problems. In contrast, the D indicator with a value of 31.81 with a low category shows that many students do not explain the results of trial solving. Students will be trained in honing metacognitive skills in the problem-solving planning process because it will refer to the executive control process of their problem-solving strategies (Hmelo-silver, 2004).
d. The results of research number 4 show that the response to this question is easy to understand by 69%. Indicator A is pictured in 54.54 with a suitable category. It means that students write to identify known elements and ask those who do not write them down. Then, indicator B represented in a score of 93, 18 with a very high category. It explains that many students correctly write mathematical problem formulations. Then, indicator C is defined in a

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

score of 89.39 with a very high type. It is obtained from the data that most students are correct in implementing strategies in solving problems. Furthermore, indicator D was defined in a score of 72, 72 with the high category. It is known from the data that many students explain trial solving. The results of research conducted by Simpol, Shahrill, M Li, and Prahmana found that most of the students' progress in planning and implementing the plan was quite visible because it could explain how to find answers to questions, even when they were able to provide the correct answers with steps right (Simpol et al., 2017).

Students' problem-solving abilities that appear and display in the process of solving linear program problems will show communication skills. This communication skill is seen in the ability of students to provide explanations through mathematical logic and straightforward, systematic language so that it is easy to understand. Problem-solving skills can be seen in whether students can identify problems correctly, show arguments, or the others data identified to conclude. Students are required to write problem formulations and conclusions in precise, sharp, logical sentences and without unnecessary words.

These results reflect that the ability of students of the Mathematic Education Program Study in applying mathematics learning as a tool to solve problems in the form of contextual and included in the category is sufficient. It means that students do not have difficulty understanding problems, solving context-based issues, and turning them into math problems. The same phenomenon regarding the views on soft student skills development activities through increasing students' confidence in solving linear programming problems. Lack of student self-confidence will indirectly kill soft skills in working together in teams or communicating the results of their thoughts. Thus students' mathematical soft skills will be well formed and by themselves will always be easy to develop.

As a reflection, this situation occurs because the researcher directly approaches students in guiding them to study the contextual issues. Researchers do not limit the steps chosen by students to solve solutions. Also, researchers used contextual difficulties that were very close to the students' things (Ismail & Al Allaq, 2019).

The results of research conducted by Hulaikah, Degeng, Sulton, and Muwarni stated that there were significant differences in the problem-solving abilities of students when learning with contextual problems. They added a holistic process in problem-solving that allows students to identify, clarify, and always focus on the issue at hand. Each step in the learning process that you go through will provide a different experience with possible solutions for various things (Hulaikah et al., 2020).

Mathematics learning that displays images as illustrations of problems (Connell et al., 2019) will help students to image mathematics in eleven components, including attitudes, feelings, descriptions or metaphors expressed for mathematics, views of mathematicians and their work, beliefs about the nature of mathematics, mathematical abilities, and gender differences in mathematics abilities (Hatisaru & Murphy, 2019).

In the implementation of

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ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i3.5728

research, several obstacles focus on the performance of mathematics learning at the next meeting. These obstacles include problems that are very difficult and very easy for students. It has an impact on students because they feel lazy and saturated while working. The preparation of questions that have been known to be low quality in the sense of unreal reliable should not be used in research.

The results of this study have a significant impact on university in evaluating students' problem-solving skills. The focus of online learning is the supervision of the answer discovery process. There are times when there is a sense of disbelief, whether it is an answer that a student gets with his or her efforts without anyone's help to help complete or the results of imitating someone else's response. Therefore, based on the results of the experience, online learning is also accompanied by a parenting schedule for the supervision of students' learning process. There is sufficient empirical data to help mathematics teachers to understand the relationship between mathematical modeling and its effects on learning. Most of the studies that focus on influence do not relate to the context of mathematical modeling, and most other studies on mathematical modeling do not affect a studied factor (Chamberlin & Parks, 2020).

Research findings that Olivares and Ceglie have conducted highlight the influence caused by social persuasion as feedback and very significant on students' mathematics performance (Olivares et al., 2020). it is necessary to present unstructured problems in mathematics learning when assisting students in developing their problem-solving skills (Hobri et al., 2020). So that further teachers must provide scaffolding as needed (Widiana et al., 2018)

CONCLUSION AND SUGGESTION

Based on data analysis and discussion results, several things: (1) still found aspects of indicators that have low categories means that many students even do not use the completion procedure correctly. (2) there is no significant difference in categorization between tests conducted directly and conducted online.

This research is intended to know the extent of students' ability to solve problems with the correct procedures and the evaluation materials of educators to maximize the way of teaching problem-solving skills so that students' abilities are evenly distributed and in the expected categories.

For the recommendation, other research can be further explored to improve students' problem skills. one of which is to vary the form of problem management in a cultural context. Besides, this exploration can give colors to see that mathematics is very close to students' daily lives.

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