

Digital literacy of biology science teacher in learning during the covid-19 pandemic

Uswatun Hasanah ⁽¹⁾ *, Aminuddin Prahutama Putra ⁽²⁾, Badruzsaufari ⁽³⁾

⁽¹⁾ Master Program of Biology Education, Postgraduate Program, Universitas Lambung Mangkurat, Banjarmasin City, South Kalimantan, Indonesia

⁽²⁾ Study Program of Biology Education, Faculty of Teacher Training and Education, Universitas Lambung Mangkurat, Banjarmasin City, South Kalimantan, Indonesia

⁽³⁾ Study Program of Biology, Faculty of Mathematics and Natural Science, Universitas Lambung Mangkurat, Banjarmasin City, South Kalimantan, Indonesia

*Corresponding Author Email: uswahasanah28@gmail.com

Article Information	Abstract
Keyword: Digital literacy level; Learning; Covid-19 pandemic; Biology science; 21st century Kata Kunci: Tingkat literasi digital; Pembelajaran; Pandemi covid-19; Ilmu biologi; Abad 21 History: Received : 14/07/2022 Accepted : 13/02/2023	The Challenges of 21st Century Education in the digital era 4.0 require the learning process to follow digitalization. Since 2019 the world has been hit by the Covid-19 pandemic, and this condition has made the government issue an online distance learning policy. So that digital literacy competence is an urgent need for teachers to carry out learning. The study aims to describe the level of digital literacy and the character of each level of digital literacy of Biology Science teachers in learning during the Covid-19 pandemic at MTsN 2 Kapuas. The research method is descriptive qualitative with three people of the research subject. The research instrument includes the main instrument of the researcher himself and the supporting instrument of the teacher's written sheet (LTG). The level of digital literacy is categorized based on a hypothetical theory with five levels, namely LDGPP 4 (very high), LDGPP 3 (high), LDGPP 2 (medium), LDGPP 1 (low) and LDGPP 0 (very low). The results showed that Biology Science teachers' digital literacy level in learning during the Covid-19 pandemic at MTsN 2 Kapuas consisted of two levels, namely LDGPP 4 (very high) and LDGPP 3 (high). The teacher's high level of digital literacy is strength to produce students with a high level of digital literacy as well. Abstrak Tantangan Pendidikan Abad 21 era digital 4.0 menuntut proses pembelajaran mengikuti digitalisasi. Sejak tahun 2019 dunia dilanda pandemi Covid-19, kondisi ini membuat pemerintah mengeluarkan kebijakan pembelajaran jarak jauh secara <i>online</i>. Sehingga kompetensi literasi digital menjadi kebutuhan mendesak yang harus dimiliki guru dalam melaksanakan pembelajaran. Penelitian bertujuan untuk mendeskripsikan tingkat literasi digital dan karakteristik setiap tingkat literasi digital guru IPA Biologi dalam pembelajaran masa pandemi Covid-19 di MTsN 2 Kapuas. Metode penelitian adalah deskriptif kualitatif dengan tiga orang subjek penelitian. Instrumen penelitian meliputi instrumen utamanya peneliti sendiri dan instrumen pendukungnya lembar tertulis guru (LTG). Tingkat literasi digital dikategorikan berdasarkan teori hipotetik dengan lima tingkatan, yaitu LDGPP 4 (sangat tinggi), LDGPP 3 (tinggi), LDGPP 2 (sedang), LDGPP 1 (rendah) dan LDGPP 0 (sangat rendah). Hasil penelitian menunjukkan tingkat literasi digital guru IPA Biologi dalam pembelajaran pada masa pandemi Covid-19 di MTsN 2 Kapuas terdiri dari dua tingkatan yaitu LDGPP 4 (sangat tinggi) dan LDGPP 3 (tinggi). Level literasi digital guru yang tinggi merupakan kekuatan untuk menghasilkan peserta didik dengan level literasi digital yang tinggi pula.

A. Introduction

The progress of the times towards the beginning of the digital era 4.0 is marked by the rapid development of data innovation (Listiaji & Subhan, 2021; Cholily et al., 2019). Education in this period requires teachers to develop digital literacy skills (Mahsunah, 2021; Listiaji & Subhan, 2021). Thus, developing learning is not enough to add information. It also needs to include reasoning skills (Sulianto et al., 2019), imagination (Fitriyani et al., 2021), and solid character (Sultoni et al., 2020), for example, responsible, social, tolerant, helpful, versatile, and literacy skills.

Since 2019, the world has been hit by the coronavirus pandemic (Sahu & Kumar, 2020; Guo et al., 2020). Large-scale scope restrictions (PSBB) have also been carried out by the government of the Republic of Indonesia, which was first carried out in Jakarta on April 10, 2020. This has caused the government to provide rules or policies in various regions to limit the spread of Covid-19 infection, including in the world of education (Anugerah et al., 2021).

The learning process is generally conducted face-to-face but can be done by utilizing technological innovation media through virtual meeting applications (Puryanto, 2020). At this stage, educators are expected to be able to apply digital literacy, which is an advantage, attitude mentality, and personal capacity to utilize digital innovations and exceptional devices to obtain, create, coordinate, dissect, assess data, collect new information, design, and communicate with students to participate effectively (Liansari et al., 2018).

Digital literacy is an individual's expertise or proficiency in utilizing digital media and being responsible for obtaining data and communicating (Nasrullah et al., 2017). Digital literacy is needed today, considering that technological advances cannot be balanced with knowledge in utilizing innovation (Novitasari & Fauziddin, 2022). As during the coronavirus pandemic, educators are expected to carry out internet-based learning (Anggita, 2020).

The usual educational paradigm of meeting each other in person has shifted to distance learning (PJJ) by utilizing internet applications such as Zoom Gathering, WhasApps, Google Meet, and so on (Rochman & Pertiwi, 2020). Teachers who are used to using digital applications will find it easier to provide online-based learning. Therefore, teachers are required to master advanced digital literacy in delivering distance learning during the Coronavirus pandemic. In this case, the level and characteristics of teachers' digital literacy need to be measured. To measure it refers to ten (10)

digital literacy competencies according to the digital literacy activist network, namely: accessing, selecting, understanding, checking, confirming, assessing, disseminating, producing, taking part, working together (Adikara et al., 2021). This demand is not only for teachers in big cities but also in small towns such as Kapuas city, so the level of digital literacy of teachers in that city needs to be studied.

Teachers also did online learning of Biology topics at MTsN 2 Kapuas during the pandemic. The fluency of science teachers at the school in using digital-based facilities for biology learning is not yet known. Therefore, the digital literacy skills of Biology Science teachers of MTs Negeri 2 Kapuas in learning during the pandemic need to be studied.

Previously, several studies have led to the study of teachers' digital literacy levels. According to research by Sánchez-Cruzado et al. (2021), improving teacher digital skills should have as its target improving those of their pupils. It is very important that students have acquired key skills by the end of their compulsory school period. This will make them the citizenry that the 21st century society needs. It is, therefore, crucial that teachers reach a high level of digital literacy. Widana (2020) explain the level of teacher skills using digital media and the internet is one of digital literacy indicators that affect the ability of teachers to develop HOTS-based assessment. Anisimova (2020) designing digital media as a work of a new study program in the Information Technology discipline. The results show an increase in the interest of future teachers of various ages to use digital technology, after the previous survey results showed that the digital literacy level of future teachers was not high enough.

Everyone's abilities are likely to be different; for this reason, the level and characteristics of teachers' digital literacy are measured based on digital literacy competencies (Ayyildiz et al., 2021; Adikara et al., 2021). This study aims to describe the level and characteristics of digital literacy of Biology Science teachers of MTs Negeri 2 Kapuas.

B. Material and Method

This research uses a qualitative approach to naturalistic phenomenology. Qualitative phenomenology naturalistic aims to understand what phenomena occur as follows: a) how the level of digital literacy of science teachers is what is the level of digital literacy in learning during the pandemic, and b) how to characterize each level of literacy digital guru science in learning during the pandemic at MTs Negeri 2 Kapuas

This study involved three teachers of Biology Science subjects as research subjects with purposive sampling techniques. The research instrument includes the primary instrument (the researcher himself) and supporting instruments in the form of written teacher sheets (LTG) and interview guidelines. The method of data collection is carried out with four techniques, namely: (1) observation; (2) interviews; (3) documentation, and (4) triangulation.

Digital literacy level profile data was obtained from teacher answers analyzed to digital literacy indicators on teacher written assignments (LTG) given with ten digital literacy competencies and 25 indicators developed by researchers. Data on the characteristics of digital literacy levels are obtained through the interview process of science teachers. Digital literacy levels are categorized based on a hypothetical theory with five levels, namely LDGPP 4 (very high), LDGPP 3 (high), LDGPP 2 (medium), LDGPP 1 (low), and LDGPP 0 (very low). According to Adikara et al. (2021), digital literacy competency indicators include ten indicators: accessing, selecting, understanding, analyzing, verifying, evaluating, distributing, producing, participating, and collaborating.

The level and characteristic data analyzed using the Miles and Huberman model. The Miles and Huberman model stages include data reduction, data presentation, and conclusion.

C. Results and Discussion

The results of the digital literacy level of Biology Science teachers in learning during the Covid-19 pandemic (LDGPP) at Madrasah Tsanawiyah Negeri 2 Kapuas are LDGPP 3 (high) and LDGPP 4 (very high). The results of the answers to the LDGPP 3 and 4 teacher written assignments (LTG) are briefly described in Table 1 and Table 2.

A high level of digital literacy was obtained in one teacher who was the final subject of the study, then codenamed LD1. Based on the results in the table above, it is known that at the LDGPP 3 LD1 level in the supporting section, it cannot meet the digital literacy competency indicators, namely participating and collaborating to involve themselves in online communities as a support for learning during the Covid-19 pandemic. LD1's ability to present the answers on the sheet looks short and inappropriate. This data shows that out of 10 digital literacy competency indicators, only eight can be met, and there are still two digital literacy competency indicators that have not been met. Meanwhile, in Table 2, digital literacy at the LDGPP 4 level was very high in two teachers who

were the final subjects of the study, then codenamed LD2 and LD3.

Based on the research data that has been displayed, the level of digital literacy shows the LDGPP 3 and LDGPP 4 categories. The ability of each teacher influences this. In line with this, the level of digital literacy is determined by various essential factors, especially the competencies a person has because each individual has different digital literacy competencies and background profiles.

In this study, there was no competence in digital literacy of teachers at the level of LDGPP 0 (very low), LDGPP 1 (low), and LDGPP 2 (medium). This is because all subjects are able to meet digital literacy competencies at the planning stage. From the findings in the research conducted, it can be described the levels of LDGPP 3 and 4 based on ten digital literacy competencies as follows.

First, the ability to access is competence in obtaining information by operating digital media. At the LDGPP 3 and LDGPP 4 levels, all teachers are able to meet the competence of accessing digital literacy. This is because all subjects have digital devices to access learning information. In line with this, access is an inherent skill in everyone who actively uses internet facilities in their daily lives (Raharjo & Winarko, 2021). This access competency is a basic ability in digital literacy (Adikara, Kurnia, & Adhrianti, 2021). With the ability to access it, it is effortless for teachers to find references for learning materials and effective and efficient teaching methods.

Second, the ability to select is competence in selecting and sorting out various information from various access sources considered helpful for digital media users. At the LDGPP 3 and LDGPP 4 levels, the three teachers were able to meet the digital literacy competencies of selection. This is due to the guidance and direction of the principal, who conducts technical advice to select and avoid hoax information. Related to the ability to select is in line with Raharjo & Winarko (2021) that the ability to select is a skill that involves the skill of filtering information from various sources.

Third, the ability to understand is the competence to understand information that has been selected previously. At the LDGPP 3 and LDGPP 4 levels, the three teachers can meet the competence of digital literacy to understand. This means showing that the teacher has begun understanding the existing information's intention, purpose, and truth (Raharjo & Winarko, 2021).

Fourth, the ability to analyze is the competence to analyze by looking at plus and minus information that has been understood

before. At LDGPP level 3 and LDGPP4, all three teachers could meet the competence of digital literacy analysis. According to Raharjo and Winarko (2021), most teachers are required to think critically and adaptively in keeping up with the times.

Fifth, the ability to verify is the competence to cross-confirm with similar information. At LDGPP level 3 and LDGPP 4 all three teachers were able to meet the verifying digital literacy competencies. In line with this, digital media literacy is the ability of social media users who can

critically and creatively filter information circulating in various media (Stefany et al., 2017).

Sixth, according to Adikara et al. (2021), the ability to evaluate is the competence to mitigate risks before distributing information by considering the way and platform to be used. At the LDGPP 3 and LDGPP 4 levels, the three teachers were able to meet digital literacy competencies in learning during the Covid-19 pandemic. This is because, based on the answers, the teacher must be careful and thorough. According to Raharjo & Winarko (2021), The ability to evaluate this will increase along with the ability to think critically.

Table 1 Teacher written assignment answer results (LTG) at LDGPP level 3 (high)

Stages	Achievement of Digital Literacy Competency Indicators		Reason
Planning	Access	✓	Able to use digital devices to access the internet in search of learning information
		✓	Able to search for information on the internet through various applications such as (Google, Mozilla, Opera Mini, etc.)
	Selection	✓	Able to choose learning information that suits learning needs
		✓	Able to ignore learning information that is not in accordance with learning needs
	Understand	✓	Able to understand written learning information in accordance with the language used
		✓	Able to understand photos / images used in learning
		✓	Able to understand learning videos
	Analyze	✓	Able to determine the suitability of learning information with its media application
		✓	Able to determine learning information according to learning objectives
	Verify	✓	Able to connect learning information with the objectives of the learning material
		✓	Able to identify the diversity of meanings of learning information
	Implementation	Evaluate	✓
✓			Able to identify errors in the learning information received
✓			Able to decide the correctness of the learning information received
Distribute		✓	Able to deliver learning materials in accordance with learning objectives
		✓	Able to consider sharing learning materials
Producing		✓	Able to make learning materials in writing on digital media
		✓	Able to create learning materials in the form of photos / images on digital media
Support	Participate	✓	Able to make learning materials in the form of videos on digital media
		✓	Able to involve yourself in an online community that suits your learning needs
		-	Unable to regularly participate in online community activities
	Collaborate	-	Unable to contribute to online communities
		-	Unable to create online forums/groups/communities (social media, chat groups, etc.)
		-	Unable to manage forums/groups in online communities (social media, group chats, etc.) and collaborate with other communities
		-	Unable to determine topics in online communities (social media, group chats, etc.) to achieve a goal

Description: sign (✓) means that the indicator is fulfilled; sign (-) means that the indicator is not fulfilled

Table 2 Results of teacher written assignment answers (LTG) at LDGPP level 4 (very high)

Stages	Achievement of Digital Literacy Competency Indicators	Reason
Planning	Access	√ Able to use digital devices to access the internet in search of learning information
		√ Able to search for information on the internet through various applications such as (Google, Mozilla, Opera Mini, etc.)
	Selection	√ Able to choose learning information that suits learning needs
		√ Able to ignore learning information that is not in accordance with learning needs
	Understand	√ Able to understand written learning information in accordance with the language used
		√ Able to understand photos / images used in learning
		√ Able to understand learning videos
	Analyze	√ Able to determine the suitability of learning information with its media application
		√ Able to determine learning information according to learning objectives
	Verify	√ Able to connect learning information with the objectives of the learning material
		√ Able to identify the diversity of meanings of learning information
Implementation	Evaluate	√ Able to compare learning information from various sources of learning information received
		√ Able to identify errors in the learning information received
	Distribute	√ Able to decide the correctness of the learning information received
		√ Able to deliver learning materials in accordance with learning objectives
	Producing	√ Able to consider sharing learning materials
		√ Able to make learning materials in writing on digital media
		√ Able to create learning materials in the form of photos / images on digital media
Support	Participate	√ Able to make learning materials in the form of videos on digital media
		√ Able to involve yourself in an online community that suits your learning needs
		√ Unable to regularly participate in online community activities
	Collaborate	√ Unable to contribute to online communities
		√ Unable to create online forums/groups/communities (social media, chat groups, etc.)
		√ Unable to manage forums/groups in online communities (social media, group chats, etc.) and collaborate with other communities

Description: sign (√) means that the indicator is fulfilled; sign (-) means that the indicator is not fulfilled

Seventh, the ability to distribute is competence in sharing information by considering who will access the information. At the LDGPP 3 and LDGPP 4 levels, all three teachers can meet the digital literacy competencies. In this case, teachers consider sharing learning mates to look at students who are sometimes constrained by technical situations such as networks and quota.

Eighth, according to Adikara et al. (2021), the ability to produce is competence in compiling new information that is accurate, clear, and pays attention to ethics. At the LDGPP 3 and LDGPP 4 levels, the three teachers were able to meet the competence of digital literacy production.

Ninth, according to Adikara et al. (2021), participating in the competence to play an active role in sharing good and ethical information through social media and other online communication activities. This participating competency is part of the supporting competencies in digital literacy. On this competence, not all subjects or respondents can meet all indicators. LDGPP level 3 teachers can only meet the indicators of being able to involve themselves in online communities that are following learning needs but are unable to participate in online community activities regularly and contribute to online communities that are following learning needs. Therefore, at the LDGPP

level, three teachers could not meet digital literacy competencies in learning during the Covid-19 pandemic to participate.

Meanwhile, at the LDGPP 4 level, teachers are able to meet digital literacy competencies in learning during the Covid-19 pandemic to participate because they can meet all indicators, namely being able to involve themselves in online communities that are in accordance with learning needs, being able to participate in online community activities regularly and being able to contribute to online communities that are following learning needs. Unfortunately, MGMP organizational activities only involve civil servant teachers, whereas, in other schools, honorary teachers are also involved in activities and learning support organizations. According to Putra et al. (2020), organizational culture in accepting technology is crucial for teaching and learning methods.

Tenth, according to Adikara et al. (2021), collaborating is the competence to take the initiative and distribute honest, accurate, and ethical information through cooperation with other stakeholders. This participating competency is part of the supporting competencies in digital literacy. Based on the study's results, not all respondents/research subjects could meet the competence of digital literacy in collaboration. LDGPP level 3 teachers cannot meet all three indicators, while LDGPP level 4 can meet all three indicators. Of the ten digital literacy competencies above, all competencies can be met.

The final results of the LD1 subject were only able to meet eight digital literacy competencies. Based on hypothetical theory categorized at the LDGPP 3 (high) level, namely at this level, teachers can complete 7-8 indicators of digital literacy competence during the Covid-19 pandemic: accessing, selecting, understanding, analyzing, verifying, evaluating, distributing, and producing. Meanwhile, the subjects of LD2 and LD3 can meet ten digital literacy competencies. Based on hypothetical theory categorized at the LDGPP 4 (high) level, namely at this level, teachers can complete 9-10 indicators of digital literacy competence during the Covid-19 pandemic, namely accessing, selecting, understanding, analyzing, verifying, evaluating, distributing, producing, participating and collaborating. The final results of the LD1 subject were only able to meet eight digital literacy competencies. Based on hypothetical theory categorized at the LDGPP 3 (high) level, namely at this level, teachers can complete 7-8 indicators of digital literacy competence during the Covid-19 pandemic: accessing, selecting, understanding, analyzing, verifying, evaluating, dis-

tributing, and producing. Meanwhile, the subjects of LD2 and LD3 can meet ten digital literacy competencies. Based on hypothetical theory categorized at the LDGPP 4 (high) level, namely at this level, teachers can complete 9-10 indicators of digital literacy competence during the Covid-19 pandemic, namely accessing, selecting, understanding, analyzing, verifying, evaluating, distributing, producing, participating and collaborating.

This has a positive impact on achieving learning goals during a pandemic. Teachers with a high level of digital literacy can provide maximum learning. According to Putra (2019); Yulia (2020), teachers act as facilitators to demonstrate the competencies that students must have and open opportunities for students to learn from various digital learning resources globally.

D. Conclusion

Based on the results of research and discussions that have been carried out, the level of digital literacy of Biology Science teachers in learning during the Covid-19 pandemic (LDGPP) obtained by MTs Negeri 2 Kapuas teachers has two levels, namely the LDGPP 3 as the high level (one teacher), and LDGPP 4 as the very high level (two teachers). The teacher's high level of digital literacy is strength to produce students with a high level of digital literacy as well. Research related to this strength needs to be done to see its contribution.

E. References

- Adikara, G. J., Kurnia, N., Adhrianti, L., Astuty, S., Wijayanto, X. A., Desiana, F., & Astuti, S. I. (2021). *Modul aman bermedia digital*. Jakarta: Kementrian Komunikasi dan Informatika Republik Indonesia Japelidi, Siberkreasi.
- Anggita, Z. (2020). Penggunaan powtoon sebagai solusi media pembelajaran di masa pandemi covid-19. *Jurnal Konfiks*, 7(2), 44-52. DOI: <https://doi.org/10.26618/konfiks.v7i2.4538>
- Anisimova, E. (2020). Digital literacy of future preschool teachers. *Journal of Social Studies Education Research*, 11(1), 230-253. Retrieved from <https://www.learntechlib.org/>
- Anugerah, A. R., Muttaqin, P. S., & Purnama, D. A. (2021). Effect of large-scale social restriction (PSBB) during COVID-19 on outdoor air quality: Evidence from five cities in DKI Jakarta Province, Indonesia. *Environmental Research*, 197, 1-8. DOI: <https://doi.org/10.1016/j.envres.2021.111164>
- Ayyildiz, P., Yilmaz, A., & Baltaci, H. S. (2021). Exploring digital literacy levels and technology integration competence of Turkish Academics. *International Journal of Educational*

- Methodology*, 7(1), 15-31. DOI: <https://doi.org/10.12973/ijem.7.1.15>
- Cholily, Y. M., Putri, W. T., & Kusgiarohmah, P. A. (2019, June). Pembelajaran di era revolusi industri 4.0. In *Seminar & Conference Proceedings of UMT*, (pp. 1-6). Universitas Muhammadiyah Tangerang. DOI: <http://dx.doi.org/10.31000/cpu.v0i0.1674>
- Fitriyani, Y., Supriatna, N., & Sari, M. Z. (2021). Pengembangan kreativitas guru dalam pembelajaran kreatif pada mata pelajaran IPS di sekolah dasar. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, 7(1), 97-109. DOI: <https://doi.org/10.33394/jk.v7i1.3462>
- Guo, H., Sheng, Y., Li, W., Li, F., Xie, Z., Li, J., ... & Wang, F. (2020). Coagulopathy as a prodrome of cytokine storm in COVID-19-infected patients. *Frontiers in Medicine*, 7, 1-7. DOI: <https://doi.org/10.3389/fmed.2020.572989>
- Liansari, V., Ermawati, E., & Nuroh, N. (2018). Realitas penerapan literasi digital bagi mahasiswa. In *Proceedings of The ICECRS*, 1(3), 241-252. DOI: <https://doi.org/10.21070/picecrs.v1i3.1397>
- Listiaji, P., & Subhan, S. (2021). Pengaruh pembelajaran literas digital pada kompetensi. *Jurnal Pendidikan dan Kebudayaan*, 6(1), 107-116. DOI: <https://doi.org/10.24832/jpnk.v6i1.1948>
- Mahsunah, E. (2021). Pembelajaran bahasa inggris berbasis literasi digital pasca pandemi covid 19. *QALAMUNA: Jurnal Pendidikan, Sosial, dan Agama*, 13(2), 957-968. DOI: <https://doi.org/10.37680/qalamuna.v13i2.1257>
- Nasrullah, R., Aditya, W., Satya, T. I., & Hanifah, N. (2017). *Materi pendukung literasi digital*. Jakarta: Kementerian Pendidikan dan Kebudayaan. Retrieved from <https://gln.kemdikbud.go.id/glnsite/wp-content/uploads/2017/10/literasi-DIGITAL.pdf>
- Novitasari, Y., & Fauziddin, M. (2022). Analisis literasi digital tenaga pendidik pada pendidikan anak usia dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(4), 3570-3577. DOI: <https://doi.org/10.31004/obsesi.v6i4.2333>
- Puryanto, P. (2020, Agustus 3). *Teknologi pendidikan era digital dan tantangan Indonesia menghadapi dinamika peradaban milenium sebagai era robotic*. BDK Jakarta: Kementrian Agama RI. Retrieved from <https://bdkjakarta.kemenag.go.id/berita/teknologi-pendidikan-era-digital-dan-tantangan-indonesia-menghadapi-dinamika-peradaban-milenium-sebagai-era-robotic>
- Putra, A. P. (2019). *Pendidikan biologi dan interpreneur*. Yogyakarta: Phonix Publisier.
- Putra, A. P., Akrim, A., & Dalle, J. (2020). Integration of high-tech communication practices in teaching of biology in Indonesian Higher Education Institutions. *International Journal of Education and Practice*, 8(4), 746-758. DOI: <https://doi.org/10.18488/journal.61.2020.84.746.758>
- Raharjo, N. P., & Winarko, B. (2021). Digital literacy level analysis of the millennial generation of Surabaya in overcoming the spread of hoaxes. *Jurnal KOMUNIKA: Jurnal Komunikasi, Media, dan Informatika*, 10(1), 33-44. Retrieved from <https://jurnal.kominfo.go.id/index.php/komunika/article/download/3795/1570>
- Rochman, C., & Pertiwi, C. S. R. (2020). Learning at Covid-19 pandemic era: Science technology engineering and mathematic competencies and student character. *SEJ (Science Education Journal)*, 4(2), 129-142. DOI: <https://doi.org/10.21070/sej.v4i2.574>
- Sahu, K. K., & Kumar, R. (2020). Current perspective on pandemic of COVID-19 in the United States. *Journal of family medicine and primary care*, 9(4), 1784-1791. DOI: https://doi.org/10.4103/jfmpc.jfmpc_424_20
- Sánchez-Cruzado, C., Santiago Campión, R., & Sánchez-Compañía, M. T. (2021). Teacher digital literacy: The indisputable challenge after COVID-19. *Sustainability*, 13(4), 1-29. DOI: <https://doi.org/10.3390/su13041858>
- Sulianto, J., Sunardi, S., Anitah, S., & Gunarhadi, G. (2019). Analisis implementasi pembelajaran di sekolah dasar pada pengembangan model advance organizer berbasis pendekatan open ended untuk meningkatkan penalaran siswa. *International Journal of Elementary Education*, 3(4), 396-403. DOI: <https://doi.org/10.23887/ijee.v3i4.21312>
- Sultoni, S., Gunawan, I., & Argadinata, H. (2020). Dampak pembelajaran berkarakter terhadap penguatan karakter siswa generasi milenial. *JAMP: Jurnal Administrasi dan Manajemen Pendidikan*, 3(2), 160-170. DOI: <http://dx.doi.org/10.17977/um027v3i22020p160>
- Widana, I. W. (2020, July). The effect of digital literacy on the ability of teachers to develop HOTS-based assessment. In *Journal of Physics: Conference Series* (Vol. 1503, No. 1, pp. 1-9). IOP Publishing.
- Yulia, H. (2020). Online learning to prevent the spread of pandemic corona virus in Indonesia. *ETERNAL (English Teaching Journal)*, 11(1), 48-56. DOI: <https://doi.org/10.26877/eternal.v11i1.6068>