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1 Effects of Online Learning on Digital Literacy During the Covid-19 Pandemic

Astuti Muh. Amin^{a,1,*}, Fitriyah Karmila^{b,2}, Romi Adiansyah^{c,3}, Noor Hujjatusnaini^{d,4}, Ahmad Yani^{e,5}, Lilin Ika Nur Indahsari^{f,6}

^a Department of Biology Education, FTIK, IAIN Ternate, North Maluku, Indonesia.

^a Department of Biology Education, FTIK, IAIN Ternate, North Maluku, Indonesia.

^c Department of Biology Education, Universitas Muhammadiyah Bone, South Sulawesi, Indonesia.

^d Department of Biology Education, FTIK, IAIN Palangkaraya, Central Kalimantan, Indonesia.

^e Department of Biology Education, FTIK, Universitas Puangrimanggalatung Sengkang, South Sulawesi, Indonesia.

^f Department of Biology Education, FTIK, IAIN Palangkaraya, Central Kalimantan, Indonesia.

¹ astutimuhamin@iain-terbate.ac.id.*; ²fitri.uncp@gmail.com; ³romiadiyah04@gmail.com; ⁴noor.hujjatusnaini@iain-palangkaraya.ac.id; ⁵ahyanstkip30@gmail.com; ⁶lilinika.nurindahsari@iain-palangkaraya.ac.id,

* Corresponding author: astutimuhamin@iain-terbate.ac.id.

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ABSTRACT

2 Digital literacy is one of the skills needed in preparing students to face the challenges of the 21st century. 20 During the Covid-19 pandemic, digital activities have expanded and are increasing because many people have to turn to online alternatives including teaching and learning activities in schools. The purpose of this study is to identify the effects of online learning on digital literacy during the Covid-19 pandemic. This research is a quantitative research. The study population was all students at the Senior High School of Ternate City, North Maluku, Indonesia. The research sample was 56 students at State Senior High School 4 of Ternate and State Senior High School 6 of Ternate, North Maluku, Indonesia. The research instruments used in this study were digital literacy instruments, questionnaires on student responses to online learning, questionnaires on learning motivation, and student activity observation sheets. All previous research instruments have been validated by experts and empirically validated. All research instruments have been declared valid and reliable. The results showed that the average score of digital literacy was in the medium category. The hypertext direction guide dimension has the lowest mean score compared to the three dimensions of digital literacy measurement. Digital literacy skills still need to be improved through the empowerment of active and innovative learning models integrated with IT

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Introduction

The Covid-19 pandemic has caused significant changes in the world, specifically in education. The compulsory distance education (Covid-19 pandemic) process may have advantages as well as disadvantages for learners and teachers (Elçiçek, 2021). Biology teacher candidates must also be selective, and critical of various information about biological phenomena that occur around them, including COVID-19 (Fauzi et al., 2020). The world, including Indonesia, imposes a restrictions status, maintains distance and avoids gathering activities to break the chain of virus spread (Adnan, 2020; Dove et al., 2020; Engzell et al., 2021; Kartimi et al., 2021; Rusydiyah et al., 2021). School closures and restrictions on movement by staying at home have an impact on student learning. The Covid 19 pandemic period presents challenges in various sectors of life, especially in the field of education on how to use digital technology to conduct the academic process throughout the academic year (Gibson & Shelton, 2021; Tagata & Ribas, 2021). Digitalization in the educational process poses several challenges, including digital literacy (Sá et al., 2021). Technological skills must be acquired through structured learning experiences in order to bridge all the technological information needed for the academic and personal worlds (Falloon, 2020; Santos & Serpa, 2017).

Digital learning styles and digital resources are good supplements for students to continue the educational process during the Covid-19 pandemic (Samiullah et al., 2021). Students using flipped classroom complete the homework and another online activities (Jafar & Sither, 2021). A digital learning environment is becoming a necessity so educators must maximize digital tools and the potential of online learning (Hillmayr et al., 2020; Moses & Yakubu, 2020). Teacher awareness in integrating Information Communication and Technology (ICT) in the teaching and learning process is important and the main thing (Belay et al., 2020; Oliveira et al., 2019). Digital literacy and digital competence are increasingly being formulated as important educational goals (Svendsen, 2021). Digital literacy facilitates better learning for students (Baterna et al., 2020; Reyna, 2021).

Digital literacy includes a wide range of skills, all of which are necessary to succeed in an increasingly digital world. There are relationship between digital literacy, digital competence and research productivity of educators. (Yazon et al., 2019). The digital literacy ability of students is influenced by age, gender, and experience of digital media literacy, Information and Communication Technology (ICT) infrastructure, parents' educational background, and family socioeconomic status (Zhang & Zhu, 2016). Digital literacy involves mastering ideas, and not just about using technology itself (Tang & Chaw, 2016). The basic element of digital literacy is participation in accessing, integrating, analyzing, evaluating, managing which is indicated by an individual's interest in using digital technology and communication tools (Greene et al., 2014; Xie et al., 2016). It required the ability to interpret digital data and use the data to build arguments so that students can demonstrate their existence in learning in accordance with technological developments (Schultheis & Kjolvik, 2020).

Digital literacy is the basic skill or ability to use computers confidently, safely and effectively, including the ability to use software such as word processing, electronic mailing, presentation software, the ability to create and edit images, audio and video, and the ability to use a web browser and internet search engines (Anggeraini et al., 2019). Observations of digital literacy include the ability to analyze, synthesize, compare from various sources, present, evaluate and use information ethically (Dominggus et al., 2021). Students nowadays live and learn in the digital era, which provides space to develop curiosity, creativity and scientific literacy in dealing with basic problems of life and society (Bhatnagar, 2019). Teachers must

learn how to efficiently apply digital technology capabilities in the educational process in biology (Sumatokhin et al., 2020).

Literacy skills are needed to build a more critical and democratic society. Science and technology cannot be separated in the contemporary world. Thus, scientific literacy, computer skills, and educational competencies can be developed together (Natale et al., 2021). Digital literacy skills have a positive impact on knowledge, understanding and skills in using media, especially social media which is currently often used as a source of information by the public, especially by students (Rahma et al., 2019). Digital literacy can help the younger generation to take advantage of information sources connected to digital technology and prepare themselves to face today's technological challenges (Çam & Kiyici, 2017).

Learning science including biology by using various images as conceptual visualization requires 21st century literacy skills which include computer literacy, media literacy, information literacy, and visual literacy (Wusqo et al., 2021). In learning Biology, digital literacy is very necessary for students because there are several learning resources that can be obtained from the internet, for example by utilizing various pages (websites) and learning media that can be downloaded.

Method

This research was a quantitative research. The study population was all students at the Senior High School of Ternate City, North Maluku, Indonesia. The research sample was 56 students of State Senior High School 4 of Ternate and State Senior High School 6 of Ternate, North Maluku, Indonesia.

The research instruments used in this study were digital literacy instruments, questionnaires on student responses to online learning, questionnaires on learning motivation, and student activity observation sheets. All previous research instruments have been validated by experts and empirically validated. All research instruments have been declared valid and reliable. Descriptive data analysis is done by looking for the percentage of each aspect of the observation. Digital literacy score is obtained through the N-Gain Score. The distribution of gain scores is categorized into three levels, namely: high ($g > 0.7$), moderate ($0.3 \leq g < 0.7$), low ($g < 0.3$).

The digital literacy questionnaire was compiled based on four assessment dimensions including internet searching's, hypertext directions, evaluation of information content, and knowledge compilation (Gilster, 1997). Indicators related to the dimensions of digital literacy assessment can be seen in Table 1. Meanwhile, as research supporting data, a learning motivation questionnaire was used based on aspects of Attention, Relevance, Confidence, Satisfaction (ARCS). This data is used as research supporting data.

Table 1. Digital Literacy Indicators (Gilster, 1997)

No	Dimensions	Indicators
1	Internet searching	<ol style="list-style-type: none"> 1. Ability to utilize the internet 2. Ability to use search engine.
2	Hypertextual navigation	<ol style="list-style-type: none"> 1. Knowledge about how the web browser, brand with, http, html, and URL works. 2. Knowledge about the differences between textbook and online source. 3. Understand the navigation of hypertext in the web browser. 4. Knowledge about hypertext and hyperlink.
3	content evaluation	<ol style="list-style-type: none"> 1. Ability to analyze the background (source and author) of the available information in internet. 2. Ability to evaluate the information content from several web addresses.

No	Dimensions	Indicators
4	knowledge assembly	3. Ability to differentiate between layout and content.
		4. Ability to understand various domains (.com, ac.id, sch, Edu, go, .org).
		1. Ability to use various types of media to obtain the truth of an information.
		2. Ability to create personal newsfeed.
		3. Ability to do crosscheck or recheck the obtained information.
		4. Ability to construct knowledge from the information obtained.
		5. Ability to read and understand the information.

Results and Discussion

Data recapitulation related to the level of digital literacy in biology learning based on the dimensions of internet searching, hypertext directions, content evaluation and knowledge assembly can be presented in the following graph.

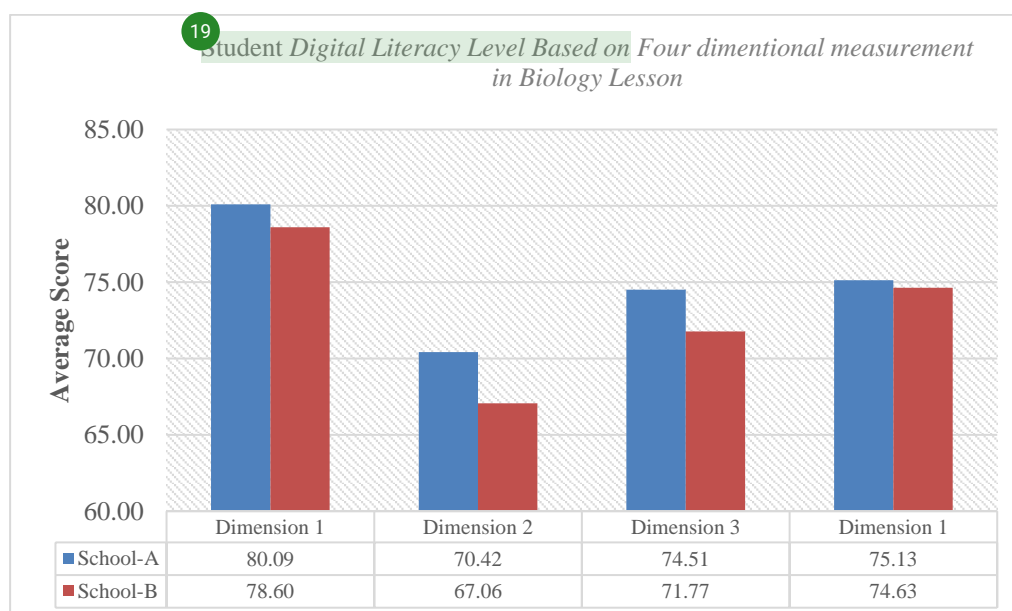


Figure 1. Student Digital Literacy Level Based on Four-dimensional measurement

Descriptions:

School-A : State Senior High School 4 of Ternate

School-B : State Senior High School 6 of Ternate

Dimension 1: Internet searching dimension

Dimension 2: Hypertext navigation dimension

Dimension 3: Content evaluation dimension

Dimension 4: Knowledge assembly dimension

Based on the data presented, it can be seen that the hypertext direction guide dimension has the lowest average score compared to the three dimensions of digital literacy measurement. The recapitulation of the average digital literacy score of students can be seen in Table 2.

Table 2. Recapitulation of Students' Digital Literacy Score Average

Aspect	State Senior High School 4 of Ternate	State Senior High School 6 of Ternate
Before learning	43.01	41.89
After learning	75.04	73.00
N-Gain score	0.56	0.53
N-Gain effectivity category	Medium	Medium

Based on the recapitulation of the average digital literacy score of students, it is known that the effectiveness of the N-Gain digital literacy score is in the medium category. In the following, the results of the recapitulation of student responses to online learning are presented.

Table 3. Student Respons to Online Learning

No	STATEMENTS	Frequency		Percentage (%)	
		Yes	No	Yes	No
1	I have my own smartphone/laptop at home to access the internet to take biology lessons.	44	12	78.57	21.43
2	I have an internet network/Wi-Fi to prepare online learning process.	45	11	80.36	19.64
3	I made sure that the internet network must be connected to the smartphone/laptop	42	14	75.00	25.00
4	I sometimes have difficulty accessing the internet while online learning.	43	13	76.79	23.21
5	I was well prepared to participate in online biology lessons.	48	8	85.71	14.29
6	I prepared an application/online media used in biology learning.	51	5	91.07	8.93
7	Before begin the learning biology, I prepared textbooks and equipment first.	43	13	76.79	23.21
8	I opened an online application/media to take biology lessons.	48	8	85.71	14.29
9	I check my attendance before doing the online biology learning process.	50	6	89.29	10.71
10	I understand the material given by the teacher during online biology lessons.	34	22	60.71	39.29
11	I played an active role in asking and answering teacher questions in online biology learning.	28	28	50.00	50.00
12	I easily remember the online biology learning materials presented by the teacher.	27	29	48.21	51.79
13	I listen carefully to the teacher's answers for questions during online biology lessons.	35	21	62.50	37.50
14	When there are difficulties in learning biology, I ask the teacher during the lesson.	39	17	69.64	30.36
15	I send assignments given by the teacher via online media	45	11	80.36	19.64
16	I made notes after the teacher gave an explanation about learning biology.	42	14	75.00	25.00
17	I made a summary of biology learning materials to make learning easier.	40	16	71.43	28.57
18	I worked on biology material assignments that will be sent on online media such as WhatsApp Group and Google Classroom.	44	12	78.57	21.43

Based on the results of student responses to online learning, it can be seen that 76.79% have difficulty accessing the internet network when online learning. This is due to geographical conditions which sometimes cause the internet signal strength to be less stable, especially during rainy conditions. The following presents the level of student learning motivation in terms of Attention, Relevance, Confidence, Satisfaction (ARCS) Aspects.

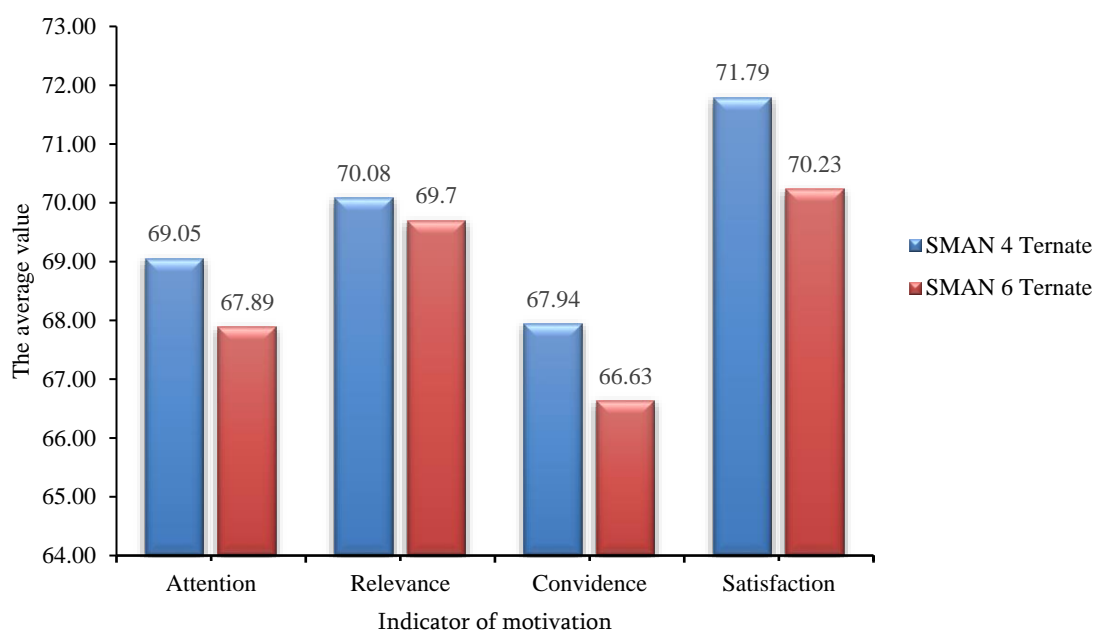


Figure 2. Student Learning Motivation Level Based on Attention, Relevance, Confidence, Satisfaction measured by (ARCS) Aspects

Based on Figure 2, it can be seen that the highest student motivation in State Senior High School 4 of Ternate and State Senior High School 6 of Ternate is in the aspect of satisfaction. The recapitulation of observations on students' abilities in online learning obtained from observation sheets is presented in the following Table 4.

Table 4. Recapitulation of observations on students' abilities in online learning

No	Assessment Aspects	Frequency		Percentage (%)	
		Yes	No	Yes	No
1	Able to understand and recall knowledge that has been learned.	42	14	75.00	25.00
2	Able to interpret or state something in their own words about the knowledge that has been studied.	44	12	78.57	21.43
3	Able to use knowledge in solving various problems that arise in everyday life.	36	20	64.29	35.71
4	Able to analyze the depth and breadth of the discussions that have been carried out.	36	20	64.29	35.71
5	Able to prepare individual study plans in accordance with applicable school policies.	43	13	76.79	23.21
6	Able to assess the quality of thinking skills based on their abilities.	28	28	50.00	50.00
7	Able to establish communication to learn together.	44	12	78.57	21.43
8	Able to complete structured tasks given by the teacher.	51	5	91.07	8.93
9	Able to follow simple practical activities related to biology learning.	45	11	80.36	19.64
10	Able to complete the deficiencies in the assignments given by the teacher.	51	5	91.07	8.93
11	Able to show good manners during online learning.	49	7	87.50	12.50
12	Able to turn on and off the computer after seeing a demonstration by the teacher.	43	13	76.79	23.21

No	Assessment Aspects	Frequency		Percentage (%)	
		Yes	No	Yes	No
13	Able to use computer keyboard properly.	37	19	66.07	33.93
14	Able to operate computer/laptop well.	41	15	73.21	26.79
15	Able to show enthusiasm in learning biology.	48	8	85.71	14.29
16	Able to increase reading interest during learning.	35	21	62.50	37.50
17	Able to express opinions during discussions.	39	17	69.64	30.36
18	Able to ask questions to the teacher if there is material that I do not understand.	43	13	76.79	23.21
19	Able to actively participate in class discussions.	44	12	78.57	21.43
20	Able to understand the subject matter given by the teacher.	39	17	69.64	30.36

Based on Table 4. recapitulation of observations on students' abilities in online learning, it can be seen that online learning is quite capable of providing understanding knowledge to students. This can be seen in the ability of students to interpret or state something in their own words about the knowledge they have learned. Students are able to cooperate well by following the direction and guidance of the biology teacher during the online learning process. 85.71% of students show enthusiasm for learning during online learning. Students begin to actively participate in responding to questions and expressing opinions confidently. Students are able to operate computers/laptops well and are enthusiastic in completing the deficiencies in the assignments given by the teacher. However, this online learning also has its own obstacles for students at State Senior High School 4 of Ternate and State Senior High School 6 of Ternate. Unstable network constraints can cause obstacles in online learning, especially if rainy weather conditions can cause power lines and the internet to go out.

Moreover, students' ability in the search dimension is in the moderate category with a score of around 80.09 at State Senior High School 4 of Ternate and 78.60 at State Senior High School 6 of Ternate, students are quite capable of using the internet and have sufficient ability to use search engines. Students also have the ability to evaluate the information content of various web sites, and have the ability to understand various domains (.com, ac.id, .sch, edu, .go, .org). The ability to construct knowledge from the information obtained begins to appear to be built in the online learning. However, it is not enough to be able to build thinking skills and assess the quality of thinking skills based on their abilities. This is because before the COVID-19 pandemic, students were only using conventional learning with the dominance of the lecture method. From this study, digital literacy scores were obtained in the medium category.

Digital literacy skills have a positive influence on students' achievement motivation (Tarumasely, 2020). Research conducted by (Nahdi & Jatisunda, 2020) concluded that increasing digital literacy and students' skills in using information technology is an important thing to do, especially in carrying out online learning based on virtual classrooms. According to (Shavab, 2020), the stages contained in digital literacy include: digital competence, digital use, and digital transformation. With digital literacy skills, teachers can carry out professional development through professional development programs to contribute to creating qualified teachers (Kuncahyono & Kumalasani, 2020). Female students have lower digital literacy skills than males, particularly in the hardware, software and safety competence areas (Penh, 2020).

Digital literacy has become one of the competencies that need to be possessed in the 21st century, where advances in information and communication technology are growing very rapidly. Digital literacy in the curriculum is very important, because it aims to help students acquire the technical knowledge and skills needed to use digital media effectively, be competent in using digital media to solve problems of daily life, understand the social dimensions and impact of digital media in modern society, and foster a positive attitude about digital media and face the demands of modern times (Jimoyiannis & Gravani, 2011).

Teachers must be able to identify the extent to which the teaching given to students is related to the development of digital literacy and how this contributes to realizing 21st century learners. Teachers should ensure to what extent their students also have confidence in the development of digital literacy (List, 2019). Digital literacy is a component in supporting the integration of knowledge, perspectives, attitudes, skills in realizing a 21st century learning framework (Van Laar et al., 2017). Today, the internet provides the facility to store a lot of information in a virtual space and users can access their information anytime and anywhere in the world (Soroya et al., 2021). Online learning and virtual laboratory experiments can be designed by teachers to meet the learning needs of students in the digital era during the COVID-19 pandemic so that students continue to acquire science inquiry skills (Hamed & Aljanazrah, 2020).

In the digital era, the learning environment is enhanced by the integration of technology, thus offering opportunities for students to increase students' engagement, motivation, and positive attitude towards science (Kapici et al., 2020). Students are required to have basic information and skills. Aspect of confidence, is an aspect related to taste competent in oneself so as to be able to interact positively with the environment (Amin et al., 2021).

Conclusion

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Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Effects of Online Learning on Digital Literacy During the Covid-19 Pandemic

ARTICLE INFO	ABSTRACT
Article history Submission Revision Accepted Keyword: Covid-19 Pandemic Digital Literacy Online Learning.	Digital literacy is one of the skills needed in preparing students to face the challenges of the 21st century. The purpose of this study is to identify the effects of online learning on digital literacy during the Covid-19 pandemic. This research is a quantitative research. The study population was all students at the Senior High School (SMA) of Ternate City, North Maluku, Indonesia. The research sample was 56 students of SMA Negeri 4 Kota Ternate and SMA Negeri 6 Kota Ternate, North Maluku, Indonesia. The research instruments used in this study were digital literacy instruments, questionnaires on student responses to online learning, questionnaires on learning motivation, and student activity observation sheets. All previous research instruments have been validated by experts and empirically validated. All research instruments have been declared valid and reliable. The results showed that the average score of digital literacy was in the medium category. The hypertext direction guide dimension has the lowest mean score compared to the three dimensions of digital literacy measurement. Digital literacy skills still need to be improved through the empowerment of active and innovative learning models integrated with IT This is an open-access article under the CC-BY-SA license  

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Introduction

The Covid-19 pandemic has caused significant changes in the world, specifically in education (Elçiçek, 2021; Fauzi et al., 2020). The world, including Indonesia, imposes a restrictions status, maintains distance and avoids gathering activities to break the chain of virus spread (Adnan, 2020; Dove et al., 2020; Engzell et al., 2021; Kartimi et al., 2021; Rusydiyah et al., 2021). School closures and restrictions on movement by staying at home have an impact on student learning. The Covid 19 pandemic period presents challenges in various sectors of life, especially in the field of education on how to use digital technology to conduct the academic process throughout the academic year (Gibson & Shelton, 2021; Tagata & Ribas, 2021). Digitalization in the educational process poses several challenges, including digital literacy (Šá et al., 2021). Technological skills must be acquired through structured learning experiences in order to bridge all the technological information needed for the academic and personal worlds (Falloon, 2020; Santos & Serpa, 2017).

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Digital learning styles and digital resources are good supplements for students to continue the educational process during the Covid-19 pandemic (Jafar & Sittther, 2021; Samiullah et al., 2021). A digital learning environment is becoming a necessity so educators must maximize digital tools and the potential of online learning (Hillmayr et al., 2020; Moses & Yakubu, 2020). Teacher awareness in integrating Information Communication and Technology (ICT) in the teaching and learning process is important and the main thing (Belay et al., 2020; Oliveira et al., 2019). Digital literacy and digital competence are increasingly being formulated as important educational goals (Svendsen, 2021). Digital literacy facilitates better learning for students (Baterna et al., 2020; Reyna, 2021).

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Digital literacy includes a wide range of skills, all of which are necessary to succeed in an increasingly digital world (Yazon et al., 2019). The digital literacy ability of students is influenced by age, gender, and experience of digital media literacy, Information and Communication Technology (ICT) infrastructure, parents' educational background, and family socioeconomic status (Zhang & Zhu, 2016). Digital literacy involves mastering ideas, and not just about using technology itself (Tang & Chaw, 2016). The basic element of digital literacy is participation in accessing, integrating, analyzing, evaluating, managing which is indicated by an individual's interest in using digital technology and communication tools (Greene et al., 2014; Xie et al., 2016). It required the ability to interpret digital data and use the data to build arguments so that students can demonstrate their existence in learning in accordance with technological developments (Schultheis & Kjelvik, 2020).

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Digital literacy is the basic skill or ability to use computers confidently, safely and effectively, including the ability to use software such as word processing, electronic mailing, presentation software, the ability to create and edit images, audio and video, and the ability to use a web browser and internet search engines (Anggeraini et al., 2019). Observations of digital literacy include the ability to analyze, synthesize, compare from various sources, present, evaluate and use information ethically (Dominggus et al., 2021). Students nowadays live and learn in the digital era, which provides space to develop curiosity, creativity and scientific literacy in dealing with basic problems of life and society (Bhatnagar, 2019). Teachers must learn how to efficiently apply digital technology capabilities in the educational process in biology (Sumatokhin et al., 2020).

Literacy skills are needed to build a more critical and democratic society (Natale et al., 2021). Digital literacy skills have a positive impact on knowledge, understanding and skills in using media, especially social media which is currently often used as a source of information by the public, especially by students (Rahma et al., 2019). Digital literacy can help the younger generation to take advantage of information sources connected to digital technology and prepare themselves to face today's technological challenges (Çam & Kiyici, 2017).

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Learning science including biology by using various images as conceptual visualization requires 21st century literacy skills which include computer literacy, media literacy, information literacy, and visual literacy (Wusqo et al., 2021). In learning Biology, digital literacy is very necessary for students because there are several learning resources that can be obtained from the internet, for example by utilizing various pages (websites) and learning media that can be downloaded.

Method

This research was a quantitative research. The study population was all students at the Senior High School (SMA) of Ternate City, North Maluku, Indonesia. The research sample

was 56 students of SMA Negeri 4 Kota Ternate and SMA Negeri 6 Kota Ternate, North Maluku, Indonesia.

The research instruments used in this study were digital literacy instruments, questionnaires on student responses to online learning, questionnaires on learning motivation, and student activity observation sheets. All previous research instruments have been validated by experts and empirically validated. All research instruments have been declared valid and reliable. Descriptive data analysis is done by looking for the percentage of each aspect of the observation. Digital literacy score is obtained through the N-Gain Score. The distribution of gain scores is categorized into three levels, namely: high ($g > 0.7$), moderate ($0.3 \leq g < 0.7$), low ($g < 0.3$).

The digital literacy questionnaire was compiled based on four assessment dimensions including internet searching's, hypertext directions, evaluation of information content, and knowledge compilation. Indicators related to the dimensions of digital literacy assessment can be seen in Table 1. Meanwhile, as research supporting data, a learning motivation questionnaire was used based on aspects of Attention, Relevance, Confidence, Satisfaction (ARCS). This data is used as research supporting data.

Table 1. Digital Literacy Indicators

No	Dimensions	Indicators
1	Internet searching	<ol style="list-style-type: none"> 1. Ability to utilize the internet 2. Ability to use search engine.
2	Hypertextual navigation	<ol style="list-style-type: none"> 1. Knowledge about how the web browser, brand with, http, html, and URL works. 2. Knowledge about the differences between textbook and online source. 3. Understand the navigation of hypertext in the web browser. 4. Knowledge about hypertext and hyperlink.
3	content evaluation	<ol style="list-style-type: none"> 1. Ability to analyze the background (source and author) of the available information in internet. 2. Ability to evaluate the information content from several web addresses. 3. Ability to differentiate between layout and content. 4. Ability to understand various domains (.com, ac.id, sch, Edu, go, .org).
4	knowledge assembly	<ol style="list-style-type: none"> 1. Ability to use various types of media to obtain the truth of an information. 2. Ability to create personal newsfeed. 3. Ability to do crosscheck or recheck the obtained information. 4. Ability to construct knowledge from the information obtained. 5. Ability to read and understand the information.

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Results and Discussion

Data recapitulation related to the level of digital literacy in biology learning based on the dimensions of internet searching, hypertext directions, content evaluation and knowledge assembly can be presented in the following graph.

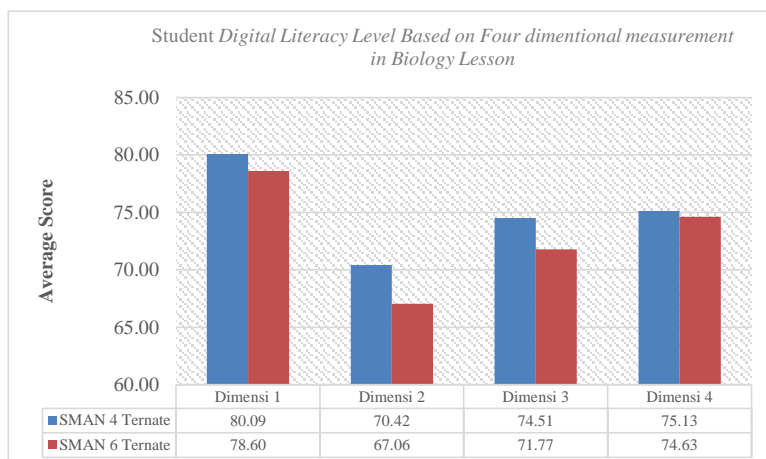


Figure 1. Student Digital Literacy Level Based on Four-dimensional measurement

Descriptions:

- Dimension 1: Internet searching dimension
- Dimension 2: Hypertext navigation dimension
- Dimension 3: Content evaluation dimension
- Dimension 4: Knowledge assembly dimension

Based on the data presented, it can be seen that the hypertext direction guide dimension has the lowest average score compared to the three dimensions of digital literacy measurement. The recapitulation of the average digital literacy score of students can be seen in Table 2.

Table 2. Recapitulation of Students' Digital Literacy Score Average

Aspect	SMAN 4 Ternate	SMAN 6 Ternate
Before learning	43.01	41.89
After learning	75.04	73.00
N-Gain score	0.56	0.53
N-Gain effectivity category	Medium	Medium

Based on the recapitulation of the average digital literacy score of students, it is known that the effectiveness of the N-Gain digital literacy score is in the medium category. In the following, the results of the recapitulation of student responses to online learning are presented.

Table 3. Student Respons to Online Learning

No	STATEMENTS	Frequency		Percentage (%)	
		Yes	No	Yes	No
1	I have my own smartphone/laptop at home to access the internet to take biology lessons.	44	12	78.57	21.43
2	I have an internet network/Wi-Fi to prepare online learning process.	45	11	80.36	19.64
3	I made sure that the internet network must be connected to the smartphone/laptop	42	14	75.00	25.00
4	I sometimes have difficulty accessing the internet while online learning.	43	13	76.79	23.21

5	I was well prepared to participate in online biology lessons.	48	8	85.71	14.29
6	I prepared an application/online media used in biology learning.	51	5	91.07	8.93
7	Before begin the learning biology, I prepared textbooks and equipment first.	43	13	76.79	23.21
8	I opened an online application/media to take biology lessons.	48	8	85.71	14.29
9	I check my attendance before doing the online biology learning process.	50	6	89.29	10.71
10	I understand the material given by the teacher during online biology lessons.	34	22	60.71	39.29
11	I played an active role in asking and answering teacher questions in online biology learning.	28	28	50.00	50.00
12	I easily remember the online biology learning materials presented by the teacher.	27	29	48.21	51.79
13	I listen carefully to the teacher's answers for questions during online biology lessons.	35	21	62.50	37.50
14	When there are difficulties in learning biology, I ask the teacher during the lesson.	39	17	69.64	30.36
15	I send assignments given by the teacher via online media	45	11	80.36	19.64
16	I made notes after the teacher gave an explanation about learning biology.	42	14	75.00	25.00
17	I made a summary of biology learning materials to make learning easier.	40	16	71.43	28.57
18	I worked on biology material assignments that will be sent on online media such as WhatsApp Group and Google Classroom.	44	12	78.57	21.43

Based on the results of student responses to online learning, it can be seen that 76.79% have difficulty accessing the internet network when online learning. This is due to geographical conditions which sometimes cause the internet signal strength to be less stable, especially during rainy conditions. The following presents the level of student learning motivation in terms of Attention, Relevance, Confidence, Satisfaction (ARCS) Aspects.

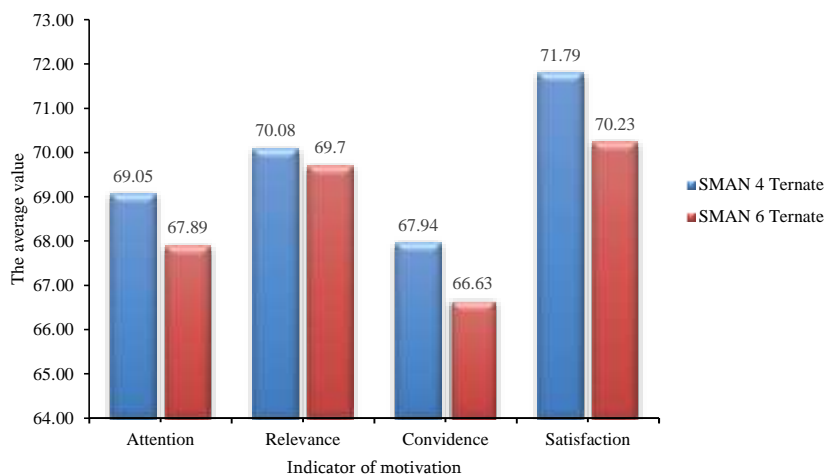


Figure 2. Student Learning Motivation Level Based on Attention, Relevance, Confidence, Satisfaction measured by (ARCS) Aspects

Based on Figure 2, it can be seen that the highest student motivation in SMAN 4 Ternate and SMAN 6 Ternate is in the aspect of satisfaction. The recapitulation of observations on students' abilities in online learning obtained from observation sheets is presented in the following Table 4.

Table 4. Recapitulation of observations on students' abilities in online learning

No	Assessment Aspects	Frequency		Percentage (%)	
		Yes	No	Yes	No
1	Able to understand and recall knowledge that has been learned.	42	14	75.00	25.00
2	Able to interpret or state something in their own words about the knowledge that has been studied.	44	12	78.57	21.43
3	Able to use knowledge in solving various problems that arise in everyday life.	36	20	64.29	35.71
4	Able to analyze the depth and breadth of the discussions that have been carried out.	36	20	64.29	35.71
5	Able to prepare individual study plans in accordance with applicable school policies.	43	13	76.79	23.21
6	Able to assess the quality of thinking skills based on their abilities.	28	28	50.00	50.00
7	Able to establish communication to learn together.	44	12	78.57	21.43
8	Able to complete structured tasks given by the teacher.	51	5	91.07	8.93
9	Able to follow simple practical activities related to biology learning.	45	11	80.36	19.64
10	Able to complete the deficiencies in the assignments given by the teacher.	51	5	91.07	8.93
11	Able to show good manners during online learning.	49	7	87.50	12.50
12	Able to turn on and off the computer after seeing a demonstration by the teacher.	43	13	76.79	23.21
13	Able to use computer keyboard properly.	37	19	66.07	33.93
14	Able to operate computer/laptop well.	41	15	73.21	26.79
15	Able to show enthusiasm in learning biology.	48	8	85.71	14.29
16	Able to increase reading interest during learning.	35	21	62.50	37.50
17	Able to express opinions during discussions.	39	17	69.64	30.36
18	Able to ask questions to the teacher if there is material that I do not understand.	43	13	76.79	23.21
19	Able to actively participate in class discussions.	44	12	78.57	21.43
20	Able to understand the subject matter given by the teacher.	39	17	69.64	30.36

Based on Table 4. recapitulation of observations on students' abilities in online learning, it can be seen that online learning is quite capable of providing understanding knowledge to students. This can be seen in the ability of students to interpret or state something in their own words about the knowledge they have learned. Students are able to cooperate well by following the direction and guidance of the biology teacher during the online learning process. 85.71% of students show enthusiasm for learning during online learning. Students begin to actively participate in responding to questions and expressing opinions confidently. Students are able to operate computers/laptops well and are enthusiastic in completing the deficiencies in the assignments given by the teacher. However, this online learning also has its own obstacles for

students at SMAN 4 Ternate and SMAN 6 Ternate. Unstable network constraints can cause obstacles in online learning, especially if rainy weather conditions can cause power lines and the internet to go out.

Moreover, students' ability in the search dimension is in the moderate category with a score of around 80.09 at SMAN 4 Ternate and 78.60 at SMAN 6 Ternate, students are quite capable of using the internet and have sufficient ability to use search engines. Students also have the ability to evaluate the information content of various web sites, and have the ability to understand various domains (.com, ac.id, .sch, edu, .go, .org). The ability to construct knowledge from the information obtained begins to appear to be built in the online learning. However, it is not enough to be able to build thinking skills and assess the quality of thinking skills based on their abilities. This is because before the COVID-19 pandemic, students were only using conventional learning with the dominance of the lecture method. From this study, digital literacy scores were obtained in the medium category.

Digital literacy skills have a positive influence on students' achievement motivation (Tarumasely, 2020). Research conducted by (Nahdi & Jatisunda, 2020) concluded that increasing digital literacy and students' skills in using information technology is an important thing to do, especially in carrying out online learning based on virtual classrooms. According to (Shavab, 2020), the stages contained in digital literacy include: digital competence, digital use, and digital transformation. With digital literacy skills, teachers can carry out professional development through professional development programs to contribute to creating qualified teachers (Kuncahyono & Kumalasan, 2020). Female students have lower digital literacy skills than males, particularly in the hardware, software and safety competence areas (Penh, 2020).

Digital literacy has become one of the competencies that need to be possessed in the 21st century, where advances in information and communication technology are growing very rapidly. Digital literacy in the curriculum is very important, because it aims to help students acquire the technical knowledge and skills needed to use digital media effectively, be competent in using digital media to solve problems of daily life, understand the social dimensions and impact of digital media in modern society, and foster a positive attitude about digital media and face the demands of modern times (Jimoyiannis & Gravani, 2011).

Teachers must be able to identify the extent to which the teaching given to students is related to the development of digital literacy and how this contributes to realizing 21st century learners. Teachers should ensure to what extent their students also have confidence in the development of digital literacy (List, 2019). Digital literacy is a component in supporting the integration of knowledge, perspectives, attitudes, skills in realizing a 21st century learning framework (Van Laar et al., 2017). Today, the internet provides the facility to store a lot of information in a virtual space and users can access their information anytime and anywhere in the world (Soroya et al., 2021). Online learning and virtual laboratory experiments can be designed by teachers to meet the learning needs of students in the digital era during the COVID-19 pandemic so that students continue to acquire science inquiry skills (Hamed & Aljanazah, 2020).

In the digital era, the learning environment is enhanced by the integration of technology, thus offering opportunities for students to increase students' engagement, motivation, and positive attitude towards science (Kapici et al., 2020). Students are required to have basic information and skills.

Conclusion

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Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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#23718 Summary

SUMMARY REVIEW EDITING

Submission

Authors	Astuti Muh Amin, Fitriyah Karmila, Romi Adiansyah, Noor Hujjatusnaini, Ahmad Yani, Lilin Ika Nur Indahsari
Title	Effects of online learning on digital literacy during the covid-19 pandemic
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Supp. files	None
Submitter	Astuti Muh Amin
Date submitted	March 29, 2022 - 02:31 AM
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Editor	Ika Maryani
Author comments	

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Authors

Name	Astuti Muh Amin
ORCID ID	http://orcid.org/0000-0001-7269-0299
URL	https://scholar.google.co.id/citations?user=02Z9EFQAAAA&hl=id
Affiliation	IAIN Ternate
Country	Indonesia
Bio Statement	Department of Biology Education, IAIN Ternate, North Maluku

Principal contact for editorial correspondence.

Name	Fitriyah Karmila
Affiliation	IAIN Ternate
Country	Indonesia
Bio Statement	Department of Biology Education, IAIN Ternate, North Maluku
Name	Romi Adiansyah
Affiliation	Universitas Muhammadiyah Pro...


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Title and Abstract

Title Effects of online learning on digital literacy during the covid-19 pandemic

Abstract

Misconceptions are important to know so that future learning can be Digital literacy is one of the skills needed in preparing students to face the challenges of the 21st century. During the Covid-19 pandemic, digital activities have expanded and are increasing because many people have to turn to online alternatives, including teaching and learning activities in schools. The purpose of this study is to identify the effects of online learning on digital literacy during the Covid-19 pandemic. This research is quantitative. The study population was all students at the Senior High School of Ternate City, North Maluku, Indonesia. The research sample was 56 students at State Senior High School 4 of Ternate and State Senior High School 6 of Ternate, North Maluku, Indonesia. The research instruments used in this study were digital literacy instruments, questionnaires on student responses to online learning, questionnaires on learning motivation, and student activity observation sheets. All previous research instruments have been validated by experts and empirically validated. All research instruments have been declared valid and reliable. The results showed that the average score of digital literacy was in the medium category. The hypertext direction guide dimension has the lowest mean score compared to the three dimensions of digital literacy measurement. Digital literacy skills still need to be improved through the empowerment of active and innovative learning models integrated with IT.

Indexing

Keywords Covid-19 Pandemic; Digital Literacy; Online Learning.

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