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7th International Conference on Research, Implementation and Education of Mathematics and Science (7th ICRIEMS)
Universitas Negeri Yogyakarta, Friday-Saturday, 25th-26th September 2020

Due to the COVID-19, the 7th ICRIEMS will be conducted online (Virtual Conference)

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About the Conference

Globalization has affected all aspects of human life in the fields of economics, education, politics, social culture, and science and technology. Scientific and technological innovations have clearly made an important contribution to improving the quality of human life, including the ease of access to information, health services, education, travel, recreation and so on. However, this progress is also accompanied by negative impacts, including increasing environmental damage and decreasing the morale of the younger generation. This is a challenge and at the same time provides an opportunity for science, technology and education to play a role in anticipating these negative impacts.

As the world has entered the new era of industrial revolution as well as new society, human being is now haunted with novel various problems that need to be solved immediately. Recent development in science and technologies has proven to be an important tool to counter such problems. However, the development of science and technology can only be used to its maximum capacity if human can manage it properly.

Science and technology have been known as a “double-edged sword”. It can be used for the good of humanity and environment but it can also be the cause of world’s destruction. In order to properly navigate this powerful tool, human as the main controller should realize that morality and ethics goes hand in hand with the development of science and technology. Morality and ethics should become the guidance while competition will be the driving force to keep creative and innovative mind challenged.

The Faculty of Mathematics and Natural Science – Yogyakarta State University invites researchers, educators, students, and practitioners to share ideas in the Seventh International Conference on Research, Implementation, and Education of Mathematics and Science (7th ICRIEMS). The theme of the 7th ICRIEMS is **“Science, Technology, and Education in The Global Era for Virtuous and Competitive Generation”** The scope of this conference covers all topics but are not limited to in the field of mathematics, chemistry, physics, biology, mathematics education, chemistry education, physics education, biology education, and science education.

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We are pleased to present you the 7th International Conference on Research, Implementation, and Education of Mathematics and Science (ICRIEMS 7) Conference Proceeding. The 7th ICRIEMS was held on 25-26th September 2020 and organized by the Faculty of Mathematics and Science, Universitas Negeri Yogyakarta, Indonesia. The theme of the 7th ICRIEMS is “Science, Technology, and Education in The Global Era for Virtuous and Competitive Generation”. We hope that the theme will bring the knowledge to navigate science and technology for the good of humanity and environment by sharpening the morality and ethnics as well as creativity. This ability could be used to handle globalized problem such as economics, education, politics, social culture, and science and technology.

In this conference, there are prominent practitioners, researchers, students and educators sharing their research findings and exchange ideas. Furthermore, six keynote speakers have delivered their talk, i.e.: Prof. Dr. Lee Ching Kuo from Taipei Medical University, Taiwan; Prof. Peter Charles Taylor form Murdoch University, Australia; Prof. Dr. Suriani Abu Bakar from Universiti Pendidikan Sultan Idris, Malaysia; Assoc. Prof. Chatree Faikhamta from Kasetsart University, Thailand; Dr. Ariyadi Wijaya from Universitas Negeri Yogyakarta, Indonesia; and Dr. Agus Purwanto from Institut Teknologi Sepuluh Nopember, Indonesia. In addition, two invited speakers also contributed in this conference, i.e.: Dr. Retno Arianingrum from Universitas Negeri Yogyakarta, Indonesia; and Assoc. Prof. Vichit Rangpan from Yala Rajabhat University, Thailand.

We have accepted 190 articles from several researchers including from Indonesia, Thailand, Malaysia, and Turkey. We have peer-reviewed those papers and selected 100 papers for publication in Atlantis Press. We believe that the proceedings will provide references of novel research in sciences, which may give an impetus to stimulate further studies in all related areas. Finally, we would like to address the acknowledgment and big appreciation to all authors and participants who have been actively involved in the conference. We also wish to thanks to our scientific committee for their invaluable comments during review process.

3 February 2021

Editors
Supardi
Nur Aeni Ariyanti
Isti Yunita

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Volume
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ISSN
2352-5398

ISBN
978-94-6239-348-6

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Students' Problem-Solving Profile in Overcoming Sound Wave Concepts Based Students' Academic Abilities on Online Class

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Available Online 8 March 2021.

DOI

https://doi.org/10.2991/assehr.k.210305.076 How to use a DOI?

Keywords

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Volume Title
Proceedings of the 7th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS 2020)

Series
Advances in Social Science, Education and Humanities Research

Publication Date
8 March 2021

ISBN
978-94-6239-348-6

ISSN
2352-5398

DOI
https://doi.org/10.2991/assehr.k.210305.076 How to use a DOI?

Cite this article

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TY  - CONF
AU  - Iron Ujulu
AU  - Masri K. Umar
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PY  - 2021
DA  - 2021/03/08
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TI - Students' Problem-Solving Profile in Overcoming Sound Wave Concepts Based Students' Academic Abilities on Online Class
BT - Proceedings of the 7th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS 2020)
PB - Atlantis Press
SP - 516
EP - 520
SN - 2352-5398
UR - https://doi.org/10.2991/assehr.k.210305.076
DO - https://doi.org/10.2991/assehr.k.210305.076
ID - Ujulu2021
ER -

Advances in Social Science, Education and Humanities Research, volume 528
Proceedings of the 7th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS 2020)

Students' Problem-Solving Profile in Overcoming Sound Wave Concepts Based Students' Academic Abilities on Online Class

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ABSTRACT
A research has been conducted to describe the students' initial problem-solving abilities through five stages of problem-solving. This study was aim to describe the profile of students' problem-solving in overcoming sound wave concepts in terms of academic ability, where the research subjects were grade XI students of SMA Negeri 6 Gorontalo Utara. It was a part of the research development of social media-aided named blended learning models to improve problem-solving skills. It used qualitative descriptive study it shows percentage of problem-solving ability test completion stages is in the category of students with academic abilities, with an average score of 83.75%, after that students are in the medium and low categories. It showed that there are some who are able to carry out the stages of problem-solving in completing problem-solving tests but have not been able to describe it properly. Finally, the maximum score was difficult to get either in students with high, medium and low academic ability categories.

Keywords: *Blended learning, problem-solving, academic abilities.*

1. INTRODUCTION

Problem-solving is one of the important abilities that must have by students. It is a person's ability to find solutions through a process that involves obtaining and organizing information [1]. it involves finding a viable way to achieve the goal [2].

There are many previous studies that attempted to improve the problem-solving abilities of students through various learning strategies. In some of these studies, it shows the low ability of students to solve problems which probably caused by several things including learning patterns and the use of media to support learning. The low problem-solving skills are caused by several factors including science learning that more oriented to textbooks and more traditional laboratory activities [3]. Furthermore, it stated that students are more concern to solve structured problems rather than unstructured [3]. To increase the ability of solving problems in physical material, we can use several indicators including: (1) visualizing or describing the problem; (2) physics approach; (3) applying physics concepts; (4) mathematical procedure; and (5) logically conclude the problem [4].

Problem-solving abilities cannot be separated with the structure of students' knowledge. In the process of it, they need knowledge from previous experiences, both from face-to-face online learning experiences with the help of social media. In accordance with the view of constructivist learning theory, learning is not just a process of knowledge transfer but about it is how

to construct knowledge by connecting their initial knowledge with the experience they just gained [5].

The effort to know the problem-solving abilities of students in physics, it is necessary to have learning innovations to support the achievement of learning objectives. In addition, during the current Covid-19 pandemic, learning innovations are expected to take advantage of technology, one of which is the WhatsApp social media. The use of instructional media has a specific purpose to assist in the teaching and learning process. The general purpose of using media is to increase effectiveness and efficiency in teaching and learning activities. The specific objectives of using the media are: (1) to support class activities; (2) encouraging the use of appropriate methods to achieve the objectives of the academic program; and (3) assist, provide planning, production operations and follow-up to develop instructional systems [6].

Physics is a very interesting subject to discuss using social media. However, so far physics lessons are still difficult to learn because they are still abstract, causing low problem-solving abilities. Instruments are needed to measure the problem-solving abilities of students in physics by optimizing the use of social media in supporting the implementation of learning.

The developed instrument in this study focuses on sound wave material. The problem-solving ability test was developed based on five indicators of problem-solving ability adapted from Heler and Heller. This design consists of five stages of problem-solving, namely: (1) focusing on the problem, (2) describing it physically, (3) planning the solution, (4) implementing the completion plan, and (5) evaluating the solution [7]. The indicators and guidelines for scoring problem-solving as in table 1 below.

2. EXPERIMENTAL METHOD

This research used mixed method that combines quantitative and qualitative methods. The chosen strategy was a sequential explanatory strategy. That strategy explains and interprets quantitative results based on the results of qualitative data collection and analysis. The instrument developed measures the students' physics problem-solving ability in the form of tests. in this case, the test is multiple choice but the answer is presented in the form of an essay to analyse the stages of solving the problem in each item. This type of question can measure the problem-solving ability as a whole, because it involves developing perceptions and reasoning. The subjects in this study were 20 students of class XI SMA Negeri 6 Gorontalo Utara, Gorontalo Province and the data analysed were students' answers to the multiple choice test which was completed based on essay completion. Furthermore, student answers are analysed based on indicators of problem-solving stages per item to measure student achievement in completing tests according to problem-solving, the data is then analysed or described based on the category of academic ability. this is done to compare students' academic abilities to the ability to solve problem-solving tests.

Table 1. Problem-solving guidlines

score	Problem-solving criteria				
	Problems	Physical description	Planning	Implementation	Evaluation
0	unknown	none	None plan	No progress	None
1	Less Interpretation of question	Know few variables	Mathematical equations are not related	mismatch	Mathematics mistake founding
2	Understanding the problems	incomplete view	Mathematics equations are related	Finished but incomplete	Stuck
3		completing		Finished and completed	finished but incorrect manipulates the number
4				Complete and continuing the solving	Finish and done completely
Max score	**2**	**3**	**2**	**4**	**4**

3. RESULT AND DISCUSSION

The research was conducted through the stages of the problem-solving ability test and guidelines for evaluating students' answers based on the indicators that adapted from Heller, et.al. The data was obtained based on the test results, multiple choice type test was given, but it was solved based on the essay method. The data were analyzed based on the level of students' academic abilities. The academic ability of physics scores during the learning process in the classroom either accumulated per semester or in each particular exam. This is divided into: a) The upper group, for students with a value of ≥75, b) the middle group, for students with a value of 50 - 74, and c) the lower group, for students with a value of ≤ 49 and for completion based on stages solution to problem. From the test results, it shows that most students have been able to complete the test based on the problem-solving stages.

Problem-solving result along with subjects' interview transcript.

3.1. The upper group is students with a value ≥75

First student

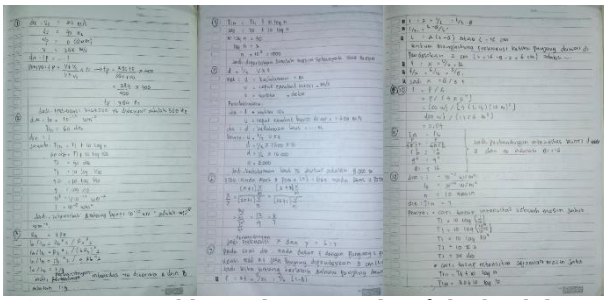

Figure 1. Problem-solving result of high ability category students**.**

The students' results tests on high academic categories showed that they can solve problems with stages based on the indicators. one stage of the physics Figure was not carried out and the problem-solving stage were not described completely. Students have been able to write down all things that are known in the questions completely, focus the problem, plan problem-solving, execute problems and evaluate the answers to the results.

Apart from the written test, an online interview held where the subject stated that the stages of problem-solving were not completely described, the final result of the problem-solving was still a benchmark in the assessment. However, the subject understands well in these stages. Furthermore, the results of problem-solving carried out by student 2 are as follows.

Second student

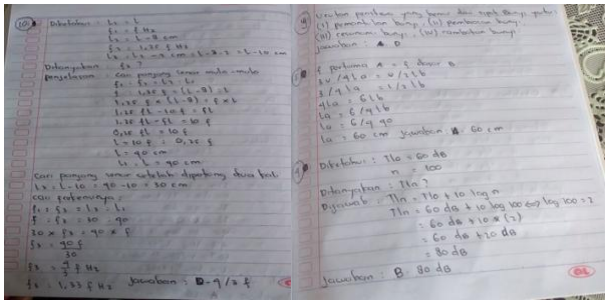

Figure 2. Problem-solving result of high ability category students

The Result shows that second student does not understand the problem well. It presents the lack, few things written as known on the problem and evaluate the answers of the results. Students in the category of high academic ability, but in terms of solving problem-solving tests have not been able to complete based on these stages.

Interviews were conducted through the courage associated with the completion of the test. The subject stated that the remaining stages of the problem were not described completely. it took a few minutes to complete the questions. This causes the second students unable to be on time to finish the test. Furthermore, he explained that he did not know clearly how these stages were and so far in terms of solving the physics test, it was just like solving in general. However, students 2 understand well in these stages.

3.2 Middle group with the value 50 – 74

Third student

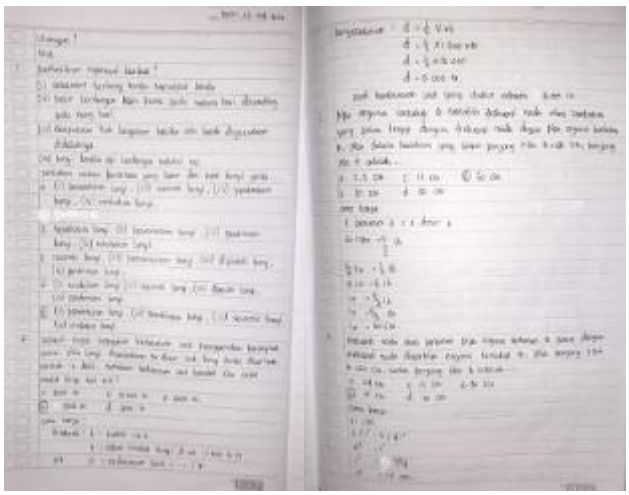

Figure 3. Problem-solving result of medium ability category students.

Third student are as the medium category in solving problem test questions got score 75. This student wrote down everything he know completely, focus on problems, plan problem-solving, execute problems and evaluate the answers well. However, He could not explain in the completion of the test based

on these stages. Students 3 are also the same as others, which have not described the questions in physics and completed the test based on completion generally.

An online interview to confirm the test results, the third students stated that he entered the problem-solving test earlier than the specified time. So, he still have plenty of time to complete the test and even have time to do a Google search and related to the problem-solving stages. He did not understand how to complete the test based on these stages. While the results of the subject 4 problem-solving test are as follows.

Fourth student

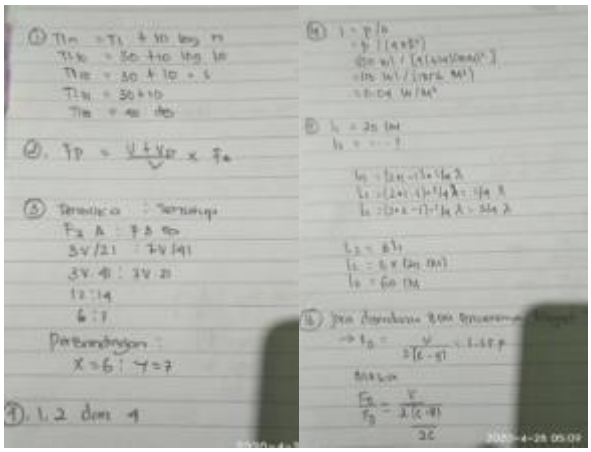

Figure 4. Problem-solving result of medium ability category students.

Based on the results of the test conducted, the fourth student was in middle category academic ability. In the test, he can understand the problem well but solve 3 questions only and could not do describing physics, the stage of planning the problem-solving, the stage of executing the problem so that the results obtained are less precise. Here are the following transcripts from the fourth student's interview. he stated his inability to complete a problem-solving test. This is due to the lack of understanding of physics material generally.

3.3 The lower group with the value ≤ 49

The fifth student

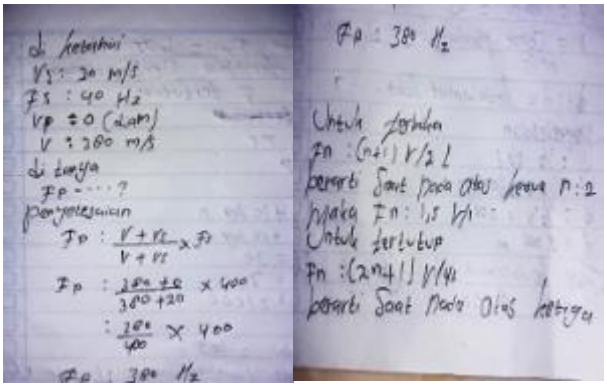

Figure 5. Problem-solving result of low ability category students.

The fifth Student is in low category; he could not complete the problem-solving test and got total score of 15. In some questions, he just completes the last stage of the problem-solving test, namely evaluation of answers. Some questions acquire the correct points but without the stages of solving the problem so the score are still less. While the results of the student problem-solving test 6 are as follows.

Sixth student

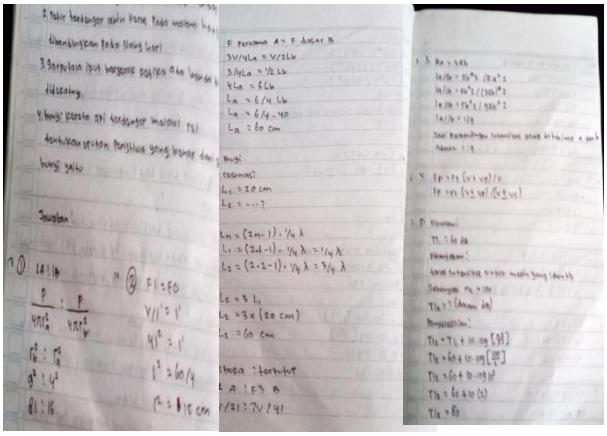

Figure 6. Problem-solving result of low ability category students**.**

The sixth student is in low academic ability to solve problem. He did not passed the test with following structural steps so his answers in the test was incorrect. In the interview, the fifth and sixth students stated that they did not understand and have no clue to answer the question properly. From that obstacle, they only can get the low scores.

From the overall results to the problem-solving tests and interviews that have been conducted, there are some who are able to carry out the stage in solving the problem-solving test but have not been able to describe it properly so that they could not get the maximum score. To determine the wetness of the findings, they are presented in the form of a result table as follows.

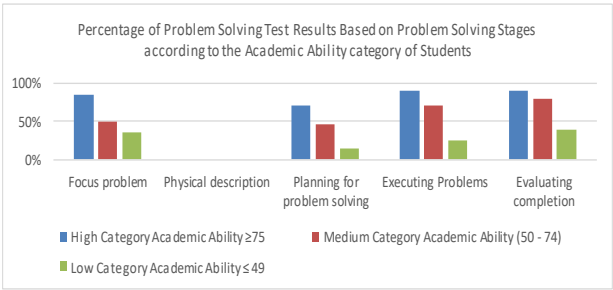

Figure 7. Problem-solving result

Based on the results in the table above, it shows that the highest percentage of problem-solving ability test completion stages is in the category of students with academic abilities, with an average score of 83.75%, after that students are in the medium 49.2% and low categories 23%. However, all categories have not carried out the stages of describing it physically, but as a whole it can be seen that the comparison of the categories high category academic ability, medium category academic ability and low category academic ability to the four aspects of problem-solving is directly proportional. This finding is in line with research from Pratiwi, Samparadja, Arapu (2019: 54) explaining that the level of academic potential of students also has an influence on higher thinking skills, high thinking abilities of students with high academic potential are different from students with medium and low academic potential. . Theoretically, academic potential indicates a person's thinking ability profile so that students with high academic potential have high thinking skills as well [**8**].

4. CONCLUSION

Based on the results and discussion previously, it can be concluded that.

1. Students with high academic abilities are able to solve problem-solving tests with problem-solving stages well but have not fully explained them in solving the test either in focusing problems, describing physics, planning problem-solving, executing problems and evaluating answers.
2. Students with moderate or middle academic ability have not been able to complete the problem-solving ability test appropriately, it affects the stage of implementing the plan so that the results obtained are not right.
3. Students with a low academic ability category and in solving problem-solving tests did not carry out the problem-solving stages properly so that the results obtained were wrong.

Overall, it can be seen that the highest percentage of students' initial problem-solving ability test completeness is in the category with academic ability, with an average score of 83.75%, after that students are in the medium category of 49.2% and the low category of 23%.

ACKNOWLEDGMENTS

My deepest Thank to all those who have helped in completing this research, Directorate of Research and Community Service Ministry of Research and Technology/National Agency for Research and Innovation, UNG Postgraduate Leaders, Heads and Teachers and Students at SMAN 6 Gorontalo Utara and other parties who help this research.

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