The Relationship between Critical Thinking and Digital Literacy in Natural Science Learning in Elementary Schools

Idam Ragil Widianto Atmojo, Roy Ardiansyah, Fadhil Purnama Adi, Ainun Nafisah

Faculty of Teacher Training and Education, Sebelas Maret University

idamragil@fkip.uns.ac.id, royardiansyah@staff.uns.ac.id,
fadhil@staff.uns.ac.id, ainunnafisah814@student.uns.ac.id

Abstract. The research aims to determine a positive and significant relationship between critical thinking and digital literacy in science learning human and animal breathing material. The research method used is quantitative. This study uses a correlation research design. The population of this research is the fifth-grade elementary school students in Laweyan District. The research sample came from fifth-grade students at SDN Pajang IV, SDN Tegalrejo, SDN Setono, and SDN 1 Jajar totaling 86 students. Data collection was carried out using tests. The data analysis technique used simple correlation analysis. The research procedure includes research preparation, research implementation, data analysis, interpretation, and conclusion. The results obtained in this study, there is no positive and significant relationship between critical thinking and digital in science learning human and animal breathing material with a significance value (2-tailed) between critical thinking and digital literacy is 0.136. Further research needs to examine how to improve students' critical thinking, reading interest, and digital literacy using learning models and methods and examine the relationship with skill variables in the 21st century.

Keywords: critical thinking, digital literacy, science learning

1 Introduction

The 21st century is referred to as the century of information technology, globalization, and the industrial revolution 4.0 which causes changes in all areas of life including education, economy, technology, communication, information, transportation, and others.[1]. According to Saputri et al (2019), several skills must be possessed in the 21st century, including critical thinking and problem-solving skills, information technology literacy skills, information skills, and media literacy. The ability to access technology and manage information in digital media is known as digital literacy [3]. These capabilities are needed in the era of technological disruption, especially in processing information in digital media and responding to the challenges of the times [4].

M. Salimi et al. (eds.), *Proceedings of the 6th International Conference on Learning Innovation and Quality Education (ICLIQE 2022)*, Advances in Social Science, Education and Humanities Research 767,
https://doi.org/10.2991/978-2-38476-114-2_43

Based on data from the central statistics agency, the average percentage of students in urban areas in Indonesia aged 5-24 years at the elementary level who access cellular phone devices is 90.94%, accessing computers is 23.52%, and accessing the internet is 85.13%., while in rural areas in Indonesia, access to cellular telephones is 81.20%, computer access is 8.77%, and access to the internet is 66.87%. This shows the problem of gaps in access to information and communication technology between cities and villages [5]. Another problem of digital literacy is the misuse of internet access to view pornographic content, cyberbullying, cybercrime, and sexual violence among students [6], [7], [8]. Data kominfo (2020)the Indonesian digital literacy survey shows that the digital literacy index has not yet reached a score of 4.00 (good), only reaching a score above 3.00 (medium). The existence of these digital literacy problems can be avoided by building critical thinking skills through the use of digital technology [10].

Critical thinking is needed in digital literacy because of the user's ability to assess information in digital media, especially in interpreting the information presented in digital media and using reasoning in understanding the interconnections between information and concepts with one another [12]. Critical thinking skills need to be possessed by someone to be able to think logically, answer more complicated questions, find, and solve more complicated problem cases [11].

However, the critical thinking ability of students in Indonesia is still low which can be found in previous research, namely, research conducted by Hidayat (2019), which found that the critical thinking ability of fourth-grade students at 23.8% was classified as very low, 33.3% classified as low, 23.8% classified as moderate, and only 19.1% classified as high [14]. Then, research conducted by Ilhamdi et al. (2020) revealed that fifth-grade students still have low critical thinking skills with an average science value of 48.67. Based on the data above, it can be concluded that students' critical thinking is still low.

Based on the results of interviews with several fifth-grade elementary school teachers in the Laweyan district, they said that the critical thinking skills of fifth-grade students were still low, unable to analyze the main points of the problem to conclude. Students only memorize the material without understanding it. The average value of science learning is 71.25. The value is not yet high. In addition, the lack of adequate facilities to access smartphone technology causes information management of digital content and information to remain low. This causes students to have not been able to find valid sources of information to support critical thinking, understand, and evaluate information and content in digital media such as hoaxes, cyberbullying, etc. Based on the explanation above,

However, this research is different from previous research. The topic of this research raises skills in the 21st century, namely the topic of the relationship between critical thinking and reading interest with digital literacy. Students need to have critical thinking skills and digital literacy to compete in the international world. The choice of variables x and y is in the form of critical thinking and digital literacy because these abilities are one of the skills that global citizens need to have in the 21st century.

This research is important to carry out to find the relationship between students' critical thinking and digital literacy. This is because, in the digital era, information in digital media needs to be processed by reading and thinking critically so that students

can ward off hoaxes, and cybercrime and know the positive and negative impacts that may occur due to the use of technology [16]. Furthermore, the ability of digital literacy to make it easier for students to obtain wider and deeper information so that knowledge and completing tasks in finding information from digital media is further increased [17].

Based on the above background, it is necessary to conduct research entitled "the relationship between critical thinking and digital literacy in science learning in elementary schools".

2 Method

The research method used is a quantitative research method with a correlational research design. The subjects of this study were elementary school students in class V. The population of this study was students in class 5 elementary schools in the district of Laweyan. The sample of this research is the fifth-grade students of SD N Pajang 4, SDN Tegalrejo, SDN Jajar 1, and SDN Setono, totaling 86 students. This sampling technique is probability sampling with cluster random sampling type. Data collection techniques were carried out by testing for critical thinking and digital literacy variables. The critical thinking test uses a two-tier multiple-choice question, while the digital literacy test uses a multiple-choice test. Natural Science Materials (IPA) used as test materials are Class 5 Theme 2 (Clean Air and Its Environment), and Subtheme 1 (The Body's Way of Managing Clean Air). The selection of the subject matter for the respiratory system of animals and humans is based on the timing of student learning when studying theme 2 and the usefulness of the material in this pandemic era. Data analysis used correlation test statistical data analysis with the help of the SPSS 24 program. This research procedure includes research preparation, research implementation, data analysis, interpretation, and conclusion.

3 Result and Discussion

Based on the results of the instrument validity test conducted on both instruments by the expert, it was stated that both instruments were valid. Furthermore, the reliability value of the critical thinking test instrument is 0.615, and the reliability of the digital literacy questionnaire is 0.668. This is in the high category. The results of the data description of the digital literacy variable, critical thinking, are presented in the histogram image and the following table:

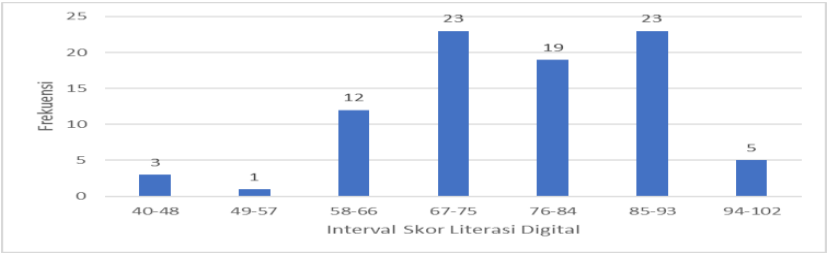

Fig. 1. Histogram of Digital Literacy Frequency Distribution Data

Table 1. Digital Literacy Score Data for Each Indicator

No.	Indicator	Percentage
1	Use of technology	80.23%
2	Information management on digital media	54.65%
3	Social networking	82.85%
4	*online safety*	82.17%
5	The positive impact of technology	72.67%
	Total Average	74.51%

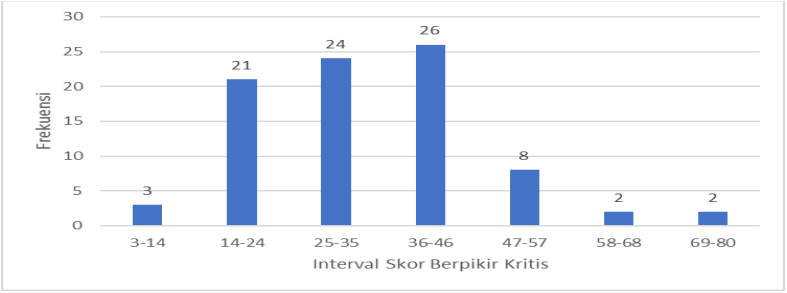

Fig. 2. Histogram of Critical Thinking Frequency Distribution Data

Table 2. Data Category Critical Thinking Students Class V

No.	Score obtained	Category	Frequency	Frequency percentage
1.	81.25 < X 100	Very high	0	0
2.	71.5 < X 81.25	Tall	1	1.2%
3.	62.5 < X 71.5	Currently	1	1.2%
4.	43.75 < X 62.5	Low	19	22.1%
5.	0 < X 43.75	Very low	65	75.6%

Table 3. Critical Thinking Score Data for Each Indicator

No.	Indicator	Average score	Category
1.	Formulate the main points of the problem	65,70	Currently
2.	Reveal the facts	23.26	Very low
3.	Choose a logical argument	36.63	Very low
4.	Detect bias with different points of view	26.36	Very low
5.	Draw conclusions	20.54	Very low
	Total average	34.50	Very low

Description: the average score on a scale of 0-100

The researcher conducted a prerequisite analysis test before testing the research hypothesis. The prerequisite test carried out consisted of a normality test and a linearity test. The normality test of the data was carried out using the SPSS 24 program. The normality test was carried out using the Kolmogorov-Smirnov normality test. The results of the normality test are known to have a significant value of 0.200 > 0.05, so it can be concluded that the residual value of the data is normally distributed. The results of the linearity test of data between critical thinking variables and digital literacy with a significant value of deviation from linearity of 0.389 > 0.05, it is stated that the relationship between critical thinking variables and digital literacy is linear. After the prerequisite test is done, the hypothesis is tested.

Hypothesis testing has shown that the significance value of the simple correlation coefficient between the critical thinking variable (X) and Digital Literacy (Y) is 0.136 > 0.05, so there is no positive and significant relationship between critical thinking and digital literacy.

There is no positive and significant relationship between critical thinking and digital literacy, this can be because students are not ready and accustomed to face-to-face learning which was originally online. This is related to Thorndike's behavioristic learning theory, namely the theory of connectionism. Behavioristic learning theory is a theory that views learning as a change in behavior through stimuli and responses. According to Thorndike, the relationship between stimuli and responses can be strengthened by the individual's readiness to accept changes in behavior (Law of Readiness), given repetition (Law of Exercise), and awarded (Law of Effect) [18]. If it is related to the results of this study, students are not ready and accustomed to face-to-face learning so it affects low critical thinking outcomes even though they have learned to use digital media. This is to research conducted by Oktaviana (2016), which states that the low critical thinking ability of students is caused by not being trained and accustomed to working on critical thinking skills [19].

Thorndike in connectionism theory suggests that the law of readiness is when an individual is ready to act on something, then acting is a reward, and if not doing it is a punishment. The more ready the individual to get a behavior change, the implementation of the behavior change will give the individual satisfaction so that the association will tend to be strengthened [20]. If it is related to the state of the research subjects in this study, students are not ready to face face-to-face learning starting from the learning process and working on their assignments. In online learning, students depend on and are accustomed to looking for material and doing assignments and learning tests from

teachers with the help of digital media, for example, Google software, while in face-to-face learning students learn from books and teachers at school, take tests without the help of digital media and tools. So the test results are also low. This is known from the results of initial interviews with fifth-grade teachers. The law of exercise states that the more often an individual's behavior is trained, the stronger the association will be. Online learning students rarely hone their competencies because they depend on the use of Google in learning so students do not understand and hone their abilities. Students in face-to-face learning will be carried away by the habit of rarely honing their critical thinking skills. In addition, students are also not used to practicing with two-tier multiple-choice tests so their critical thinking skills in doing these tests are low. This is following the factors that affect critical thinking skills expressed by students who are also not used to practicing with a two-tier multiple-choice test so that the ability to think critically in doing the test is low. This is by the factors that affect critical thinking skills expressed by students who are also not used to practicing with a two-tier multiple-choice test so the ability to think critically in doing the test is low. This is following the factors that affect critical thinking skills expressed by Sutriyanti & Mulyadi (2019), namely the habit and consistency factor. The law of effect states that a connection (association) can be changed between a situation and a response made and followed by satisfactory circumstances, and the strength of the connection increases. However, if accompanied by unpleasant conditions or situations, the power will decrease [22]. If it is related to the results of this study, the use of high-technology digital media in students is expected to be able to improve critical thinking skills, but because critical thinking skills are low the connection strength decreases or does not exist.

Based on the explanation above, the things that cause critical thinking have no relationship with digital literacy. A high critical thinking score does not have to be accompanied by a high digital literacy score. Vice versa. The results of this study are different from the research of Celik et al. (2018), which revealed that critical thinking has a positive and significant relationship with digital literacy, but the level of the relationship is low. This research is also different from the research conducted by Zou'bi (2021), which states that digital literacy has implications for critical thinking in understanding, evaluating, and interpreting digital media content.

However, this research occurs because the research focuses on the relationship between critical thinking and digital literacy, in which the subjects in this study have only tried face-to-face learning so students are not ready and accustomed to face-to-face learning. After all, previously learning was done online. Therefore, this deficiency is a special concern for teachers in elementary schools to provide constructive learning and use learning activities according to the 21st century so that students can think critically and have good digital literacy. This is because digital literacy needs to include reasoning and critical thinking. After all, digital technology continues to influence teaching, learning, and teaching [25].

4 Conclusion

Based on the results of the research and discussion that have been described, this study concludes that there is no positive and significant relationship between critical thinking and digital literacy in science learning of human and animal respiratory materials. The significance value (2-tailed) between critical thinking and digital literacy is 0.136.

The results of this study can be used as a benchmark for students' critical thinking skills and digital literacy. Therefore, it can be used as a lesson for teachers to use models, strategies, methods, and learning media that are relevant to the development of the 21st century so that critical thinking skills and digital literacy increase.

References

1. I. W. Redhana, "Mengembangkan Keterampilan Abad Ke-21 Dalam Pembelajaran Kimia," *J. Inov. Pendidik. Kim.*, vol. 13, no. 1, 2019.
2. A. C. Saputri, Sajidan, Y. Rinanto, Afandi, and N. M. Prasetyanti, "Improving students' critical thinking skills in cell-metabolism learning using Stimulating Higher Order Thinking Skills model," *Int. J. Instr.*, vol. 12, no. 1, pp. 327–342, 2019, doi: 10.29333/iji.2019.12122a.
3. H. Abdul and A. Riyanti, "Independent Learning Through Digital Literacy," *Semin. Tah. Linguist.*, pp. 1–6, 2018.
4. S. R. Janah, H. Suyitno, and I. Rosyida, "Pentingnya Literasi Matematika dan Berpikir Kritis Matematis dalam Menghadapi Abad ke-21," *Prism. Pros. Semin. Nas. Mat.*, vol. 2, pp. 905–910, 2019, [Online]. Available: https://journal.unnes.ac.id/sju/index.php/prisma/article/download/29305/12924.
5. R. P. Putri and R. I. Permata, "Transformasi perpustakaan desa bandung kidul sebagai sarana mengatasi kesenjangan akses informasi," *J. Ilmu Perpust.*, vol. 8, no. 2, pp. 178–188, 2020, [Online]. Available: https://ejournal3.undip.ac.id/index.php/jip/article/view/26807.
6. P. Adhistian and I. Muhlisin, "Penyuluhan Membentuk Kesadaran Orang Tua Terhadap Penyalahgunaan Gadget Anak Dalam Menangkal Akses Pornografi Di Internet Desa Cijengkol Kecamatan Caringin Kabupaten Sukabumi," *J. Adibrata*, vol. 2, no. 1, pp. 37–47, 2021.
7. D. Nawangsari, "Pola-Pola Sophistikasi dalam Penyalahgunaan Gadget di Kalangan Anak," *An-nisa*, vol. 12, no. 1, pp. 31–48, 2019.
8. Q. Q. A'yuni, "Literasi Digital Remaja Di Kota Surabaya: Studi Deskriptif tentang Tingkat Kompetensi Literasi Digital pada Remaja SMP, SMA dan Mahasiswa di Kota Surabaya," Universitas Airlangga, 2015.
9. Kominfo, "Survei Literasi Digital Indonesia 2020," *Katadata Insight Cent.*, no. November, p. 32, 2020.
10. S. Muliawanti and A. B. Kusuma, "Literasi Digital Matematika di Era Revolusi Industri 4.0," *Pros. Sendika*, vol. 5, no. 1, pp. 637–646, 2019.
11. F. Handayani, "Building Students ' Critical Thinking Skills through STEM-Based Digital Literacy during the Pandemic Period Covid 19," *Cendekiawan*, vol. 2, no. 2, pp. 69–74, 2020.
12. D. Bawden, "Information and digital literacies: a review of concepts," *J. Doc.*, vol. 57, no. 2, pp. 218–259, 2001.

13. B. Sriyanto, "Meningkatkan Keterampilan 4C dengan Literasi Digital di SMP Negeri 1 Sidoharjo," *J. Didakt. Pendidik. Dasar*, vol. 5, no. 1, pp. 125–142, 2021, doi: 10.26811/didaktika.v5i1.291.
14. T. Hidayat, Mawardi, and S. Astuti, "Peningkatan Kemampuan Berpikir Kritis Dan Hasil Belajar Siswa Kelas Iv Melalui Model Pembelaran Discovery Learning Pada Tema Indahnya Keberagamandi Negeriku," *Judika (Jurnal Pendidik. Unsika)*, vol. 7, no. 1, pp. 1–9, 2019.
15. M. L. Ilhamdi, D. Novita, and A. N. K. Rosyidah, "PENGARUH MODEL PEMBELAJARAN INKUIRI TERBIMBING TERHADAP KEMAMPUAN BERPIKIR KRITIS IPA SD," *J. Kontekst.*, vol. 1, no. 02, pp. 49–57, 2020.
16. Y. Ariyana, A. Pudjiastuti, R. Bestary, and Z. Zamromi, "Buku Pegangan Pembelajaran Keterampilan Berpikir Tingkat Tinggi Berbasis Zonasi," *Direktorat Jendral Guru dan Tenaga Kependidikan*, pp. 1–87, 2018.
17. D. R. Wulandari and M. Sholeh, "Efektivitas Layanan Literasi Digital Untuk Meningkatkan Minat Baca Siswa Di Masa Pandemi Covid-19," *J. Inspirasi Manaj. Pendidik.*, vol. 9, no. 2, pp. 327–335, 2021.
18. D. Amsari and U. N. Padang, "IMPLIKASI TEORI BELAJAR E.THORNDIKE (BEHAVIORISTIK) DALAM PEMBELAJARAN MATEMATIKA," *J. BASICEDU*, vol. 2, no. 2, pp. 52–60, 2018.
19. V. Oktaviana, "PENERAPAN MODEL PEMBELAJARAN AUDITORY INTELLECTUALLY REPETITION (AIR) DENGAN MEDIA AUDIO VISUAL UNTUK MENINGKATKAN KETERAMPILAN BERPIKIR KRITIS DAN HASIL BELAJAR SISWA (Kelas X MIPA 4 SMA Negeri 4 Jember Pokok Bahasan Plantae Tahun Pelajaran 2015/2016)," Universitas Jember, 2016.
20. M. S. Lubis, *Teori Belajar dan Pembelajaran Matematika*. Medan: UIN Sumatera Utara, 2016.
21. Y. Sutriyanti and M. Mulyadi, "Analisis Faktor-Faktor yang Mempengaruhi Penerapan Berpikir Kritis Perawat dalam Melaksanakan Asuhan Keperawatan di Rumah Sakit," *J. Keperawatan Raflesia*, vol. 1, no. 1, pp. 21–32, 2019, doi: 10.33088/jkr.v1i1.394.
22. B. R. Hergenhahn and M. H. Olson, *Theories of Learning, Edisi Ketujuh*, 7th ed. Jakarta: Kencana Prenada Media Group, 2009.
23. Ö. Çelik, H. Çokçalişkan, and A. Yorulmaz, "Investigation of The Effect of Pre-Service Classroom Teachers' Critical Thinking Disposition on Their Media Literacy," *Int. J. Eval. Res. Educ.*, vol. 7, no. 3, p. 194, 2018, doi: 10.11591/ijere.v7i3.13960.
24. R. Al Zou'bi, "The impact of media and information literacy on acquiring the critical thinking skill by the educational faculty's students," *Think. Ski. Creat.*, vol. 39, no. November 2020, p. 100782, 2021, doi: 10.1016/j.tsc.2020.100782.
25. A. Phippen, E. Bond, and E. Buck, *Effective strategies for information literacy education: Combatting 'fake news' and empowering critical thinking*. Elsevier Ltd., 2021.