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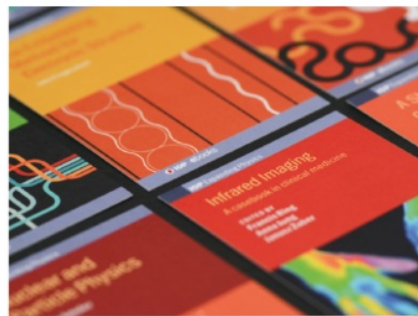
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## Problem-solving with guided inquiry learning: An analysis of student's problem-solving ability

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## Problem-solving with guided inquiry learning: An analysis of student's problem-solving ability

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**Abstract.** Mathematics problem solving is one of the goals of mathematics instruction. The learning process influences mathematics problem-solving. This research aims to know the mathematics problem-solving ability with guidance Inquiry learning process. The research method was descriptive qualitative. Data resource were students of class VII A at Junior High Islamic School 4 Kulon Progo, Yogyakarta, Indonesia. The subjects of this study consisted of 6 students who were divided into three groups, namely the top group, the middle group, and the under group with each consisting of 2 students. The obtained data was in the form of written and spoken with the technique of problem-solving ability test and interview. Data analysis was carried out through data reduction, data display, and conclusion. Data validation used source triangulation. The result showed that student of the high class could reach the entire indicators with criteria of problem-solving ability was very high. The student of the middle class was not able to reach the indicator of looking back with criteria of problem-solving ability was high and enough. The low-class student was not able yet to reach the indicator of understanding the problem, devising a plan, carrying out the plan, and not able to looking back with criteria of problem-solving ability was enough.

### 1. Introduction

Mathematics is a science that has a language and a well-defined rule, clear and systematic reasoning, and structures or linkages between a strong draft [1]. This is the underlying mathematics is given to all students from elementary school to university. Learning math since elementary school implemented to equip students with the ability to think logically, analytical, systematic, critical, creative, and the ability to collaborate [2]. The capability is necessary to master students to acquire, manage, and utilize appropriate information to troubleshoot and solve problems in life.

Problem-solving ability is the competencies to be achieved through the learning of mathematics [2]. In accordance with one eye objectives Junior High School mathematics by Ministry of Education that the students have the ability to solve problems, which include: the ability to understand the problem, devised a mathematical model, solve the model and interpret the obtained solution [2]. In addition, the crucial problem-solving ability in mathematics, for someone who will learn math and that would apply in other areas of study as well as everyday life [3].



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Therefore, it can be seen that the problem-solving ability in mathematics is needed to train the mindset of students in determining the steps to solve problems more easily and precisely. As in the theory of Polya [4] to make it easier to understand and solve a problem proposed steps to solve a problem, namely: (1) understand the problem; (2) devising a plan; (3) carrying out the plan; and (4) looking back. As noted Saragih [5] if the problem-solving skills mastered, it can directly improve student learning outcomes.

Based on the description above, it appears that students' mathematical problem-solving ability is a very important aspect. But in fact, the ability of students in terms of solving mathematical problems are still low. Internationally, the mathematical problem-solving ability can be read from research surveys TIMSS (Trends in International Mathematics and Science Study) which showed that the average mathematics achievement in Indonesia amounted to 397 from a standard value of 500 [6]. TIMSS Indonesia occupied rank 45 of the 50 countries that follow. This is in line with the opinions Wardono & Mariani that the Indonesian students' ability to solve problems that require analytical skills, reasoning, communicate effectively, solve problems, and then interpreting the solution in various situation is still low [7].

Based on the application the use of national examination results report developed by Indonesian Ministry of Education Culture, percentage achievement of mastery of the national exam in 2017/2018 Junior High Islamic School 4 Kulon Progo on Geometry and Measurement material for school level is 49.86%, the rate of Kulon Progo 54.72%, 57.17% Special Region of Yogyakarta provincial level and national level 42.80%. On the data application achievement of mastery of Geometry and Measurement gets red shading, where the red shading on the application gives the sense that, the achievement of mastery of the material Geometry and Measurement is still low.

Based on the analysis of teacher documentation regarding the Mid-Term Assessment results 2018/2019 in mathematics obtained:

**Table 1.** The results of mid-term assessments of class VII A.

Element	Result
Minimum completeness criteria	65
Mastery learning	35%
Not thoroughly studied	65%
Achievement material of mastery	57.88%

From table 1. it is known that the absorption of the results of Mid-Term Assessment said is still less with the percentage of 57.88%. Achievement is not optimal can be influenced by many aspects, one of which is cognitive, namely the ability to solve a problem.

Given the importance of problem-solving ability in mathematics, it needs to be supported by appropriate learning methods. One model of learning that can develop and facilitate problem-solving skills are Guided Inquiry. Guided Inquiry Learning Model in student-centered learning and the teacher as a guide in the learning process, so that students are actively involved in problem identification, investigation, problem analysis, conclusions manufacture, and delivery of results troubleshooting. It is within their research results Islamiah & et al which shows that the achievement and improvement of the mathematical problem-solving ability of students in Guided Inquiry learning method better than students who use the regular learning [3].

This research is searching for the problem-solving ability of three groups students of class VII A, namely the top group, the middle group, and the under in solving mathematical problems Relation Between Angles material on guided inquiry learning with application indicator according to Polya problem-solving skills. So the writer takes the title "Analysis of Mathematical Problem Solving Ability with Guided Inquiry Learning in Class VII A Junior High Islamic School 4 Kulon Progo, Yoyakarta, Indonesia".

## 2. Research Methods

This type of research is descriptive qualitative research. This research was conducted in class VII A Junior High Islamic School 4 Kulon Progo, Yoyakarta, Indonesia in March to April of the school year 2018/2019. Mechanical determination of subjects using purposive sampling, the research subjects were six students of class VII A, which consists of two groups of students on two student groups of the middle, and two under groups of students. Data collection technique used test problem-solving ability to measure the ability of problem-solving ability of subjects in solve math problems. Interviewing for more information on problem solving ability of students recorded and documented use of researchers in the form of photo test problem solving ability of students, audio recordings of in-depth interviews with students, and photos as long research.

The steps in this research are: (1) preparation of the instrument; (2) validation of the instrument; (3) pilot test instrument; (4) an analysis of the test results of test instruments; (5) data collection (tests and interviews); (6) Data analysis (results of tests and interviews); and (7) the preparation of reports.

Analysis of the results of trials conducted testing instrument to determine the validity, reliability, distinguishing features and level of difficulty of items. Analysis of the data used in this study using a model of Miles and Huberman through three processes, namely the data reduction, the data display, and conclusion and verification. The last stage to check the validity of the data using triangulation source, by comparing the results of mathematical problem-solving ability test with the results of interviews.

## 3. Results and Discussion

The research was conducted in class VII A Junior High Islamic School 4 Kulon Progo in March to June 2019. Prior to the data collection, the subject of research by applying the following study Guided Inquiry learning model on Relation Between Angles, sub-material Relation Between Angles on two lines and relationships intersect the comers on two parallel lines are cut by transversal lines. Implementation of learning for the first meeting and the second run in accordance with the lesson plan. All the material is conveyed and any Guided Inquiry learning model run in accordance with the syntax. This is supported by the observation sheet activities of teachers and students. At the first meeting, the teacher's activities obtained a score of 85.71 and 85.71 student activity, while the second meeting of the teacher's activities obtained a score of 92.86 and 95.23 student activity.

In addition, trials conducted testing instrument in class VII B Junior High Islamic School 4 Kulon Progo followed by 27 students. The trial was conducted to determine the validity, reliability, distinguishing features and level of difficulty of test items. After the analysis, obtained four test items were used as research instruments. The results of the validity, reliability, distinguishing features, and level of difficulty of test items are as follows:

**Table 2.** Criteria of validity, reliability, distinguishing features, and level of difficulty.

No.	Validity	Reliability	Distinguishing power	The difficulty level
1	valid	<i>Reliable</i>	Enough	Easy
2	valid		Enough	Moderate
3	valid		Well	Moderate
4	valid		Well	Moderate

Mathematical problem-solving ability test done in class VII A as a research subject class attended by 26 students. Based on the test results, then do the ranking assessment and then determine a lot of students in each group using the guidelines given Nitko and Hanna [8], if the number of students 21-40 on the number of groups and under each group 33.3%. Because students are so many students there are 26 groups of top, middle, and bottom, respectively 9, 9, and 8. The results of mathematical problem-solving ability, the determination of the group, and the selection of research subjects are presented below.

**Table 3.** Results of students' problem-solving abilities.

No.	Name Initials	Score	Group
1	HAR	100	Top Group
2	CWW	95	
3	SYR	95	
4	SM	90	
5	PNU	87.5	Middle Group
6	FWI	80	
7	RN	80	
8	AEF	77.5	
9	INS	72.5	
10	FKA	67.5	
11	RDP	67.5	
12	UK	67.5	
13	DS	65	
14	FA	65	
15	SCA	65	Under Group
16	ENA	62.5	
17	AFBS	60	
18	RMZN	57.5	
19	MT	55	
20	TM	55	
21	RD	52.5	
22	ANOP	50	
23	RA	50	
24	DIJN	47.5	
25	TP	42.5	
26	DNS	32.5	

Based on table 4.2, it was determined six students who will be interviewed, the HAR and PNU of the top group, RDP and RMZN of the middle group, and TP and DIJN of the under group. Here are the results of the analysis group of students top, middle, and under of each indicator mathematical problem-solving ability.

### 3.1. Understanding the problem

Stages in Guided Inquiry learning model that supports the indicator to understand the problem is at the stage of identifying the problem, make observations and ask questions. In the second stage, the student to identify the observations of a problem, then ask questions related to problems found. Through these stages, students are trained to be able to understand the problem by identifying and finding information on the problem. The result of related indicators is shown in the following table.

**Table 4.** Results of the analysis of indicators understanding the problem

Group	Analysis
Top	Subject top group is able to understand the problem well to find information on the matter with appropriate
Middle	Subjects were able to understand the problems of the middle group well to find information on the matter with appropriate
Under	Group subjects under less able to understand the problem, because in finding information about incomplete.

Based on table 4, the top and middle groups were able to understand the problem well by finding information on the matter appropriately. It is shown that students can present information in the form of what is known of the matter and sought from the matter. As well as groups of students under less able to understand the problem, because in finding information about incomplete. It is shown that students in finding information in the form of what is known of the matter and sought of the matter are still not complete and accurate.

### 3.2. Devising a plan

Stages in Guided Inquiry learning model supporting indicators devising a plan is in the planning stage as a survey. At this stage, the students put the proper work procedure. In this phase, students are trained to be able to devise a plan to analyze the problem solving and finding the information needed or the first step to resolve the issue. The result of related indicators is shown in the following table.

**Table 5.** Results of the analysis of indicators devising a plan

Group	Analysis
Top	A subject top group capable of being able to devise a plan well to analyze and find the information needed to complete and correct.
Middle	A subject middle group capable of being able to devise a plan well to analyze and find the information needed to complete and correct.
Under	Group subjects were able to devise a plan because in finding the information needed less precise.

Based on table 5, the top and middle groups capable of being able to plan with good problem solving by analyzing and finding the information needed to complete and correct. It is shown that the top and middle groups of students can determine the first step to resolve the matter. As well as groups of students under less able to plan problem solving, as in finding the information needed less precise. It is shown that the middle group of students in determining the initial step to solving problems is not yet right.

### 3.3. Carrying out the plan

Stages in Guided Inquiry learning model supporting indicators carrying out the plan is at the stage of collecting data/information and carry out investigations. At this stage, the students carry out the investigation and resolve to troubleshoot. Through this stage, students are trained to implement the plan and present troubleshooting steps to resolve. The result of related indicators is shown in the following table.

**Table 6.** Results of the analysis of indicators carrying out the plan

Group	Analysis
Top	A subject group capable of carrying out a plan on troubleshooting well by presenting the appropriate steps to resolve and the end result is correct.
Middle	A subject middle group capable of performing carrying out the plan on troubleshooting well by presenting the appropriate steps to resolve and the end result is correct.
Under	Group subjects under less able to carry out problem-solving plan well, because in the present steps to resolve the lack of proper, so the end result is not right.

Based on table 6, the top and middle groups capable of carrying out the plan troubleshooting well by presenting the appropriate steps to resolve and the end result is correct. It is shown that students top and middle groups determine the next step after finding the needed information is obtained. As well as low student groups capable of carrying out a plan solving the problem well, because in the present steps to resolve the lack of proper, so the end result is not suitable. It is shown that students under the group can determine the next step after finding the needed information is obtained is not quite right, so found the results improper end.

### 3.4. Looking back

Stages in Guided Inquiry learning model that supports the indicator looking back is on analyzing data, making inferences, and communicate the results. In this third phase, the students analyze the data whether the measures presented are correct. Then make a conclusion on the settlement of problems and students are trained to answer with present accountable for his work. The result of related indicators is shown in the following table.

**Table 7.** Results of the analysis of indicators related to looking back

Group	Analysis
Top	Subjects were able to look back so well to make the appropriate conclusions.
Middle	A subject middle group can not afford to look back problem with no conclusion
Under	Subjects under the group were unable to look back on the problem with no conclusion.

Based on table 7, on top of the group were able to check back in with a good by making the appropriate conclusions. It is shown that in the last step to solve the problem over the group of students can write and submit the conclusion of the settlement of the matter. As well as the middle and under groups of students are not able to examine the problem with no conclusion. It is shown that in the last step to solve problems and a subject group of students can not write and submit the conclusion of the settlement of the matter.



Based on research conducted by Moh. Zain, Mustamin Idris, and Muh. Rizal is done junior high school students there are some similarities and differences in results. The similarity of results from the upper group is able to reach all stages and the under group has not been able to reach all stages in solving problems. The difference is the middle research group Moh. Zain, Mustamin Idris, and Muh. Rizal was able to solve the problem, where as in this study were not able to [9]. In addition, the results of Islamiah & et al research show that learning with Guided Inquiry can help achieve better problem solving skills. In accordance, with the results of this study which shows, that the problem solving ability with guided inquiry learning is quite good [3]. This is evidenced by the criteria of problem solving ability of students at high, medium, and sufficient levels, none of which are low.

### Conclusion

Based on the exposure of data, research findings, and the discussion can be deduced that the problem-solving ability to load four indicators, namely: (1) understanding the problem; (2) devising a plan; (3) carrying out the plan; and (4) looking back. Following the achievement of indicators and criteria for each group as follows.

- a. Students can achieve the group on all of the indicators with the criteria of problem-solving ability is very high.
- b. Students are not able to achieve a middle group looking back with the criteria of high problem-solving ability and sufficient.
- c. Students under the group were unlikely to achieve the indicators to understand the problem, devising a plan, carrying out the plan, and not being able to look back, with the criteria enough problem-solving abilities.

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