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## The Role of Digital Literacy and Generic Skills on Student Physics Learning Outcomes

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**Abstract.** Digital literacy is a form of literacy that is very important for students to master along with technological developments. This digital literacy can be applied in learning, one of which is in learning physics. The urgency in this study is that it is hoped that the application of digital literacy in physics learning can improve student learning outcomes and generic skills. The purpose of this study was to determine the effect of applying digital literacy in learning physics on the learning outcomes and generic skills of class A and class B students. This study used a mixed methods research type. Then the data in this study were processed using SPSS 26 software to find values from the regression analysis. The results of the regression test function to determine the effect of implementing digital literacy on student physics learning outcomes. Based on the regression test, it is known that  $\text{sig.} < 0.05$ , namely 0.001, which means that there is an effect of applying digital literacy in learning physics on student learning outcomes and  $< 0.05$ , namely 0.000, which means that there is an effect of digital literacy on generic skills. The conclusion obtained is that there is an effect of applying digital literacy in physics learning to student learning outcomes and generic skills, where in class B the effect is greater in terms of grades or student learning outcomes.

**Keywords:** Digital literacy, learning outcomes, learning physics, generic skills

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## Introduction

Education is a means to advance all areas of human life in Indonesia, both in the economic, social, technological, security, skills, noble character, welfare, culture, and national glory (Ilham, 2019; Asmara et al., 2021; Aini, 2023). Education is the right of every citizen that must be implemented by the government under any circumstances so that national education goals can be achieved (Winata et al., 2021; Baro'ah, 2020; Hassan & Mirza, 2021). With education, it is hoped that it will give birth to the next generation of the nation with intelligent and quality individuals, which means becoming a generation that is able to make the best use of existing progress (Fitri, 2021). In the world of education, learning is needed that can help achieve the goals of education itself. The existence of various kinds of subjects in education is useful for developing the potential of the nation's generation, such as lessons or knowledge that are very useful for cultivating a scientific spirit and also useful for developing technology and information for humans. One such science is physics.

Physics is a field of study at the high school level that underlies the development of advanced technology and the concept of living in harmony with nature. In addition to studying natural phenomena, physics also provides good lessons for humans to live in harmony based on natural laws. Physics learning requires students' ability to understand concepts and solve problems (Putri et al., 2017; Markawi, 2015; Ince, 2018; Johnston, 2020). Understanding the concept of physics is the ability of students to know, define and express themselves the physics concepts they learn without reducing their meaning (Hanna et al., 2017; Uwamahoro et al., 2021; Liu et al., 2020). Learning physics is a process that involves students in studying nature and its symptoms through a series of scientific processes that are built on the basis of attitudes to acquire knowledge, skills to achieve learning goals (Putri et al. al., 2017; Handayani et al., 2018; Haryadi & Mantofani, 2021). In learning physics, further study is needed to understand material that is said to be difficult and not all events occur or actually can take place continuously in everyday life, therefore to help understand physics, literacy activities are needed in digital form to make it easier to get information about physics material.

Literacy development is important to pay attention to, because it is the initial ability that must be owned by every individual to live life in the future. Literacy in a broad sense is related to technological literacy, information literacy, critical thinking, and sensitivity to the environment, social and society (Purwaningtyas, 2018; Alfin, 2018; Pérez-Rodríguez et al., 2019). Through literacy skills, a person not only gains knowledge but can also use his knowledge and experience to be used as a reference in the future (Oktariani & Ekafiansyah, 2020; Peng & Zu, 2022). A person can only be said to be educated if he is able to understand something because he reads and does something based on his reading comprehension (Kharizmi, 2015; Dantes & Handayani, 2021). The cultivation of literacy as early as possible must be realized because it is the main capital in creating an intelligent and cultured nation (Martaulina et al., 2021). The rapid development of information technology in the current era of globalization cannot be avoided, its influence on the world of education. Global demands require the world of education to always adapt technological developments with efforts to improve the quality of education, especially adjustments to the use of information and communication technology for education, especially in the learning process. The existence of technology is currently considered very important in human life as a support in carrying out various activities both in doing work and in terms of education (Agustian & Salsabila, 2021; Promrub & Sanrattana, 2022). As an effort to keep abreast of technological developments in the world of education, the role of technology-based literacy must also be realized so that students are increasingly literate in digital technology to help and make it easier to acquire learning knowledge or information. This is in line with the opinion that digital literacy is important for everyone in this digital era, including those who are currently studying from elementary to tertiary education (Amri et al., 2021; Tohara, 2021).

Digital technology-based literacy is commonly referred to as digital literacy. Digital literacy is the knowledge and skills to apply digital media, communication tools or networks in searching, evaluating, using, creating information and using it in a healthy, wise, smart, accurate, precise and law-compliant manner in order to foster communication and interaction in everyday life. (Novitasari & Fauziddin, 2022; Simarmata et al., 2021; Koltay, 2011). According to Safitri et al., (2020) the government has been promoting the digital literacy movement for a long time, and various approaches have been taken by the government. The concept of digital literacy developed by the Ministry of Education and Culture is based on the UNESCO digital literacy concept where digital literacy includes two main perspectives, namely technology literacy and information literacy (Hadi & Suriani, 2022; Kintoko & Mulianingsih, 2022; Udeogalanya, 2022). Digital literacy is not only the process of students using media, but the process or way students use the internet and its role in its growth. The benefits of implementing digital literacy according to Fitriyani &

Nugroho, (2022) include: Activities to find and understand information, increase the ability to be more critical in thinking, improve verbal skills, increase focus and concentration, improve reading skills and compose sentences. Meanwhile, according to Mudra (2020) the benefits of digital literacy include improving students' writing skills, improving reading, listening and speaking skills, increasing the frequency of using digital technology, increasing online collaboration between teacher-students and students.

Meanwhile, based on previous research, with digital literacy students should develop their learning outcomes not only to be motivated to get good grades but students must continue to study hard both at school and at home (Arima et al., 2021). Digital literacy can also make it easier for students to learn wherever and whenever. Then based on Widiastini's research, (2021) the learning outcomes of students who study by applying digital literacy are higher compared to students who study using conventional learning. So it can be concluded that there is an influence between digital literacy on learning outcomes in citizenship subjects. Based on the research that has been done, this research complements previous research which only discussed the effect of digital literacy on civics learning, so this research measures the effect of applying digital literacy to science learning, namely physics learning, on student learning outcomes. Then the urgency of this research is to find out whether there is an effect of applying digital literacy on students' physics learning outcomes. In accordance with the objectives of this study, by implementing digital literacy activities, student learning outcomes can increase or vice versa.

Apart from influencing student learning outcomes, digital literacy also affects students' generic skills. Generic science skills are important skills needed for students to develop careers according to their respective fields. These generic science skills are not acquired suddenly but must be trained so that they continue to improve. There are nine kinds of generic science skills that can be trained on students, including: direct observation, indirect observation, awareness of scale, symbolic language, logical framework, logical inference, law of cause and effect, mathematical modeling and the ability to build concepts. One way to improve these generic skills is through digital literacy. By observing the reading material and taking the essence of the reading material, students will learn about how to build concepts from a reading material obtained digitally, then use symbolic languages in one reading, make indirect observations through writing, and so on.

## Methods

This research uses mixed methods. In this mixed methods research, two methods were used, namely the quantitative method and the qualitative method. According to Azari et al., (2023) quantitative research is empirical research in which the data is in the form of numbers and qualitative research is research in which the data is not in the form of numbers. Quantitative research data is data that exists or is expressed in the form of numbers obtained from the field, or it can also be called qualitative data which is expressed in the form of numbers obtained by changing qualitative values to be quantitative. Meanwhile, qualitative research data is defined as data that is present or expressed in the form of words, sentences, narrative expressions, and images (Ramadan, 2021).

The population in this study were all physics education students at Jambi University Class of 2020. The samples in this study were 20 class A students and 20 class B students. The sampling technique used was purposive sampling. This means that the selection of samples in this study was carried out by first setting criteria so that samples that were not

included in the criteria were not used. The sample criteria used in this study include: (1) Students majoring in physics education class of 2020, (2) College students A and B.

The instrument used in this study was an interview sheet to obtain qualitative data regarding physics learning by applying digital literacy and a test instrument, namely physics questions for quantitative data. The test instrument used to see student learning outcomes in learning by applying digital literacy consists of 20 statements with a Likert scale of 5, while the student interview sheet consists of 12 statements to determine students' generic skills. Interview sheets are used to find out students' opinions about the application of digital literacy in physics learning. While physics questions are used to see student learning outcomes after implementing digital literacy. The data collection procedure carried out in this study was to first conduct an initial study in the form of interviews with students and teachers about digital literacy and its relation to learning physics and generic skills. Then after carrying out the initial learning, the next researcher asked questions related to physics learning after students carried out the teaching and learning process with the teacher in physics learning with the application of digital literacy. After obtaining data from the test questions filled in by students, it will then be analyzed to find out how digital literacy influences student physics learning outcomes.

Data analysis in this study used quantitative analysis using SPSS 26 software to find the value of descriptive statistics and inferential statistics. While the analysis of qualitative data using Miles & Huberman analysis. In this study, researchers used the mean, median, mode, maximum value and minimum value to determine the value of student learning outcomes whether the scores obtained were high or low. Then before testing the hypothesis in this study, prerequisite tests were first carried out, namely the normality test and linearity test. After the prerequisite test, a regression test was carried out. Prerequisite tests in the form of normality tests and linearity tests were carried out before carrying out the regression test. This is useful to know in advance whether the data obtained is normal and linear so that it is feasible to do further testing, namely the regression test. Meanwhile, the regression test is useful for knowing the magnitude of the influence between digital literacy on physics learning outcomes. For qualitative analysis using Miles and Huberman's analysis, it is carried out based on 4 steps, namely data collection, data reduction, data display, and drawing conclusions.

## Results and Discussion

The following are interview questions asked of students regarding the application of digital literacy in learning at school.

**Table 1.** Results of student interviews regarding the application of digital literacy to students' generic skills in class A.

Number	Question	Respons
1	Is school provide facility technology information?	Yes.
2	How facility technology information provided by the school?	amount and time use limited.

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3	Source study what just often you use in learn?	Print book sources and digital sources like google.
4	Is you like study use technology information as source learn?	Yes I like, usually via smartphone use the internet.
5	Are you more like study from source book or from existing technological facilities information? why?	Prefer to use digital technology because it is easier and faster to get information.
6	How much often you utilise technology information as source learn?	Often once.
7	What just your benefits get from study use technology information as source learn?	The benefits is could know how method look for information on the internet for make it easy in complete about or tasks.
8	Is you once utilise technology information for study class?	Yes.
9	Are you the teacher using technology information in the learning process Like laptops?	Yes, using a laptop, projector.
10	How much often Mr / Ms teachers use technology information in the learning process?	Sometimes.
11	What just obstacles in utilise technology information as source learn?	If at school that limited use it because seldom allowed for bring a smartphone during class hours.
12	What lessons are usually using computer digital media? is lesson Physics included?	Many, like lesson Physics is also included.
13	Does using digital media make it easier and more helpful for you to learn the learning material?	Yes, using digital media is certainly easier to understand the learning material being taught.

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Based on Table 1 it is known that in class (A) the use of digital media in schools is limited especially during class hours, students are rarely allowed to use smartphones at school and the use of digital media by teachers for teaching is also not always used due to limited tools or media. digital used by teachers. However, students say that sometimes it is also difficult to understand information obtained from digital media that is displayed during learning because they are not used to it. As for the results of class A interviews, they are in Table 2.

**Tabel 2.** Results of student interviews regarding the application of digital literacy to generic skills in class B.

Number	Question	Respos
1	Is school provide facility technology information?	Yes.
2	How facility technology information provided by the school?	The amount limited.
3	Source study what just often you Use in learn?	Book print and Google.
4	Is you like study use technology information as source learn?	Yes , usually via smartphone use the internet.
5	Are you more like study from source book or from existing technological facilities information? why?	On technology , because more fun easy get the information.
6	How much often you utilise technology information as source learn?	Often once.
7	What just your benefits get from study use technology information as source learn?	The benefits is could know how method look for information on the internet for make it easy in complete about or tasks.
8	Is you once utilise technology information for study class?	Yes.
9	Are you the teacher using technology information in the learning process Like laptops?	Yes, using a laptop, projector.
10	How much often Mr / Ms teachers use technology information in the learning process?	always.
11	What just obstacles in utilise technology information as source learn?	Kendanya if at school that limited use it because seldom allowed for bring a smartphone during class hours.
12	What lessons are usually using computer digital media? is lesson Physics included?	Many, like lesson Physics is also included.
13.	Is with using digital media, you feel more easy for understand Theory learning?	Yes, because with using the accompanying digital media images, sounds and animations as well as other will more easy understand it.

14.	Benefit what are you feel with learning using digital media?	The benefits is more easy and fast for understand something, for example is because used to look animation explanation learning with moving text and images _ that could trained to focus and read as well as understand with fast.
15.	Usually how many sources on the internet that you Use for look for information about learning physics?	Many if you open the internet then the link provided related to the lesson matrix just open one new then choose which one you want to use.

In Table 2 it is known that in class B students are better trained to read and understand material more quickly and also have the ability to conclude material obtained from various sources.

The results of descriptive statistical tests regarding student learning outcomes are presented in Table 3.

**Table 3.** Descriptive statistics on the application of digital literacy

Class	Intervals	F	%	Categories	Means	Median	Min	Max
A	20-35	0	0	Very Not Good	82.00	80.00	70	95
	36-51	0	0	Not Good				
	52-67	0	0	Enough				
	68-83	10	50	Good				
	84-100	10	50	Very Good				
B	20-35	0	0	Very Not Good	84.45	84.00	75	100
	36-51	0	0	Not Good				
	52-67	0	0	Enough				
	68-83	2	10	Good				
	84-100	18	90	Very Good				

Based on Table 3 student physics learning outcomes with the application of digital literacy during learning in class A, namely 50% of students obtained results in the good category and 50% in the very good category, while in class B, class B obtained 10% in good category and 90% in very good category.

The description of the results of the regression test for applying digital literacy to learning physics can be seen in Table 4.

**Table 4.** The results of digital literacy regression analysis on physics learning outcomes

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.024	1	120.024	2072	0,001b
	Residual	2317048	40	57.926		
	Total	2437071	41			

Based on the Table 4 of regression test results in class A and class B, the sig. <0.05, then there is an influence between the application of digital literacy on students' physics learning outcomes.

**Table 5.** Results of digital literacy regression analysis on generic skills

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	55.474	1	55.474	6284	0,000b
	Residual	74.159	40	12.766		
	Total	129.632	41			

Whereas in Table 5 the significance value for digital literacy analysis on generic skills is also <0.05, which means that there is an influence of digital literacy on generic skills. The data in table 1 were obtained using Miles and Huberman's analysis. Based on the results of interviews conducted by researchers with informants, namely class A students, the results obtained by researchers are that students rarely do learning by applying digital literacy because they rarely use digital media. Then the ability of students to read something quickly and understand it quickly is also lacking. That way, it means that the generic skills possessed by class A are still lacking because students lack critical thinking and are quick to respond to something that is happening. Whereas in table 2 class B students stated that they were trained to read and understand quickly learning or material displayed with digital media by the teacher, and also students said that in concluding information, first look at the information conveyed from various sources. In this case, it means that the generic skills of class B students are better than those of class A. Students are able to make decisions by concluding the learning, then the ability to understand the displayed media means that students' generic skills in making observations are very good.

Then, based on table 3, statistical tests were carried out using SPSS 26 software to analyze research statistics in the form of median, mode, mean, maximum value, minimum value and percentage obtained from research data. For this reason, the percentage of learning outcomes in the very good category in class B is dominant, namely 90%, while in class A in the very good category the percentage is 50% or after the number of students. The average, median, mode and minimum and maximum scores in class B are also greater than those obtained in class A. This is of course the case because class B uses the application of digital literacy.

The results of the regression test in table 4 serve to determine the effect of applying digital literacy on student physics learning outcomes. Based on table 4, it is known that the sig. < 0.05, namely 0.01, which means that there is an effect of applying digital literacy in physics learning to student learning outcomes. Where students who have high literacy skills are able to complete tasks with maximum results and have good innovation (Mcguiness, 2019). Developments in technology and information that exist in various lives require students to be able to compete and compete in achieving success (Ulfa et al., 2021). With technological literacy or digital literacy, it is hoped that students will have several technological skills which are currently very crucial in finding and determining



information from unlimited sources, communicating via computers and manipulating certain information for specific purposes such as completing assignments, presentations and analysis. the required data (Suryana et al., 2023). Digital literacy is very important for students to master because mastery of science and technology is an important key in the development of the times (Astuti et al., 2023). In addition, learning physics which is included in science learning is one of the elements that has an important role in the process of development and progress of science and technology (Wati et al., 2022).

Then by having digital literacy skills a person will obtain information, create new knowledge, produce scientific ideas through creativity in using digital technology, use digital evidence and data to acquire knowledge, understand social and cultural closeness in digital society, solve problems through information and content. digital, capable of collaborating and disseminating, and having a scientific ethos in developing knowledge using digital technology (Turisnawati & Widodo, 2019). In digital literacy, the process of learning physics can be done with one example, namely learning media. Technology-based learning media can make learning more empowered where communication contacts between individuals supported by technology can provide added value in certain communication skills (Nursamsu & Kuksnafizal, 2017).

In addition, with good digital literacy, students can also improve their generic skills in the learning process. For the first generic skill is a). Direct observation: with digital literacy students can see or observe something that is being researched through digital media regarding the color of shapes, get to know the nature of a phenomenon. b). Indirect observation: observations for invisible objects that can be carried out with a microscope or digital tools or applications available online through digital media. c). Awareness of scale: it means being aware of the object that gets information from the digital media about how it is sized and so on. d). Understanding symbolic language: with digital literacy, students' generic abilities in understanding formulas, information from graphs, tables, or images, symbols will be better because the available information will present it. e). Logical inference: the point is that students are able to draw new conclusions on information obtained through digital media without having to do experiments. f). Logical framework: Students are able to think systematically based on the regularity of phenomena obtained or known from digital literacy activities. g). Causal relationship: Based on the information obtained by literadi digutak, this causal relationship arises as a result of the belief that the information obtained about learning physics is interrelated in a causal pattern that can be understood by reasoning.

Furthermore, the research conducted is in line with the previous research mentioned above, namely the learning outcomes of students who study by applying digital literacy are higher than those of students who study using conventional learning. Then there is an influence between digital literacy on citizenship learning outcomes. In this study, the effect that was measured was learning outcomes in civics learning, not physics learning. There is also research conducted by Landa et al., (2021) which measures the effect of teacher digital literacy on students' learning interest. However, this previous research did not measure the effect of digital literacy on physics learning outcomes. So in this study measuring the effect of digital literacy on other subjects that have not been measured.

The novelty of this study is to determine the effect of applying digital literacy to learning physics on students' learning outcomes and generic skills. Where there is no research that examines the application of digital literacy to student learning outcomes and generic skills. So that this research seems to cover other disciplines that have not been measured, namely physics. While the implication of this research is that digital literacy can improve student learning outcomes in physics learning and also generic skills. Where in this study it can be seen that the learning outcomes of students who apply digital literacy are better.

As for this study, there are also limitations, namely only using learning outcome variables, and no testing has been carried out on other variables. Where learning outcomes are important things that determine student success in the learning process at school and determine whether students are capable of learning seen from their learning outcomes. Researchers suggest conducting further research to measure other variables and compare them with other variables in learning physics at the senior high school level.

## Conclusion

Based on the formulation of the problem in this study, the researcher concluded that there was an effect of implementing digital literacy on the learning outcomes of physics learning in class A and class B. Where is the sign.  $< 0.05$ , namely 0.001. For the effect of digital literacy on generic skills sig.  $< 0.05$ , namely 0.000 where there is an influence. It can also be concluded that with digital literacy students can obtain better learning outcomes while students who do not apply digital literacy in their learning obtain lower learning outcomes.

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