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HOTS Study: How are the literacy and thinking skills of students different?

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ABSTRACT

This research was conducted to determine how the influence of digital literacy and critical thinking skills. This research was conducted using a mixed method with the convergent parallel design. The subjects of this study were students from SMAN 6 Batanghari and SMAN 10 Batanghari with a specialization in science, where each school took 2 classes with a total of 80 students as samples with 297 eleventh graders in both schools as population, where research sample chosen with purposive sampling. The data analysis carried out in this study was a normality test, linearity test, and regression test. From this research, it was found that there were significant differences in the level of digital literacy skills and understanding of students on digital literacy between the two test schools. Significant differences are also seen in the level of critical thinking of students. The interesting thing in the findings of this research is that students who have a good level of skills and understanding of digital literacy will have a good level of critical thinking as well. So, it was found that digital literacy also has an influence on students' critical thinking skills.

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INTRODUCTION

The era of society 5.0, is evidence of the very rapid development of technology (Meneses & Mominó, 2010; Syam, 2019). This development is a challenge in the field of education, especially in Indonesia to produce students who are tough and able to meet the demands of the times. Digital literacy is one of the demands of the times (Asari et al., 2019; Perdana et al., 2019; Widana & Ratnaya, 2021). Where, with the rapid development of technology, society as the center is required to be able to utilize technology to solve social problems and improve the economy (Bransford et al., 1984; Gick, 1986). Therefore, educators need to know and improve students' digital literacy skills.

Literacy is the ability to read and write (Yuliati, 2017). However, with the development of technology, literacy also develops into digital literacy (Dashtestani & Hojatpanah, 2022; Meneses & Mominó, 2010). Digital literacy is the ability to operate technology to solve the problems faced (Samputri, 2019). According to another opinion, digital literacy is a skill in utilizing digital devices to obtain information in various contexts, one of which is academic information. However, with access to information quickly and widely. It takes understanding in processing and evaluating the information obtained. Therefore, in digital literacy, students are required to be critical in receiving the information obtained.

Critical in evaluating the information obtained is needed, so as not to receive wrong

information (Dewi & Utami, 2019; Mahbubah & Hermita, 2019; Sudrajat et al., 2018). Therefore, digital literacy is closely related to critical thinking skills. Critical thinking skills are one of the higher-order thinking skills. Where, critical thinking skills are oriented to students' skills in evaluating ideas and information obtained to draw conclusions or solve problems (Rosdiana, 2020; Yahya, 2019). Critical thinking skills are very important for students, especially in the era of revolution society 5.0 as it is today. One of the subjects that demand students in critical thinking skills is natural science subject matter.

Natural science is the science of how to think. Another opinion states that science is a science that is obtained through data collection by conducting experiments, observations, and deductions to get an explanation of an observed phenomenon (Noeraida & Nuraeni, 2016; Wilijeng, 2018; Yuliati, 2017). Science learning is carried out using a scientific approach, where in learning activities students are required to be able to observe critically the natural phenomena they observe. Thus, students learn how to understand the causes and effects of natural phenomena that occur. The demands of critical thinking skills in science learning, because these skills can help students solve problems, evaluate, and conclude information from the observed phenomena (Asy'ari et al., 2019; Hernawati et al., 2018; Riantoni et al., 2017).

Research related to digital literacy skills and critical thinking skills was carried out with the demands of the directorate general of education and the implementation of the independent curriculum (Atmazaki et al., 2017). Research conducted by (Juita et al., 2019; Mahanani et al., 2019; Rosdiana, 2020) looked at how the influence of the inquiry learning model on students' critical thinking skills. Meanwhile, research on digital literacy was carried out by (Asari et al., 2019; Dashtestani & Hojatpanah, 2022) in describing the level of digital literacy skills of students and educators. Meanwhile, this research was conducted to find out how the influence of digital literacy skills on students' critical thinking skills in science subjects.

With meaningful learning, students are expected to be able to develop the potential that exists within themselves. Therefore, this research was conducted to know the relationship between digital literacy and critical thinking skills possessed by students. Thus, educators can know and understand the description of students' literacy abilities and critical thinking skills. So that educators can improve the scientific literacy and critical thinking skills of students in science learning.

METHODS

This study uses a mixed method with an explanatory design research design (Creswell & Creswell, 2018; Sugiyono, 2013). A mixed method is used to analyze quantitative data which is strengthened by qualitative data collected afterward (Huber & Froehlich, 2020; Samsu, 2017). Therefore, this study applies an explanatory design that uses quantitative data analysis as the main data and qualitative data as supporting data. This research was conducted at SMAN 6 Batanghari and SMAN 10 Batanghari in class XI IPA 1 and X IPA 2. With a population of 297 students sitting in class XI, this study used a sample of 80 students. The sample selection was done by purposive sampling technique. Purposive sampling is done to get a sample that can represent the population.

The grid of instruments used in this study is presented in the following table 1.

Table 1 Specifications for assessing students' digital literacy skills.

Measured ability	Rating indicators	Question points
Define	Explaining appropriate information using e-learning	1, 2, 3
Access	Operate Google classroom to get information	4, 5
Manage	Using the PhET simulation web browser as a tool to apply or classify existing schemas	11, 12
Create	Representing information via a web browser PhET simulation	13, 14, 15
Integrate	Generate information or give back information using zoom meeting	8, 9, 10
Communication	Disseminate customized information in a digital format that is effective in the use of google classroom	6, 7

(Lengkong, 2021)

Table 2. Specifications for assessing students' critical thinking skills.

No	Stages of critical thinking skills	Indicator	Question points
1	Elementary clarification	Focusing or formulating a question	5, 6, 7
		Analyze arguments	1, 4, 7
		Classify by asking and answering questions	2, 3, 5
2	The basis for the decision	Considering the truth of the source	8, 9
		Conduct observations and assess reports of observations	10, 11, 12
3	Inference	Making deductions and considering the results	10, 11
		Make an induction and consider the results	12, 13
		Create and determine value judgments	14, 15
4	Advances clarification	Define and consider it	18, 19, 20
		Identify assumptions	16, 17, 19
5	Supposition and integration	Considering the reason	12, 14, 15
		Combining information or including it in decision making	9, 10, 11, 13

(Gupita, 2016)

By using the instrument grid above, the data needed to answer this research question was obtained.

Because there are two types of data, namely quantitative data, and qualitative data. Technical data analysis was carried out using quantitative descriptive to describe the quantitative data obtained. Meanwhile, qualitative data were analysed using Miles & Huberman data analysis technique. The Miles & Huberman technique is used to understand and assess cause and effect in a population environment (Creswell & Creswell, 2018; Huber & Froehlich, 2020; Sugiyono, 2013).

In addition to the data analysis techniques above, this study also conducted tests in the form of testing assumptions and testing hypotheses. The assumption test carried out in this study was in the form of a linearity test and a normality test. While the hypothesis test is used in the form of a regression test. The test was conducted to determine the level of feasibility of the data and get answers from the research conducted. The flow of the research carried out is described as shown in the image below.

Figure 1. Research flow.

RESULTS AND DISCUSSION

The data obtained from the results of the study with samples from two classes at SMAN 6 Batanghari and SMAN 10 Batanghari were then analyzed using the assumption test and hypothesis testing shown in the tables below. Where table 3 shows the descriptive statistical data obtained.

Table 3. Table of descriptions of students' digital literacy skills SMAN 6 Batanghari

SMAN 6 Batanghari								
Class	Interval	F	Percentage (%)	Category	Mean	Median	Min	Max
XI IPA 1	6 – 10,8	0	0	Very poor	4	4	3	5
	10,9 – 15,6	0	0	Poor				
	15,7 – 20,8	1	5	Sufficient				
	20, 9 – 25,6	18	90	Good				
	25,7 - 30	1	5	Very good				
XI IPA 2	6 – 10,8	0	0	Very poor	4,55	5	3	5
	10,9 – 15,6	0	0	Poor				
	15,7 – 20,8	1	5	Sufficient				
	20, 9 – 25,6	7	35	Good				
	25,7 - 30	12	60	Very good				
SMAN 10 Batanghari								
Class	Interval	F	Percentage (%)	Category	Mean	Median	Min	Max
XI IPA 1	6 – 10,8	0	0	Very poor	2,75	3	2	4
	10,9 – 15,6	6	30	Poor				
	15,7 – 20,8	13	65	Sufficient				
	20, 9 – 25,6	1	5	Good				
	25,7 - 30	0	0	Very good				
XI IPA 2	6 – 10,8	0	0	Very poor	2,6	3	2	3
	10,9 – 15,6	8	40	Poor				
	15,7 – 20,8	12	60	Sufficient				
	20, 9 – 25,6	0	0	Good				
	25,7 - 30	0	0	Very good				

From the table above, the students of class XI IPA 2 of SMAN 6 Batanghari have a better level of ability in internet searches which are better than students of other subjects. Furthermore, the level of critical thinking skills possessed by class XI science students is described in table 4.

Table 4. Table of descriptions of students' critical thinking skills

SMAN 6 Batanghari								
Class	Interval	F	Percentage (%)	Category	Mean	Median	Min	Max
XI IPA 1	6 – 10	0	0	Poor	2,1	2	2	3
	10,1 – 14	18	90	Sufficient				
	14,1 - 18	2	10	Good				
XI IPA 2	6 – 10	0	0	Poor	2,2	2	2	3
	10,1 – 14	16	80	Sufficient				
	14,1 - 18	4	20	Good				
SMAN 10 Batanghari								
Class	Interval	F	Percentage (%)	Category	Mean	Median	Min	Max
XI IPA 1	6 – 10	0	0	Poor	2,05	2	2	3
	10,1 – 14	19	95	Sufficient				
	14,1 - 18	1	5	Good				
XI IPA 2	6 – 10	4	20	Poor	1,8	2	1	2
	10,1 – 14	16	80	Sufficient				
	14,1 - 18	0	0	Good				

From the table above, students in class XI IPA 1 at SMAN 6 Batanghari have a level of critical thinking skills in evaluating information content that is better than other subjects.

Furthermore, the assumption test was carried out in the form of normality and homogeneity tests of the data to determine the feasibility level of the data used, and hypothesis testing was carried out to determine the level of difference between each variable in the two sample classes. The table of data normality test results can be seen in the following table.

Table 5. Data normality test table

Variable	Test of Normality					
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
V_1	0.091	80	0,200*	0.983	80	0.118
V_2	0,083	80	0,200*	0,957	80	0.213

a. V_1 = Digital literacy skills of students
b. V_2 = Students' critical thinking skills

From the table above, the results of the data normality test have a sig value that is greater than the sig 0.05. So that the data used in this study is normally distributed. Furthermore, the linearity test of the data used in this study is shown in table 6.

Table 6. Homogeneous test table

School	Test of Linearity			
	Class	Sig	F	Distribute
SMAN 6 Batanghari	XI IPA 1	0,166	2,120	Linear
	XI IPA 2	0,276	3,099	Linear
SMAN 10 Batanghari	XI IPA 1	0,101	3,074	Linear
	XI IPA 2	0,157	3,108	Linear

From the table above, the results of the data homogeneity test have a sig value that is greater than the sig 0.05. So that the data used in this study is homogeneous. Furthermore, the data hypothesis testing carried out in this study is shown in table 7.

Table 7. Regression test table

School	Class	Variable	B	t	Sig
SMAN 6 Batanghari	XI IPA 1	(Constant)	20,420	10, 339	0,000
		Digital Literacy	0,250	2,205	0,049
	XI IPA 2	(Constant)	22,109	11,058	0,000
		Digital Literacy	0,437	2,277	0,039
SMAN 10 Batanghari	XI IPA 1	(Constant)	21,973	11,071	0,000
		Digital Literacy	0,497	2,293	0,037
	XI IPA 2	(Constant)	19,741	10,707	0,000
		Digital Literacy	0,0301	2,211	0,045

a. Dependent Variable: Critical thinking skills

The regression test was carried out using the independent variable in the form of digital literacy skills with the dependent variable being students' critical thinking skills. The results of the regression tests carried out; the results obtained as shown in table 7. The t value of each dependent variable is known. Then look for the t-table value and get a value of 1.994. Then we compare the calculated t value for each dependent variable with the t-table value. There is a significant positive effect between the independent variable and the dependent variable. This is evidenced by the t value

which is higher than the t-table in the entire research sample. The positive effect is obtained from the t value which is positive and greater in value than the t-table.

Furthermore, the influence between the two variables used in this study can also be observed through the significance value. Where, the table shows that the significant value in each sample has a lower value than the significant value used, which is 0.05. This indicates that digital literacy skills have a significant influence on the critical thinking skills of class XI students at SMAN 6 Batanghari and SMAN 10 Batanghari.

The test is not only done using quantitative data, but this research also collects interview data with teachers and students regarding interest in learning, scientific literacy, and science process skills. Interviews were conducted using an instrument adapted from Chaniago (2018). The results of the interviews are presented in table 8.

Table 8. Interview Results

No	Subject	Question and Answer
1	Student A	Q: How do you get information from the internet? A: "...Usually I do browsing using the Google application. If I get the answer right away, I copy it right away." Q: How do you apply this method in learning? A:"... I only do it when I'm given an assignment." Q: In solving the problems given, do you apply the internet in the process? A:"... depending on the permission of the use of the given device." Q: With the method, you use to solve the problem, how do you prove the solution to the problem? A:"... Usually, we use the most votes or answers from trusted people."
2	Student B	Q: How do you get information from the internet? A: "...I use google, youtube, and similar apps to get information from the internet." Q: How do you apply this method in learning? A:"... To study, I very rarely use the internet. due to signal problems." Q: In solving the problems given, do you apply the internet in the process? A:"... It's rare, I often make assignments with friends in the library or the classroom." Q: With the method, you use to solve the problem, how do you prove the solution to the problem? A:"... Based on reading books, but when I ran out of resources. I chose the most likely answer with my friends."
3	Student C	Q: How do you get information from the internet? A: "...I use browser apps like google and such." Q: How do you apply this method in learning? A:"... I always rely on the use of gadgets to solve the problems given." Q: In solving the problems given, do you apply the internet in the process? A:"...Always, is there any opportunity to use gadgets. I took the opportunity to find the answer I was looking for." Q: With the method, you use to solve the problem, how do you prove the solution to the problem? A:"... Usually I see the number of visits or ratings from these sources. Another way is to link the reading books that I use with sources found on the internet."
4	Student D	Q: How do you get information from the internet? A: "...I use browser apps like google and such. Sometimes use youtube tutorials" Q: How do you apply this method in learning? A:"...It's quite difficult to use gadgets and the internet to solve problems because it takes time and enough signal." Q: In solving the problems given, do you apply the internet in the process? A:"...When the opportunity arises, I along with my friends look for answers using smartphones and the internet."

No	Subject	Question and Answer
		Q: With the method, you use to solve the problem, how do you prove the solution to the problem? A:"...I see from the top searches and frequently visited blogs, and the match between the problem and the solution provided."

Based on the research conducted, it was found that students of class XI IPA 2 at SMAN 6 Batanghari have better skills and understanding related to digital literacy which are shown in table 5 and table 6. While students of class XI IPA 2 at SMAN 10 Batanghari have skills and lower comprehension compared to other research subjects related to digital literacy with the same table. Furthermore, if you pay attention to table 7, the students of class XI IPA 2 SMAN 6 also have a better level of critical thinking skills compared to other research subjects.

If you look at the results of interviews with students, students certainly have a basic understanding of digital literacy to get the desired information. However, students are still unable to analyse the content found on the internet, such as the relationship with the subject or the validity of the source. Another problem can be seen in that students find it difficult to access the internet because of the prohibition on bringing cell phones but can still access the internet through the school's computer laboratory, although not all students are interested in doing so.

With the data from the research that has been done, digital literacy skills and understanding have a significant influence on critical thinking skills. This is shown in students who have the skills and understanding of digital literacy have a better level of critical thinking skills compared to other students. This is not only shown in the table of research results but also in students who have a deeper understanding of digital literacy and are seen to be more critical in receiving information or answers or responses given by others. This is because students become more familiar with the amount of information and can filter information that has good quality and follows what they need.

Critical thinking skills are not new, especially in the world of education. Studies related to students' critical thinking skills have at least been carried out by (Shaw et al., 2020) explaining how the difference between critical thinking skills is measured by measuring independent critical thinking skills by students, even though the research was carried out on a large scale, research conducted by (Shaw et al., 2020) has limitations only measure without knowing the causes of the low high of the measured critical thinking skills. Another research (Giselsson, 2020) focuses on how the level of effectiveness of critical literacy as a framework for implementing critical thinking skills in learning, which is lacking in this research is the number of research subjects totaling seven students. Research related to digital literacy skills and critical thinking skills was carried out with the demands of the directorate general of education and the implementation of the independent curriculum (Atmazaki et al., 2017). Research conducted by (Juita et al., 2019; Mahanani et al., 2019; Rosdiana, 2020) looked at how the influence of the inquiry learning model on students' critical thinking skills. Meanwhile, research on digital literacy was carried out by (Asari et al., 2019; Dashtestani & Hojatpanah, 2022) in describing the level of digital literacy skills of students and educators. Meanwhile, this research was conducted to find out how the influence of digital literacy skills on students' critical thinking skills in science subjects.

Based on previous research that has been done regarding the variable critical thinking skills, as well as the demands of technological and educational developments in Indonesia for digital literacy skills. Therefore, this research was conducted to find out how digital literacy can affect students' critical thinking skills. However,

the link between digital literacy and critical thinking skills is the limitation of this research. So, the researchers suggest to future researchers look for the relationship between digital literacy and the abilities of other students, both in the affective, cognitive, and psychomotor domains.

CONCLUSION AND SUGGESTION

By doing this research, it can be seen that skills and understanding related to digital literacy have a significant influence on one of the higher-order thinking skills, namely critical thinking skills, especially in SMAN 6 Batanghari and SMAN 10 Batanghari schools. Learners who have skills and understanding related to digital literacy are seen to be more critical in observing an event, or in receiving the information they get. This of course is trained through digital literacy where they get a lot of information and understanding needed to filter the information to get accurate and reliable information. Digital literacy is very important because it is not only a demand of the times but is also proven to improve the quality of students so that they can face challenges in the future.

AUTHORS CONTRIBUTION

DAK constructing and reviewing the literature. D, A reviewed the literature and edited the manuscript. D, A, and RIW edited the manuscript. All authors read and approve the final manuscript.

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