

## THE INFLUENCE OF DIGITAL LITERACY ON STUDENTS PROBLEM SOLVING ABILITY IN PHYSICS SUBJECTS

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### Abstract :

This research aims to measure the effect of digital literacy on students' problem solving abilities in physics subjects which are limited to class XI dynamic fluid material. This research uses quantitative methods with a causal associative research design. The sample for this research was 74 students obtained from the sampling technique, namely purposive sampling. The research instruments used in this study were a questionnaire sheet for the digital literacy variable and a question sheet for the problem solving ability variable. The data analysis technique that will be carried out is inferential statistical analysis using simple linear regression hypothesis testing. The results of this study show a significance value of 0.00, which means it is smaller than 0.05, so there is an influence between digital literacy and students' problem solving abilities. However, this research has limitations, namely it only focuses on measuring the influence and only on dynamic fluid materials.

Keywords: Digital Literacy, Problem Solving Abilities, Students

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## INTRODUCTION

Varying educational standards across countries or regions can create inequities in students' preparation for the global challenges of the 21st century. a. Some of the key characteristics of 21st century education involve the integration of technology, the development of 21st century skills, a student-centered learning approach, and the empowerment of students to face global challenges (Chotimah et al., 2020; Fadilah & Kartini, 2019). This is a teacher's demand in processing and conditioning the class in learning and teaching activities.

Learning is the foundation for personal development, intellectual growth, and positive contributions to society. This is a complex activity and involves various cognitive, emotional, and behavioral aspects (Irwandi et al., 2022; Rahardja et al., 2019). Approaches to learning can vary between individuals and can be influenced by various factors such as learning style, motivation, and learning environment (Astalini et al., 2023; Khery et al., 2022). The importance of learning activities means that educational units need to establish educational rules, instruments to measure students' abilities and educational foundations (Darmaji et al., 2021;

Harizon et al., 2023; Nusantari et al., 2020). Currently education in Indonesia sets an independent curriculum as a starting point for learning activities.

This Independent Curriculum is known as the Prototype Curriculum for Driving Schools. The Merdeka Curriculum is a curriculum that aims to hone children's interests and talents from an early age by focusing on essential material, character development and student competence (Amnuel et al., 2023; Suendarti & Virgana, 2022). The Merdeka Curriculum divides class levels from grade 1 to grade 12 into 6 phases, namely phase A to phase F (Nugrohadi et al., 2022). This curriculum includes 2 elements that students need to achieve in phase f, namely the physics understanding element and the process skills element. The learning outcomes required are so that students can apply digital literacy and have problem solving abilities.

Digital literacy is an individual's ability to use digital technology, especially in the context of information and communication. Digital literacy involves the skills of reading, assessing, understanding and creating digital content (Chodijah et al., 2022; Gomez, 2022). This digital literacy can be used to search for information in all fields, including education (Rahmi & Azrul, 2022). In the field of education, students are required to be more selective in evaluating information to gain in-depth abilities such as problem solving abilities.

Problem solving abilities are classified as one of the higher order thinking skills (HOTS). Problem solving ability is the skill to identify, analyze and solve a problem in an effective and efficient way (Azizah et al., 2015; Siripan & Noirid, 2022). This ability involves a series of cognitive steps or processes that help a person understand a problem, develop strategies to address the problem, and evaluate possible solutions (Jufrida et al., 2019; Morin & Herman, 2022; Siburian et al., 2019). For this reason, the level of difficulty of the questions given in honing students' problem solving abilities in phase f is higher, in Bloom's taxonomy starting from C4-C6.

Previous research by Rosidah (2022) conducted to analyze students' problem solving abilities in dynamic fluid material in class XI. The novelty of this research is that it adds digital literacy variables and is carried out in different places or research samples. The aim of this research is to measure the influence of digital literacy on students' problem solving abilities in the physics subject of dynamic fluid material. The urgency of this research is in terms of the importance of these variables, so they need to be measured to determine their achievement in learning activities. However, this research has limitations, namely it only focuses on measuring the influence and only on dynamic fluid materials.

## **RESEARCH METHOD**

This research uses quantitative methods with a causal associative research design. Causal associative research is causal in nature which aims to find the influence of the independent variable on the dependent variable (Putra, 2021; Setyawan, 2017). In this research, the role of the independent variable is digital literacy, while the dependent variable is problem solving ability. The population of this study was students in class XI of a private high school in Jambi City. The sampling technique for this research was carried out using a purposive sampling technique.

The purposive sampling technique is a sampling method that is carried out deliberately or with a specific purpose (Majid, 2023; Rachmawati et al., 2023). In this technique, researchers selectively select participants or sample elements based on certain criteria that are in accordance with the research objectives. In this study, the sample criteria were students who studied dynamic fluid material in class XI, with the aim of obtaining data from distributing questionnaires and questions. The purposive sampling technique provides flexibility for researchers to obtain in-depth and relevant information to the research focus (Pamungkas et al.,

2023; Wardani et al., 2023). From the research sampling technique, 74 students were the source of quantitative data.

Through this research sample, a research instrument will be created. Research instruments are tools or means used to collect data or information needed in a study. This instrument was designed with the aim of measuring the variables in the research and assisting researchers in obtaining valid and reliable data. For the digital literacy variable, the research instrument used was a questionnaire with 20 statements. Indicators in preparing the questionnaire were adapted from research Dinata (2021), presented in the following table.

Table 1. Digital literacy questionnaire indicators

Indicator	Explanation	Statement item
Functional skill and beyond Creativity	<ul style="list-style-type: none"> <li>• Ability to use computers and make use of the internet.</li> <li>• Be creative in presenting group material using digital media; Ability to think creatively and deeply imaginatively planning and exploring ideas</li> </ul>	1,2,3,4,5
Collaboration	<ul style="list-style-type: none"> <li>• Ability to participate in the digital space; Able to understand and explain ideas to others in the digital space.</li> </ul>	5,7,8
Communication	<ul style="list-style-type: none"> <li>• Able to communicate via digital technology media; The ability to perceive and understand others in the digital space.</li> </ul>	9,10,11
The ability to find and select information Critical thinking and evaluation	<ul style="list-style-type: none"> <li>• Ability to search and select information.</li> <li>• Able to contribute, analyze and think critically when dealing with information.</li> </ul>	12,13,14,15,16
Cultural and social understanding 17 E-safety	<ul style="list-style-type: none"> <li>• Understanding of social and cultural context.</li> <li>• Understand security when exploring, creating, and collaborating with digital technology.</li> </ul>	17,18,19,20

This is different from the digital literacy variable which uses a questionnaire. For the problem solving ability variable, a question sheet of 8 questions will be created which will be arranged with difficulty levels starting from C4. In preparing the questions, indicators of problem solving ability were adapted from research Heller et al (1992). Problem solving ability question sheet indicators are presented in the following table.

Table 2. Indicators of problem solving abilities

Indicator	Sub indicators
Understand the problem	Draw a sketch of a situation Identify the known and unknown Rewrite the question Identify concepts and principles with problem situations
Describe the problem into physics concepts	a. Write known and unknown variables with physical symbols b. Write down the variable in question using physics symbols
Planning a solution	a. Identify physics concepts and principles with the state of an equation b. Apply principles systematically into equation form
Using solutions	a. Substituting values of variables into physics equations
Evaluate solutions	a. Check whether the solution is complete b. Check whether the answer is correct c. Check whether the answer results make sense

In research on the influence of digital literacy on students' problem-solving abilities in Physics, the data analysis technique used can be regression analysis to determine the extent to which digital literacy affects problem-solving abilities. Data obtained from instruments such as problem-solving ability tests and digital literacy questionnaires are analyzed quantitatively (Sari et al., 2023; Suantara et al., 2023). This analysis aims to identify the linear relationship between the independent variable (digital literacy) and the dependent variable (problem-solving ability). In addition, statistical tests such as the t-test or ANOVA can be used to test the significance of the influence, so that valid conclusions can be obtained regarding the correlation and influence between the two variables (Majid, 2023; Wardani et al., 2023).

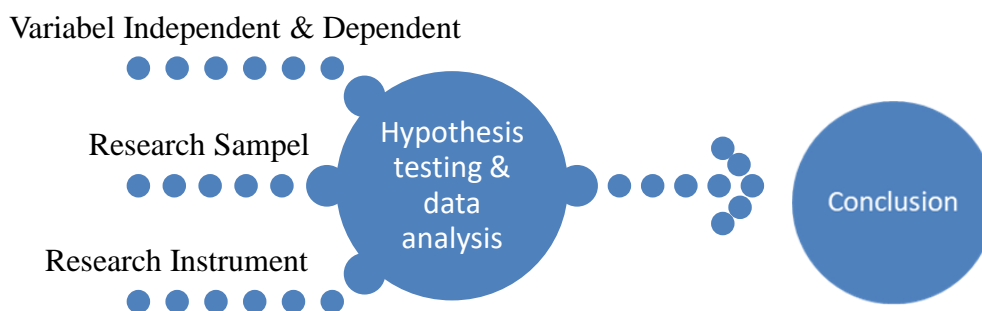


Figure 1. Research Procedure

Based on Figure 1, it is explained that this research began by determining the independent variable and dependent variable, namely digital literacy and problem solving abilities. Furthermore, from the sampling technique, a research sample of 74 students will be obtained, and an appropriate instrument will be prepared according to the research objectives. After the data is obtained from the distribution of instruments, it will be analyzed based on inferential statistics with hypothesis testing in the form of a simple linear regression test (Fitriyani, 2022; Maulidinah & Ekasari, 2023; Rinjani & Romadona, 2023). From the results obtained, a decision is made, namely comparing the value obtained with the determined probability value of 0.05.

**RESULTS AND DISCUSSION**

Digital literacy includes understanding and skills in using digital technology. Meanwhile, problem solving abilities involve the ability to identify, analyze and solve problems. Digital literacy enables individuals to access and use technology effectively. With good digital literacy, a person can utilize various digital tools to assist in the problem solving process (Gafurov et al., 2020; Khoza & Biyela, 2020). Individuals who have high digital literacy are more likely to use creative and innovative tools in designing solutions to the problems they face.

The ability to analyze digital data and information, which is part of digital literacy, can help in solving problems that involve understanding and interpreting data. By combining digital literacy and problem-solving abilities, individuals can become more efficient and effective in facing challenges involving technology in an increasingly digitalized world (Solikhah, 2022; Uswatiyah et al., 2021). It also supports lifelong learning, where adaptability and development continue as technology changes. Below are presented the results of a simple regression analysis of the influence of digital literacy on students' problem solving abilities in dynamic fluid material.

Table 3. Results of simple linear regression analysis; Coefficients

Coefficients <sup>a</sup>				
	Model	Unstandardized Coefficients	t	Sig.
		B		
1	(constant)	-78.992	-5.482	.060
	DL	3.65	1.912	.000
Dependent Variabel: PSA				

The coefficients table in the simple linear regression test is used to create a regression equation, namely  $Y = a + bX$ . From the table, it can be seen that the regression equation is  $Y = -78.992 + 3.65X$ .

Furthermore, the following table displays the results of a simple linear regression test on the ANOVA table:

Table 4. Results of simple linear regression analysis; ANOVA

ANOVA <sup>a</sup>			
	Model	df	Sig.
1	Regression	1	.000b
	Residual	72	
	Total	73	
Dependent Variable: PSA			
Predictors: (Constant), DL			

The ANOVA table in the simple linear regression test is used to determine the influence of the independent variable on the dependent variable. Based on table 4, a significance value of 0.000 is obtained, which is less than the probability value of 0.05. So it can be concluded that the independent variable (digital literacy) has a significant effect on the dependent variable (problem solving ability) of students.

The results of the simple linear regression test in the model summary table are presented in the following table:

Table 5. Results of simple linear regression analysis; Model Summary  
**Model Summary**

R	R Square
.220a	.48
a. Predictors: (Constant), DL	

The simple linear regression test results from the model summary table are used to determine the percentage contribution of the independent variable (digital literacy) to the dependent variable (problem solving ability) of students. Based on table 5, it is known that the R Square value is 0.48, which means that 48% of digital literacy influences students' problem solving abilities.

Digital literacy has great urgency for problem-solving abilities, especially because of the many challenges and opportunities that arise in the digital era. Explained by Asari et al (2019) the following are several reasons why digital literacy is very important in improving problem-solving abilities:

1. Digital literacy allows individuals to search for, access and assess information quickly and efficiently through a variety of digital sources.
2. In solving problems, it is often necessary to use various digital tools, such as applications, software and online platforms.
3. Digital literacy helps in analyzing data correctly, identifying trends, and formulating solutions based on the information found.
4. Digital literacy includes the ability to use creative tools such as graphic design, image processing, and video editing, thereby designing creative solutions to complex problems.
5. Digital literacy allows individuals to communicate effectively through various digital channels, including email, instant messaging, and social media.
6. In solving problems, it is important to involve digital security aspects, the role of digital literacy helps individuals understand and apply appropriate security practices when operating online.
7. The digital era is often characterized by rapid technological change, digital literacy allows individuals to continuously learn and adapt to new technologies, ensuring that their problem-solving abilities remain relevant.
8. Digital literacy involves understanding digital ethics, including responsibility in the use of technology, this helps individuals to make ethical decisions in the context of problem solving.

With good digital literacy, individuals have a strong foundation to explore, understand, and solve problems in an effective way in an ever-evolving digital environment. Digital literacy not only helps in solving problems, but also allows individuals to become active participants in an increasingly connected and technology-based society.

Research conducted by Widiana, (2020) the results are the same as those found by researchers, namely that digital literacy has a significant effect on teachers' ability to develop HOTS-based assessments. The digital literacy factor is one of the variables that quite affects teachers' ability to compile HOTS-based assessments. Without good mastery of digital literacy, teachers will have difficulty compiling HOTS-based assessments.

Research on the influence of digital literacy on students' problem-solving abilities in Physics subjects has a significant impact on the world of education. The results of this study can provide important insights for educators and policy makers regarding the importance of digital literacy in improving students' cognitive abilities, especially in the context of complex problem solving. This study can also encourage more effective integration of technology into

the learning process, thereby improving the quality of Physics education in schools. In addition, the findings of this study can be the basis for developing a curriculum that is more relevant to the demands of the digital era, as well as providing new directions in teaching strategies that combine digital literacy with the development of critical and analytical thinking skills in students.

Research on the influence of digital literacy on students' problem-solving abilities in Physics has several limitations that need to be considered. First, digital literacy is a broad and complex concept, making it difficult to measure all aspects relevant to problem solving comprehensively. Second, other variables such as learning motivation, learning environment, and different technological support in each school can affect the results of the study, but cannot always be fully controlled. In addition, this study may be limited to a specific sample, so generalizing the results of the study to a wider population must be done with caution. Other limitations include potential respondent bias in filling out the questionnaire and the possible lack of validity of the instruments used to measure digital literacy and problem-solving abilities.

## CONCLUSION

Based on the results of hypothesis testing with a significance level of 5%, it was concluded that there was an influence of digital literacy on the problem solving abilities of students at Xaverius 1 Private High School Jambi City with a large contribution of 48%. Then, every 1 unit increase in digital literacy will increase the value of students' problem solving abilities by 3.65.

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