SCIENTIAE EDUCATIA: JURNAL PENDIDIKAN SAINS

journal homepage: www.syekhnurjati.ac.id/jurnal/index.php/sceducatia

http://www.syekhnurjati.ac.id/jurnal/index.php/sceducatia/article/view/7381

Transformation in Biology Learning during the Covid-19 Pandemic: From Offline to Online

Kintan Limiansi[a*], Anggi Tias Pratama[b], Rizqa Devi Anazifa[c]

[a] Biology Education Study Program, Faculty of Mathematics and Sciences, Yogyakarta State University, Yogyakarta, Indonesia
[b] Biology Education Study Program, Faculty of Mathematics and Sciences, Yogyakarta State University, Yogyakarta, Indonesia
[c] Biology Education Study Program, Faculty of Mathematics and Sciences, Yogyakarta State University, Yogyakarta, Indonesia

[*] Corresponding author: Jl. Colombo Yogyakarta No.1, Karang Malang, Caturtunggal, Depok, Sleman, Daerah Istimewa Yogyakarta, 55281, Indonesia. E-mail addresses: kintan.limiansi@uny.ac.id

a r t i c l e i n f o

a b s t r a c t

This article aims to describe the implementation of online biology learning in senior high schools (SMA/MA) in the Special Region of Yogyakarta during the pandemic. This study employed a quantitative method and involved 25 SMA/MA biology teachers in the Special Region of Yogyakarta. The data were collected through a survey by distributing questionnaires to the teachers. The results reveal that all SMA/MA biology teachers in Yogyakarta have transformed offline learning into online learning. They conduct blended online learning by combining virtual synchronous activities and asynchronous activities by utilizing online media. The virtual synchronous activities (44%) dominate the learning process, and thus, conducive communication between teachers and students is created. Whatsapp is the most dominant media utilized in the virtual synchronous activities (38%) and asynchronous activities (41%) even though this application is not designed for learning purposes. This study is expected to provide SMA/MA biology teachers' objective description of their condition in implementing online learning. Consequently, the description can become an evaluation for educational stakeholders and a consideration to conduct related research.

2020 Scientiae Educatia: Jurnal Pendidikan Sains

1. Introduction

The development of information technology in the 21st-century results in humans' inability to separate from technology (Martha et al., 2018). A survey by the Indonesian Internet Network Providers Association (2016) deploys that 132.7 million Indonesians are internet users, and 24.4 millions of them are children and teenagers aged 10-24 years old. This condition indicates that school-aged children have highly utilized information technology, and they potentially utilize technology in the learning process. Information technology used in a learning process can improve the learning quality (Cholik, 2017). However, technology and information have not been optimally utilized in education because Indonesia still implements traditional systems that highly depend on traditional approaches, including a face-to-face meeting between teachers and students (Simaremare, 2009). This condition has drastically changed since the Covid-19 pandemic occurs worldwide.

Covid-19 pandemic influences various fields, including education, in Indonesia (Syah, 2020; Wahyono et al., 2020). Educational institutions, teachers, students, parents, and stakeholders receive harmful effects of the Covid-19 pandemic on education (De Giusti, 2020). Governments of all countries worldwide implement steps to stop the spread of Covid-19, and one of them is by limiting the number of people gathering in public places. This policy disrupts the normal functions of schools and universities (Reimers et al., 2020). During the pandemic, 400 million students have learned from home from April 2020 (Wahyono et al., 2020).

Furthermore, schools' closure in more than 100 countries makes more than one billion students out of school (Onyema, 2020). The Indonesian government's policy to continue the learning process is to conduct learning from home as regulated by the Ministry of Education and Culture Circular Letter Number 4 of 2020 about the Implementation of Education Policies in an Emergency Condition for the Spread Covid-19. The circular letter announces that the learning process is conducted online or distance learning by focusing on providing meaningful learning experiences to students without burdening completeness of curriculum achievements.

Many countries worldwide implement the policy of distance learning. Italia has implemented distance learning from March 2020 (Schleicher, 2020) by lending digital tools to underprivileged students and conducting training for school staff and teachers to implement effective distance learning. Moreover, Argentina, Chile, Colombia, El Salvador, Jamaica, Peru, Saint Vincent, and Uruguay have implemented distance learning by providing laptops and tablets required in a learning process and conducting training on technology, information, and communication application in learning for teachers (Wayne et al., 2020). Massive school closure in Asia-Pacific results in transforming the learning model into technology-integrated education or EdTech (Susantono et al., 2020).

Special Region of Yogyakarta is one of Indonesia's provinces not categorized as a green zone area of Covid-19 (Satgas Covid-19, 2020). Thus, face-to-face learning is not allowed to conduct in this area during the pandemic. As a result, schools compulsorily transform offline learning into online learning (Menteri Pendidikan dan Kebudayaan Republik Indonesia, 2020). Online learning is implemented from the kindergarten level to the university level in all subjects, including biology class. The consequences of the government's policy are changes in teaching and learning systems. Education as a part of education has a vital role in

creating comfortable learning conditions and assisting students in learning effectively; thus, behavior changes can occur (Sirate & Yaumi, 2017). Educators as facilitators in learning must perform their roles in any conditions, including a situation that obliges students to conduct online learning.

Online learning has been widely used in many countries and becomes the most important distance learning sector for the last few years (Nguyen, 2015). This learning system consists of various programs that benefit the internet and provide access to learning materials as a means of interaction between teachers and students (Bakia et al., 2012). The implementation of online learning is quite effective, particularly in biology class (Sari, 2020), because it can improve learning results (Raharjo, 2020), solve boredom (Pawicara & Conilie, 2020), improve critical thinking skills (Khastini, 2020), and increase students' attention (Perangin & Ekawalta, 2020). Online learning is principally similar to face-to-face learning (Giatman et al., 2020) because both systems necessarily consider conformity to the curriculum, actively involve students, must be effective and innovative, conduct formative and summative evaluations, and compulsorily utilize operatable tools easily with affordable prices for students (Anderson & McCormick, 2005).

The online learning environment consists of synchronous activity and asynchronous activity (Perveen, 2016). Synchronous activity refers to communication between educators and students in real-time, for example, lecture and discussions. Meanwhile, asynchronous activity refers to delayed communication, and thus, communication is not bounded by time, and students can learn based on their capacity. The combination of synchronous and asynchronous activities is the general principle of learning with a blended learning approach (Chaeruman, 2017). In blended learning, various strategies, and multiple media in delivering topics triggers optimal learning (Khan, 2005). Chaeruman (2013) argues four quadrants of learning settings in blended learning; they are live synchronous activities (lecture, presentation, laboratory practices, etc.), virtual synchronous activities (video conference, audio conference, and live chatting), collaborative asynchronous activities (discussion, project work, etc.), and self-directed asynchronous activities (learning an object from texts, audios, videos, and simulation).

The successful implementation of online learning during the pandemic is determined by teachers' professionality, responsibility, and ability to conduct online learning (Fauzi & Khusuma, 2020). Therefore, it is necessary that educational researchers comprehensively

investigate teachers' implementation of online learning. This article discusses how teachers conduct learning during the pandemic comprehensively. This study investigates two aspects: types of students learning activities and media used in the learning. It is expected that this study can provide an objective description of the high school biology teachers' condition in conducting the learning process during the pandemic. Therefore, it can become an evaluation for many parties, including policymakers, to implement online biology in high schools. Furthermore, this study is expected to provide considerations to conduct comprehensive studies that improve online learning implementation.

2. Method

This study employed a quantitative approach with a survey method to reveal teachers' online learning perspectives during the Covid-19 pandemic. This research's subjects were 25 teachers from 5 regencies/cities. They were six teachers from Sleman Regency, four teachers from Yogyakarta City, seven teachers from Bantul Regency, two teachers from Gunung Kidul Regency, and six teachers from Kulon Progo Regency. The survey was conducted by distributing an open and close questionnaire to the SMA/MA biology teachers in the Special Region of Yogyakarta. The questionnaire was composed in the Google Form and accessible for the teachers. Furthermore, the questionnaire consisted of 10 questions combining open and closed questions, as presented in Table 1.

Table 1. List of the Questionnaire's Open and Closed Questions

Questions	Characteristic
Do you transform your teaching-learning activities into online learning during the Covid-19 pandemic?	Closed-ended question
What types of communication do you use in the online class?	Open-ended question
How is the proportion of virtual synchronous activities and asynchronous activities in your online class?	Closed-ended question
What mediators do you use to conduct virtual synchronous activities?	Open-ended question
What platforms do you use as a mediator of learning activities and virtual synchronous activities?	Open-ended question
In your opinion, what are the advantages of online learning with virtual synchronous activities?	Open-ended question
What activities do you implement during the online class with asynchronous activities?	Open-ended question
What learning materials do your students use in asynchronous activities?	Open-ended question
What mediators do you use in collaborative asynchronous activities and self-directed asynchronous activities?	Open-ended question
In your opinion, what are the advantages of online learning with asynchronous activities?	Open-ended question

The data analysis was conducted by considering the question characteristics. Open questions were analyzed based on inductive contents by coding the research subjects' answers. The coding stage consisted of 1) writing the respondents' answers, 2) grouping the answers based on categories, and 3) drawing a general description based on the categories. After conducting content analysis, the researchers calculated the respondents' responses by employing descriptive statistics in percentages of each category. Meanwhile, the closed questions' answers were immediately analyzed by employing descriptive statistics to discover the percentages of each response category.

3. Results and Discussion

Physical activity restrictions at schools during the pandemic have forced the transformation of face-to-face learning into online learning. Teachers and students in all Indonesian areas categorized as a red zone, including the Special Region of Yogyakarta, have conducted online learning. The survey on 25 SMA/MA biology teachers in the Special Region of Yogyakarta shows that all teachers conduct online learning during the pandemic show in Picture 1.
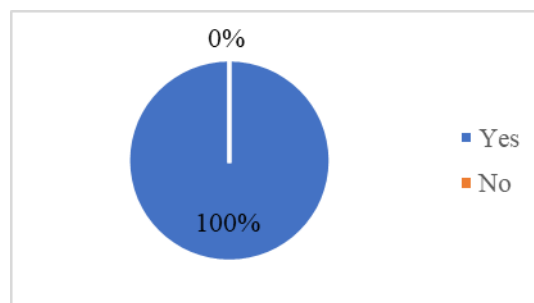

Picture 1. Teachers' responses to learning activities conducted during the Covid-19 pandemic

Online learning is the right solution because the main purpose is conducting the learning process without any direct-physical meeting by the assistance of the internet to deliver messages or interact between teachers and students. This statement agrees with Mustakim (2020), who asserted that online learning brought several consequences because students can easily access materials anytime and everywhere; they could also access learning sources worldwide. High school biology teachers have taken the right step by transforming face-to-face learning into online learning. Sanjaya (2020) deployed that online learning was one of the strategies to embody students' rights to knowledge during the pandemic.

Furthermore, the observation data reveal that the teachers conduct virtual synchronous activities, self-directed asynchronous learning, and collaborative asynchronous learning (Picture 2 and Picture 3). The pandemic disables teachers and students to conduct a face-to-

face meeting at schools. Consequently, the teachers cannot implement live synchronous activities, but they can still implement virtual synchronous activities with the assistance of technology and the internet. Besides virtual synchronous activities, teachers can implement synchronous activities. The teachers can instruct individual or group learning activities on online platforms.
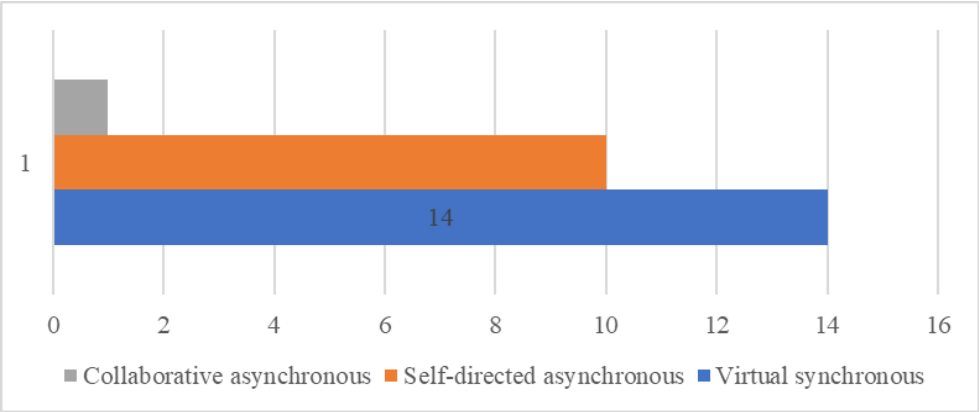
Picture 2. Teachers' quadrants of learning to set
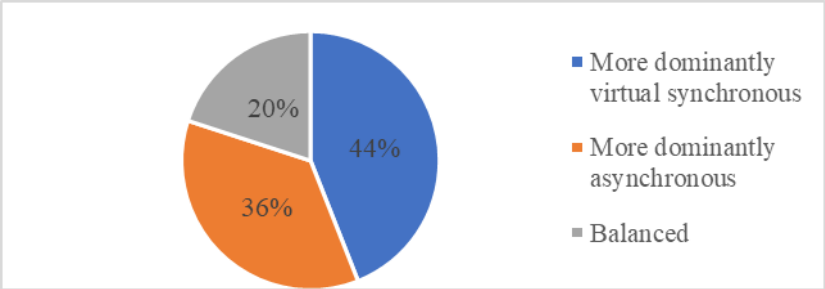
Picture 3. Dominated types of learning setting in learning

The research results reveal that 44% of teachers' learning process is more dominated by virtual synchronous activities than asynchronous activities (Picture 3). The teachers deployed that virtual synchronous activities were more dominant than asynchronous activities because of four benefits. They are 1) students receive information more quickly; 2) teachers give direct feedback to students easily, all students have similar perceptions of the learning materials; 3) miscommunication hardly occurs; 4) teachers and students more easily conduct virtual synchronous activities with the detail percentages are presented in Table 2.

Table 2. Advantages of Virtual Synchronous Activities in Online Learning

Advantages of virtual synchronous activities in online learning	Percentages (%)
Students receive information more quickly.	33.90
Teachers give direct feedback to students easily.	25.42
All students have similar perceptions of the learning materials.	20.34
Miscommunication hardly occurs.	13.56
Teachers and students more easily conduct virtual synchronous activities.	6.78

Virtual synchronous activities enable direct and spontaneous interaction between teachers and students, and thus interactive learning activities occur, and the learning process can reach students in different locations (Martin & Parker, 2014). The similar time supports the establishment of communication that assists teachers to give direct feedback to the students (Fadde & Vu, 2014; Moser & Smith, 2015); students can immediately inquire about the concepts that they do not understand (lack of comprehension); 3) students can immediately understand the teachers' information at class comprehensively; 4) students can uniform their perceptions because teachers can directly clarify any misconception. A study by (Yamagata, 2020) asserted that synchronous learning assisted the establishment of a good relationship among students. Good communication between teachers and students will improve the students' motivation to learn (Muamar, 2015). Teachers are demanded to provide a valuable synchronous learning environment, and thus they necessarily design activities that provide flexibility to the students (Yamagata, 2020). The flexibility means the designed activities must agree with the students or educational institutions' needs and conditions.
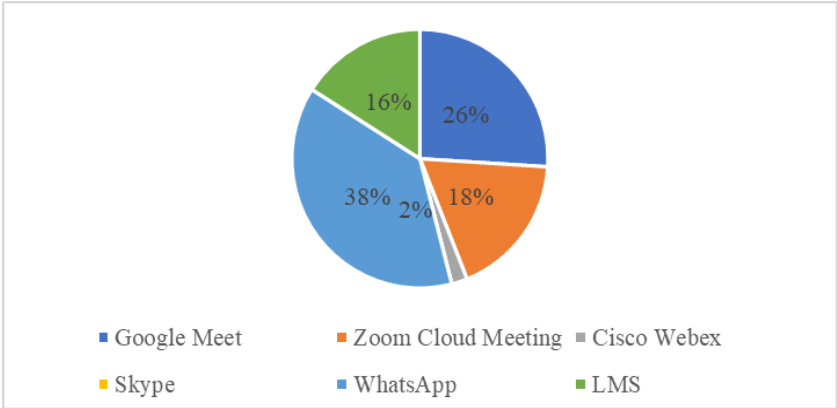
Virtual synchronous learning supports the implementation of various learning strategies, such as presentation, discussion, demonstration, and tutorial with communication technology, such as video-conference, audio-conference, and live chatting (text-based conference) (Chaeruman, 2013). These strategies have been implemented by high school biology teachers in the Special Region of Yogyakarta who conduct several virtual synchronous activities, such as live chat, video-call, and video-conference (Picture 4). Furthermore, they utilized various platforms to conduct virtual synchronous activities (Picture 5).
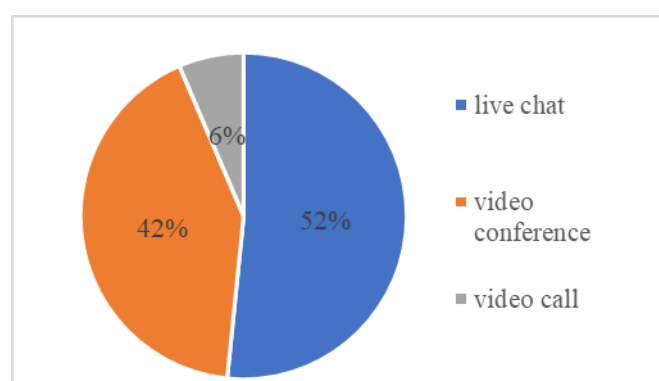
Picture 4. Types of virtual synchronous activities conducted by teachers

The results of this study (Picture 4.) reveal that the most dominant virtual synchronous communication type is chatting, the middle occurrence is a video conference, and the least occurrence is a video call. The most frequently used platform is WhatsApp and is successively followed by Google Meet, Zoom Cloud Meeting, Learning Management System

(LMS), and Cisco Webex. The teachers prefer WhatsApp because most of their activities are live-chat. Furthermore, WhatsApp highly supports intense live chat by creating WhatsApp groups. However, this application is one of the communication media and is not designed for online learning. Therefore, it has several disadvantages when used for online learning that makes the learning process less meaningful.


Picture 5. Teachers' platforms to conduct virtual synchronous activities

Asynchronous learning gives students opportunities to learn anywhere and anytime as they wish (Malik et al., 2017). The teachers must provide diverse teaching materials in audios, videos, animation, texts, and their combination. Meanwhile, collaborative asynchronous learning gives students opportunities anywhere and anytime through collaboration with other students. Examples of collaborative asynchronous activities are online discussion, problem-solving, and cooperative learning through online assignments. The teachers provide teaching materials for the collaborative asynchronous activities in tutorial videos or simulation, e-module, handout, textbooks, student worksheets, PowerPoints with or without audios, journals, and scientific papers (Picture 6). These teaching materials are delivered to the students by employing several platforms: WhatsApp, Google Classroom, email, and Learning Management System (LMS) (Picture 7).
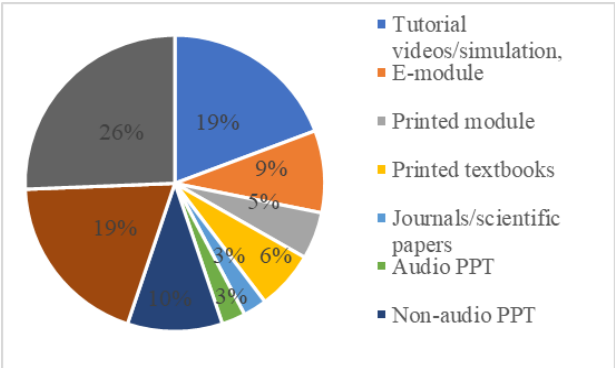
Picture 6. Learning materials in asynchronous activities

These teaching materials positively support the implementation of collaborative asynchronous and self-directed asynchronous activities. The teachers' most frequently used teaching material in the asynchronous activities is student worksheets (26%). Picture 7 shows that the teachers utilize online-based media to deliver the instructions of asynchronous activities, and the most frequently used media is WhatsApp. This application is communication media, and thus, it has several disadvantages when used for learning. However, since WhatsApp is the most affordable communication application for all students, the teachers primarily prefer this application to communicate and deliver instructions for asynchronous activities. This condition agrees with the principal concept of online learning by Anderson & McCormick (2005), who stated that online learning compulsorily utilized operatable and affordable communication tools for students.
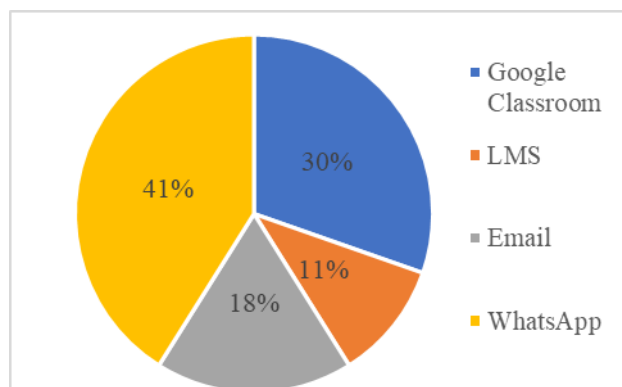

Picture 7. Media applied in asynchronous activities

The teachers deploy several benefits of learning with asynchronous activities: 1) flexible time and place of learning, 2) possibility to utilize multiple learning media, 3) ability to utilize many learning sources, and 4) opportunity to foster students' learning independence. These benefits agree with Vonderwell et al. (2007), who argued that asynchronous activities give students opportunities to learn independently without space or time constraints and enable them to learn based on each individual's capacities. Furthermore, learning with asynchronous activities allows students to process information better because they have more time to comprehend the messages (Hrastinski, 2008).

The research results reveal that learning activities possibly conducted during the Covid-19 pandemic are virtual synchronous and asynchronous activities. The teachers can only deliver the instructions in asynchronous activities through online communication media because they cannot deliver the classroom instructions through a face-to-face meeting. From this phenomenon, the general definition of blended learning as a combination of synchronous and

asynchronous activities is not comprehensive to describe the learning condition during the recent pandemic. The more comprehensive formula to combine virtual synchronous and asynchronous activities with online instructions is Blended Online Learning (Power, 2008) or Bichronous Online Learning (Martin et al., 2020); this term is frequently abbreviated as BOL. The scheme of combination between virtual synchronous and asynchronous activities in BOL is presented in Picture 8.
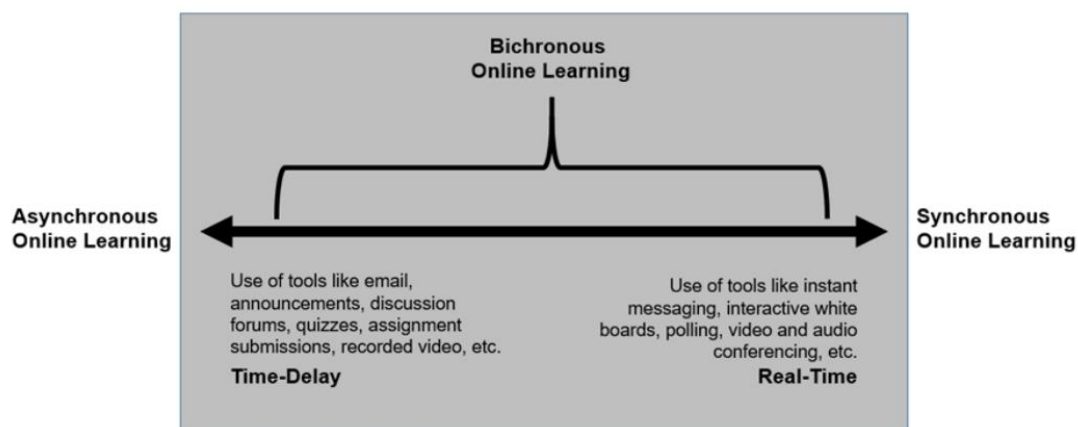
Picture 8. Scheme of a combination of synchronous online learning and asynchronous online learning (Martin et al., 2020)

The Blended Online Learning approach potentially improves students' learning engagement even though the learning is not conducted in a face-to-face meeting (Fadde & Vu, 2014). Virtual asynchronous activities encourage students to learn independently, while virtual synchronous activities facilitate students to inquire and teachers to answer the students' inquiries or problems (Murphy et al., 2011). Therefore, Blended Online Learning becomes an accurate solution for teachers to implement learning during the Covid-19 pandemic. In the implementation of online learning, teachers must provide obvious rules and procedures to create a conducive and meaningful learning process (Yamagata, 2020).

Covid-19 pandemic has 'forced' teachers to utilize technology for learning. Moreover, the pandemic condition revives educators to conduct contextual learning that is adaptable to the development of era, science, and technology. Technology is a means to maintain social cohesion during the Covid-19 pandemic though people are physically distanced (United Cities and Local Governments et al., 2020). Optimizing various strategies, technology-based media, and communication means in online learning will help students receive an optimal learning experience. Moreover, teachers' and students' willingness to improve their digital skills

following the world's digital technology influences successful-online learning development (Onyema, 2020).

This study points out that SMA/MA biology teachers in the Special Region of Yogyakarta apply the Blended Online Learning approach to conduct the class during the pandemic Covid-19. However, this study only described the combination of learning activities that the teachers apply to conduct a class during the pandemic. Therefore, further studies can explore the development of Blended Online Learning strategies and their implementation in learning, particularly in biology class.

4. Conclusion

High school biology teachers in the Special Region of Yogyakarta have transformed offline learning to online learning during the Covid-19 pandemic by combining virtual synchronous activities and asynchronous activities and delivering learning instructions through online media. The combination of online-based virtual synchronous activities and asynchronous activities is called blended online learning. The most frequently used media in synchronous or asynchronous activities is WhatsApp, a communication platform not designed for online learning. Virtual synchronous activities mostly dominate the teachers' learning process because these activities occur in real-time. As a result, positive communication between teachers and students can occur. Furthermore, balanced synchronous and asynchronous activities will help students gain optimal learning experience though they have several learning limitations.

References

Anderson, J., & McCormick, R. (2005). Ten pedagogic principals on e-learning, observatory for new technologies and education. In *It's Learning Springboar to Knowledge*.

Asosiasi Penyedia Jaringan Internet Indonesia (APJII). (2016). *Penetrasi & perilaku pengguna internet di Indonesia*. https://apjii.or.id/downfile/file/surveipenetrasiinternet2016.pdf

Bakia, M., Shear, L., Toyama, Y., & Lasseter, A. (2012). *Understanding the implications of online learning for educational productivity*. Office of Educational Technology, US Department of Education.

Chaeruman, U. A. (2013). Merancang model blended learning. *Jurnal Teknodik*, *17*(4), 53-63.

Chaeruman, U. A. (2017). P*EDATI, model desain sistem pembelajaran blended*. Direktorat Pembelajaran Kementerian Riset, Teknologi dan Pendidikan Tinggi.

Cholik, C. A. (2017). Pemanfaatan Teknologi Infpormasi dan Komunikasi untuk Meningkatkan Pendidikan di Indonesia. *Syntax Literate : Jurnal Ilmiah Indonesia*, *2*(6), 21–30.

De Giusti, A. (2020). Policy Brief: Education during COVID-19 and beyond. *Revista Iberoamericana de Tecnología en Educación y* Educación *en Tecnología*, (26), e12-e12.

Fadde, P. J., & Vu, P. (2014). Blended online learning: Benefits, challenges, and misconceptions. Online *Learning: Common Misconceptions, Benefits, and Challenges*, 33–47.

Fauzi, I., & Khusuma, I. H. S. (2020). Teachers' elementary school in online learning of COVID-19 pandemic conditions. *Jurnal Iqra' : Kajian Ilmu Pendidikan*, *5*(1), 58–70.

Giatman, M., Siswati, S., & Basri, I. Y. (2020). Online learning quality control in the pandemic Covid-19 era in Indonesia. *Journal of Nonformal Education*, *6*(2), 168–175.

Hrastinski, S. (2008). Asynchronous & Synchronous E-Learning. In *Educasue Querterly* (Issue 4, pp. 51–55). https://doi.org/10.1080/00071667608416307

Khan, B. (2005). *Managing e-learning strategies: Design, delivery, implementation and evaluation.* Idea Group Inc.

Khastini, R. O. (2020). Peningkatkan kemampuan berpikir kritis melalui scaffolding dalam pembelajaran biologi umum pada masa pandemi Covid-19. *Journal of Chemical Information and Modeling*, *3*(1), 20–27.

Malik, M., Fatima, G., Hussain Ch., A., & Sarwar, A. (2017). E-learning: Students' perspectives about asynchronous and synchronous resources at higher education level. *Bulletin of Education and Research*, *39*(2), 183–195.

Martha, Z. D., Adi, E. P., & Soepriyanto, Y. (2018). E-book berbasis Mobile learning. *Jurnal Kajian Teknologi Pendidikan*, *1*(2), 109–114.

Martin, F., & Parker, M. (2014). Use of synchronous virtual classrooms: Why, who, and how? *Journal of Online Learning and Teaching*, *10*(2), 192.

Martin, F., Polly, D., & Ritzhaupt, A. (2020). Bichronous online learning: Blending asynchronous and synchronous online learning. *EDUCAUSE Review*, *September* 1–11. Retrieved from https://er.educause.edu/articles/2020/9/bichronous-online-learning-blending-asynchronous-and-synchronous-online-learning

Moser, S., & Smith, P. (2015). Benefits of synchronous online courses. In *Association Supporting Computer Users in Education (ASCUE) Proceeding*. pp. 43-48.

Muamar. (2015). Peran komunikasi guru dengan siswa dalam mengembangkan motivasi belajar mata pelajaran aqidah akhlaq siswa kls VII MTs. Mabdaul Huda Karangaji Kecamatan Kedung Kabupaten Jepara Tahun Pelajaran 2014/2015. http://eprints.unisnu.ac.id/653/1/131310001360 Muamar %28Upload%29.pdf

Murphy, E., Rodríguez-Manzanares, M. A., & Barbour, M. (2011). Asynchronous and synchronous online teaching: Perspectives of Canadian high school distance education teachers. *British Journal of Educational Technology*, *42*(4), 583–591.

Mustakim. (2020). Efektivitas pembelajaran daring menggunakan media online selama pandemi Covid-19 pada mata pelajaran matematika the effectiveness of e-learning using online media during the Covid-19 pandemic in mathematics. *Al Asma: Journal of Islamic Education*, *2*(1), 1–12.

Nguyen, T. (2015). The effectiveness of online learning: beyond no significant difference and future horizons. *MERLOT Journal of Online Learning and Teaching*, *11*(2), 309–319.

Onyema, E. M. (2020). Impact of Coronavirus pandemic on education. *Journal of Education and Practice*, *11*(13), 108–121.

Pawicara, R., & Conilie, M. (2020). Analisis pembelajaran daring terhadap kejenuhan belajar mahasiswa Tadris Biologi IAIN Jember di tengah pandemi Covid-19. *ALVEOLI: Jurnal Pendidikan Biologi*, *1*(1), 29–38.

Perangin, A., & Ekawalta, E. S. (2020). *Upaya meningkatkan atensi siswa kelas VI SD dalam proses pembelajaran daring melalui media visual*. Universitas Pelita Harapan. http://repository.uph.edu/11968/

Perveen, A. (2016). Synchronous and asynchronous e-language learning: A case study of virtual University of Pakistan. *Open Praxis*, *8*(1), 21–39.

Power, M. (2008). The emergence of a blended online learning environment. *Journal of Online Learning and Teaching*, *4*(4), 503–514.

Raharjo, E. Y. (2020). *Efektifitas Pembelajaran daring tipe numbered heads together terhadap hasil belajar*. Universitas Muhammadiyah Malang. Retrieved from http://eprints.umm.ac.id/69318/

Reimers, F., Schleicher, A., Saavedra, J., & Tuominen, S. (2020). Supporting the continuation of teaching and learning during the COVID-19 pandemic. Annotated resources for online learning. *OECD*, 1–38.

Sirate, S. F., & Yaumi, M. (2017). Perspektif belajar sebagai landasan psikologis dalam pengembangan media dan teknologi pembelajaran. *Lentera Pendidikan : Jurnal Ilmu Tarbiyah dan Keguruan*, *20*(1), 98–111.

Sanjaya, F. R. (2020). *21 refleksi pembelajaran daring di masa darurat* (F. R. Sanjaya (ed.)). Universitas Katolik Soegijapranata. Retrieved from http://repository.unika.ac.id/22884/1/April 13-2020_21

Sari, S. A. S. W. (2020). *Efektivitas pembelajaran e-learning mahasiswa Prodi Pendidikan Biologi FKIP Universitas Muhammadiyah Surakarta pada Praktikum mikrobiologi selama pandemi Covid19 tahun akademik 2019/2020*. http://eprints.ums.ac.id/86538/16/2. Naskah publikasi.pdf

Satgas Covid-19. (2020). *Peta Zona Resiko Covid-19*. https://covid19.go.id/peta-risiko

Schleicher, A. (2020). T*he impact of covid-19 on education insights from education at a glance 2020*. OECD. Retrieved from https://www.oecd.org/education/the-impact-of-covid-19-on-education-insights-education-at-a-glance-2020.pdf.

Simaremare, R. (2009). Teknologi informasi dan dunia pendidikan. *Jurnal Bahas*, *18*(02). http://jurnal.unimed.ac.id/2012/index.php/bahas/article/view/2497

Susantono, B., Sawada, Y., & Park, C. Y. (2020). *Navigating COVID-19 in Asia and the Pacific*. Asian Development Bank. Retrieved from http://hdl.handle.net/11540/12484

Syah, R. H. (2020). Dampak Covid-19 pada pendidikan di Indonesia: Sekolah, keterampilan, dan proses pembelajaran. *SALAM: Jurnal Sosial Dan Budaya Syar-I*, *7*(5), 395-402.

United Cities and Local Governments, Metropolis, & UN-Habitat. (2020). Digital technologies and COVID-19 pandemic. *Beyond The Outbreak Live Learning Experience (LLE) Virtual*, *15*(04).

Vonderwell, S., Liang, X., & Alderman, K. (2007). Asynchronous discussions and assessment in online learning. *Journal of Research on Technology in Education*, *39*(3), 309-328.

Wahyono, P., Husamah, H., & Budi, A. S. (2020). Guru profesional di masa pandemi COVID-19: Review implementasi, tantangan, dan solusi pembelajaran daring. *Jurnal Pendidikan Profesi Guru*, *1*(1), 51–65.

Wayne, D. B., Green, M., & Neilson, E. G. (2020). Medical education in the time of COVID-19. *Science Advances*, *6*(31), 1-3.

Yamagata, L. C. (2020). Blending online asynchronous and synchronous learning. *The International Review of Research in Open and Distributed Learning*, *15*(2), 189–212.