

# Mathematical Problem Solving in Terms of Digital Literacy Ability

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## ABSTRACT

Solution of mathematical problem needed creativity in determining the problem solving strategy. Creativity that is usually done when dealing with a problem is by searching for information related to the problem on the internet. This study aims to describe solving mathematical problems in terms of digital literacy skills. The method used in this research is descriptive research method with quantitative research models to facilitate qualitative research. The research subjects were students of the 7th semester of the Mathematics Education Study Program of the Academic Year 2020/2021. The data analysis process refers to Miles and Huberman's opinion with an interactive model. Based on the research results, it can be concluded that digital literacy skills also determine success in solving math problems.

**Keywords:** *digital literacy, problem solving, creativity.*

## 1. INTRODUCTION

The ability to solve problems is one of the abilities that must be mastered by students / students in the era of the industrial revolution 4.0. Likewise in learning mathematics, problem solving ability is one of the abilities that students must train through mathematical problems [1]. Therefore, problem solving skills are very important to be mastered by students / learners. Unfortunately, some research results show that the mathematical problem solving abilities of students / students are not as expected ([2]), [3]), [4]).

Currently, students / students are very familiar with information and communication technology. It can be said that almost all students / learners have smartphones. Students / students if they want to know something, just enter a keyword in a search engine, and the desired information will be obtained. The ability to search for information, select information, and expertise in the internet according [5] are components of digital literacy.

According to Paul Gilster in his book *Digital Literacy* states that "digital literacy is the ability to understand and use information in various forms from a very wide variety of sources accessed via computer devices". Currently, in

the midst of rapid advances in information and communication technology, digital literacy skills are as important as other literacy skills, namely literacy literacy, numeracy literacy, scientific literacy, financial literacy, and cultural and civic literacy [6].

To measure digital literacy skills, it is necessary to know in advance the components of digital literacy. [5] explains that "To measure digital literacy, there are 8 components that must be measured, namely Functional Skills and Beyond; Creativity; Collaboration; Communication; The Ability to find and select Information; Critical Thinking and Evaluation; Cultural and Social Understanding; E-Safety.

When someone is faced with a problem, then to solve the problem solving. One way that is currently usually used is to find a solution by "Searching" on the internet. Likewise, with a student who is faced with mathematical problems that are difficult to solve. The majority of them tend to search engines to find related concepts to find answers or to find inspiration to find solutions to those problems. Thus digital literacy skills also determine a person's problem-solving abilities.

Several studies related to digital literacy in relation to other variables have been carried out such as research by [7] which states that there is a significant relationship between digital literacy skills and self-directed learning in completing student theses [8] states that the ability Digital literacy also determines student learning outcomes, and [9] stated that there is a significant relationship between digital literacy skills and the use of E-Resources. In this study, it has been investigated how to solve mathematical problems in terms of digital literacy skills.

**2. METHOD**

The purpose of this study was to describe how mathematical problem solving skills in terms of digital literacy skills. To achieve the research objectives, the method used in this study is a descriptive research method with a quantitative research model to facilitate qualitative research [10]. This research was conducted at the Muhammadiyah Kotabumi University. The research subjects were students of the 7th semester of the Mathematics Education Study Program of the Academic Year 2020/2021.

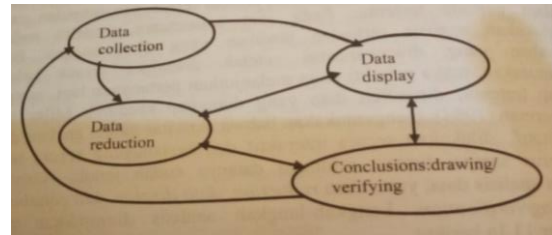
The first step in this research is knowing digital literacy skills. For this reason, a digital literacy ability questionnaire was developed. Furthermore, the questionnaire was distributed to all Mathematics Education students in semester 7 of the 2020/2021 academic year via google form. Respondents' answers were then processed to categorize digital literacy skills. The categorization of digital literacy skills is presented in the following table.

**TABLE 1 CATEGORIES OF DIGITAL LITERATION ABILITIES**

No	Interval	Interpretation
1	$X > \mu + \frac{1}{2}\sigma$	High
2	$\mu - \frac{1}{2}\sigma \leq X \leq \mu + \frac{1}{2}\sigma$	Midle
3	$X < \mu - \frac{1}{2}\sigma$	Low

Furthermore, to analyze problem-solving abilities in terms of digital literacy skills, problem-solving data was collected by providing a problem-solving ability test in the vector analysis course of vector operation study materials and conducting interviews.

The data analysis process refers to Miles and Huberman's opinion with an interactive model [11] which is described as follows



**Figure 1 Interactive Model Data Analysis**

Data collection (reduction of research data) is done by making an organized and consistent summary of the data based on the data that has been collected from the results of tests and interviews. Data display (data presentation) is done by arranging a pattern of relationships so that the research data is easier to understand. Conclusions (drawing conclusions) are carried out based on evidence of research data and consistency of research data.

**3. RESULTS AND DISCUSSION**

Data on digital literacy skills were obtained through respondents' answers from a questionnaire on digital literacy skills. The questionnaire was developed based on the opinion of [5] which explains that there are eight components of digital literacy skills, namely Functional Skills and Beyond; Creativity; Collaboration; Communication; The Ability to find and select Information; Critical Thinking and Evaluation; Cultural and Social Understanding; E-Safety. Furthermore, 11 work indicators were derived and then a 20 item questionnaire statement was made for digital literacy skills.

Data on digital literacy skills are further categorized into three, namely high, medium, and low digital literacy abilities. It should be noted that the maximum score is 120 out of the 20 items in the questionnaire statement. The results of categorizing digital literacy skills are presented in the following table.

**TABLE 2. DIGITAL LITERACY ABILITIES**

No	Interval	Interpretation	Many Respondents
1	$X > \mu + \frac{1}{2}\sigma$	High	20%
2	$\mu - \frac{1}{2}\sigma \leq X \leq \mu + \frac{1}{2}\sigma$	Midle	48%
3	$X < \mu - \frac{1}{2}\sigma$	Low	32%

Furthermore, from each category, one (1) person is taken randomly to be the research subject. Then the research subject was given a problem-solving ability test on the vector operation material. To obtain data validation on problem solving abilities, interviews were conducted with research subjects.

Problem solving ability test is "Two cities A and B are located opposite each other on the bank of a river which is 8 km wide and the river flow rate is 4 Km / hour. A resident in town A wants to reach the city C, which is 6 km towards the hillside (upstream) on the same bank as town B. If the ship can sail with a maximum speed of 10 km / hour and if it wants to reach deep C the shortest time possible, then in which direction should he travel and for how long the trip?"

Problem solving is analyzed based on the opinion of [12] which explains that there are four stages in problem solving, namely 1) understanding the problem, 2) problem solving strategy, 3) implementing problem solving, 4) concluding and checking again. The exposure of the research results is described as follows.

3.1.1. Problem Solving Ability with High Digital Literacy Ability.

Research subjects with high digital literacy skills have answered the vector analysis problem solving ability test. The answer can be seen in the following image:



Figure 2. Answers to Research Subjects with High Digital Literacy skills

In understanding problems or identifying things that are known from the questions, subjects with high digital literacy skills have the ability to understand and identify problems well. Subjects are able to illustrate problems in the form of images. In addition, the subject is also able to distinguish variables which are scalar and vector. Of course, the ability to understand problems by describing problems and differentiating between scalars and vectors requires knowledge, creativity and imagination. Based on

the results of the interview, subjects with high literacy skills in understanding the problem tried to independently relate the problem of the concept of operation to the vector. The subject does a "search" related to the concept needed. In addition, the subject is also looking for problems that are similar to the problems given. Furthermore, the subject with creativity and imagination illustrates the problem and writes what is known precisely.

In determining the strategies used in solving problems, subjects with high digital literacy skills are able to make problem solving strategies appropriately. The subject is able to make a settlement strategy in a way, namely the shortest travel time will occur if the ship goes from city A to city C. This means that it is the same as looking for the resultant between the speed of the ship and the speed of the river. Based on the results of interviews with questions; how subjects with high literacy skills are able to make such a strategy. It turns out that one thing that really helps subjects with high literacy skills to be able to make this strategy is the result of "searching" with similar problems. By understanding the settlement of problems that are similar to subjects with high literacy abilities, they get ideas for settlement strategies.

After a subject with high digital literacy skills makes a resolution strategy, the next step is to solve the problem. In carrying out problem solving, subjects with high digital literacy skills try to collect the related concepts needed in this case the concept of right triangle trigonometric comparison, cosine rules, quadratic equations, and sine rules then carry out algebraic analysis.

In the last stage of problem solving, subjects with high digital literacy skills only need to double-check the completion and conclude answers based on the questions in the questions.

Thus it can be said that, subjects with high digital literacy skills have the ability to solve problems well. Subjects are able to identify and illustrate problems, formulate resolution strategies with the right concept, solve problems with the right method, and evaluate the results of the answers.

3.1.2. Problem Solving Ability with Moderate Literacy skills

The problem-solving ability of research subjects with literacy abilities is being analyzed based on the results of the answers from the problem-solving ability tests that have been given. The results of the answers can be seen in the following figure.

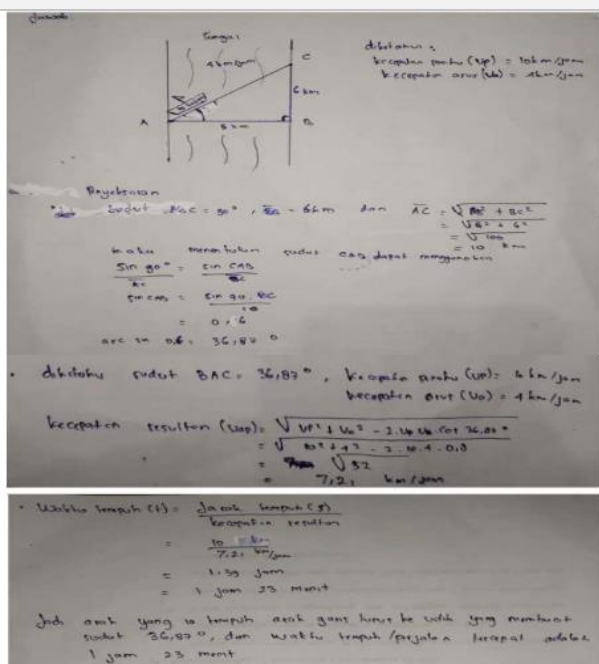


Figure 3: Results of the Answers of Research Subjects with Moderate Digital Literacy skills.

In understanding problems or identifying things that are known from the questions, subjects with digital literacy skills are having the ability to understand and identify problems well. Subjects are able to illustrate problems in the form of images. Subjects with moderate digital literacy skills are also able to identify what is known, but unfortunately the purpose of the problem is not written down. Based on the results of the interview the subject was able to answer the objectives of the problem, just forgot to write it down on the answer sheet.

In determining the subject settlement strategy with literacy skills, there is an error in implementing the concept in determining the resultant between boat speed and river flow velocity. Based on the results of interviews, subjects with moderate literacy skills are able to answer that is the resultant between the speed of the boat and the flow of the river, but the subject is not able to explain the resultant process between the two speeds. Subject is unable to understand the resultant concept between two vectors. Based on the results of the interview, the subject in answering questions is only based on knowledge that comes from notebooks or from lecturers' Ppt. The subject does not attempt to understand the concept of a simultaneous between two vectors from other sources, for example from the internet.

Errors in determining the correct settlement strategy by subjects with moderate literacy skills resulted in incorrectly answering questions.

Furthermore, in concluding answers related to the direction the boat should take, subjects with moderate literacy skills also experience errors. The subject assumes that the direction of the boat that must be taken is the BAC angle, even though it is not the speed of the boat but is the resultant between the boat and the speed of the river water flow.

Thus it can be said that the mistakes of the subject with digital literacy skills in developing strategies and evaluating the results of the answers are not yet checking whether the concept used is correct or not and only basing knowledge based on what is received by the lecturer and creativity in finding references is not optimal.

### 3.1.3 Problem Solving Ability with Low Literacy skills

The problem-solving ability of research subjects with low literacy abilities was analyzed based on the results of the answers from the problem-solving ability tests that had been given. The results of the answers can be seen in the following figure.

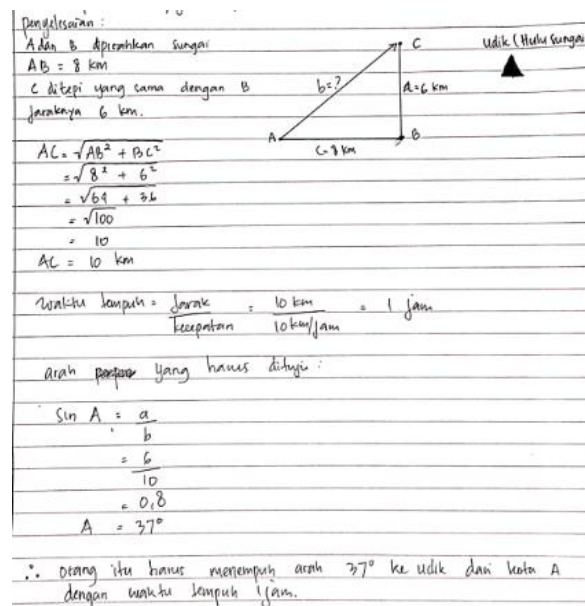


Figure 4 Answers to Research Subjects with Low Digital Literacy Skills.

If you look at how research subjects with low digital literacy skills understand problems or identify things that are known from the questions, subjects with moderate digital literacy skills have not been able to illustrate the problem as a whole. Although research subjects with low digital literacy skills have attempted to illustrate the problem by describing in the form of a point for each city A, B and C and connecting the three cities (dots) to form a triangle. The subject has not been able to identify existing vectors and illustrate them in the images that have been made. Based on the results of interviews, research subjects with low digital literacy skills are able to distinguish between vectors and scalars, but have not been able to implement the concept in the form of vector problems. In addition, research subjects with low digital literacy skills only rely on powerpoints given by lecturers as references in answering questions. Research subjects with low digital literacy skills have not attempted to search the internet for questions that are similar to the questions given.

Furthermore, in determining the strategy used in solving the problem, subjects with low digital literacy skills determine the length of the AC first, then to determine the time taken from city A to city C is to divide



the AC distance by the speed of the ship from A to C. Unfortunately, a subject with low digital literacy skills suddenly wrote down the speed of the ship from A to C as 10 km / hour without explaining how this figure was obtained. Based on the results of the interview, it was found that the subject wrote down the speed of the ship as 10 km / hour and the length of the AC. When asked about the definition of vectors and scalars, subjects with low digital literacy skills are able to answer correctly, it's just that when asked why you wrote a boat speed of 10 km / hour equal to the length of the AC, subjects with low digital literacy skills were confused to answer. In addition, in determining the direction to be taken the subject ship still experienced difficulties, resulting in errors in answering questions. Subjects do not yet understand the resultant relationship of the two vectors. Researchers suspect that the mistakes made by subjects with low digital literacy skills are because their understanding of vectors and scalars is not comprehensive and deep. The subject only remembers the definition of vectors or scalars but does not attempt to understand and implement these concepts in solving various vector problems. If only the subject tries to look back at the answer and creatively looks for the strategies needed to solve the problem from various reference sources either from the lecturer ppt or from the internet, then there is a possibility that the subject will be able to formulate the right strategy in solving the problem.

Considering that the strategies chosen by research subjects with low digital literacy skills are not yet precise, resulting in wrong completion and conclusions.

#### 4. CONCLUSION

Based on the results and discussion of the research, it can be concluded that Subjects with high digital literacy skills have the ability to solve problems well.

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