

## High School Biology Learning Media During the Covid-19 Pandemic in Indonesia: Systematic Literature Review

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### ABSTRACT

The covid-19 pandemic has led to a change in learning from face-to-face to online learning; learning media has an essential role in the online learning process in understanding students to the material studied. This research aims to determine the types and characteristics of high school biological learning media during the covid-19 pandemic. This study is a Systematic Literature Review using Google Scholar and Dimensions databases. Articles that meet the inclusion and exclusion criteria as research data several 29 scientific articles, including international journals, accredited national journals, and not accredited national journals, thesis, and proceedings. The results of this study indicate that there are various types of high school biology learning media during the COVID-19 pandemic, namely visual-based learning media, audio-visual-based learning media, and computer-based learning media. Most often used during the covid-19 pandemic were hypertext media (such as google classroom) and how to use high school biology learning media during the covid-19 pandemic, which were found to be online/offline and installed/not installed. The material biology learning most widely researched is virus and the scope of biology. This study implication shows various learning media biology in senior high school during pandemic covid-19, so other researchers can develop or use other learning media on teaching and learning biology in senior high school.

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**Keywords:** Covid-19, Learning media, PICOC

## Introduction

The COVID-19 pandemic has caused changes in all aspects of life, one of which is education. [Setyaningrum et al. \(2021\)](#) revealed that the COVID-19 pandemic currently being faced has also changed the world of education, starting from the curriculum, learning process, assessment system, and supporting infrastructure to the education budget. Learning is carried out online with a remote system between teachers and students. [Kania et al. \(2021\)](#) revealed that establishing a physical distancing policy was the basis for the implementation of Teaching from Home (learning from home). This policy is to minimize the spread of COVID-19, as instructed in circular letter No 4 of 2020 regarding the implementation of education policies in the emergency period of the spread of Coronavirus Disease (Covid-19) teaching and learning processes are carried out from home.

Students experience various problems in the distance learning process, including boredom due to monotonous learning, and cannot interacting directly with friends and teachers, which has an impact on decreasing concentration ([Pawicara & Conilie, 2020](#)). In addition, [Anjarwati et al. \(2021\)](#) said that distance learning biology material is difficult to do independently because there is no group discussion, no practicum, and the facilities are not supportive. Students' problems in distance learning during the pandemic remain the teacher's responsibility. Teachers are required to be able to adapt to distance learning. The creativity and innovation of teachers in creating learning in the classroom are expected to be able to optimally develop all student potential and improve learning outcomes ([Kurniati et al., 2021](#)).

Biology teachers, especially at the high school (SMA) level, need to package learning so that it is attractive to students. Students consider biology learning boring because the material contains memorization, many terms, and concepts that must be mastered ([Kharom et al., 2020](#)). In addition, Biology material is very complex by studying things related to all aspects of life, the ins and outs of living things, such as animals, humans, and plants ([Santosa & Marina, 2020](#)). This complex material in the learning process requires learning media to help students understand. [Aina et al. \(2021\)](#) stated that teachers must provide good teaching, create a conducive atmosphere for learning, and creatively and innovatively use interesting learning media so that students can understand the learning materials and the learning objectives. According to [Basri et al. \(2013\)](#), learning media plays a role in channeling messages during the learning process to stimulate students' thoughts, feelings, concerns, and interests to achieve the expected goals. Learning media has a vital role in helping high school biology teachers to create an online learning system that is attractive, motivating, and conveys biology material well so that students easily understand it. Learning media is needed to help students understand essential concepts in biology lessons and affect the quality of student learning ([Kharom et al., 2020](#)).

The fact is that high school biology teachers still experience many difficulties in applying appropriate learning media in the learning process so that students are not motivated and learning materials are not appropriately conveyed to students. [Kania et al. \(2021\)](#) say that teachers have a limited ability to take advantage of learning applications. Nevertheless, multifarious biology learning media innovations have been widely developed and used to overcome learning during the pandemic, as shown through scientific publications. Various types of biology learning media used during the covid pandemic can be identified through a systematic literature review. In addition, through a systematic literature review, the characteristics of biology learning media that have been used at the high school level in Indonesia during the covid 19 pandemic can be seen.

## Methods

The Systematic Literature Review (SLR) uses three stages: planning, implementing, and reporting a literature review by the Research question prepared with the help of PICOC criteria (Population, Intervention, Comparison, Outcomes, and Context) (Kitchenham et al., 2007). The PICOC framework is appropriate to determine the scope of research (de Barcelos Silva et al., 2020; Siksnylyte-Butkiene et al., 2021), and to ensure the research process is transparent, repeatability, systematic nature of the literature review and minimizes subjectivity (Siksnylyte-Butkiene et al., 2021). The implementation of PICOC in this study is as presented in Figure 1.

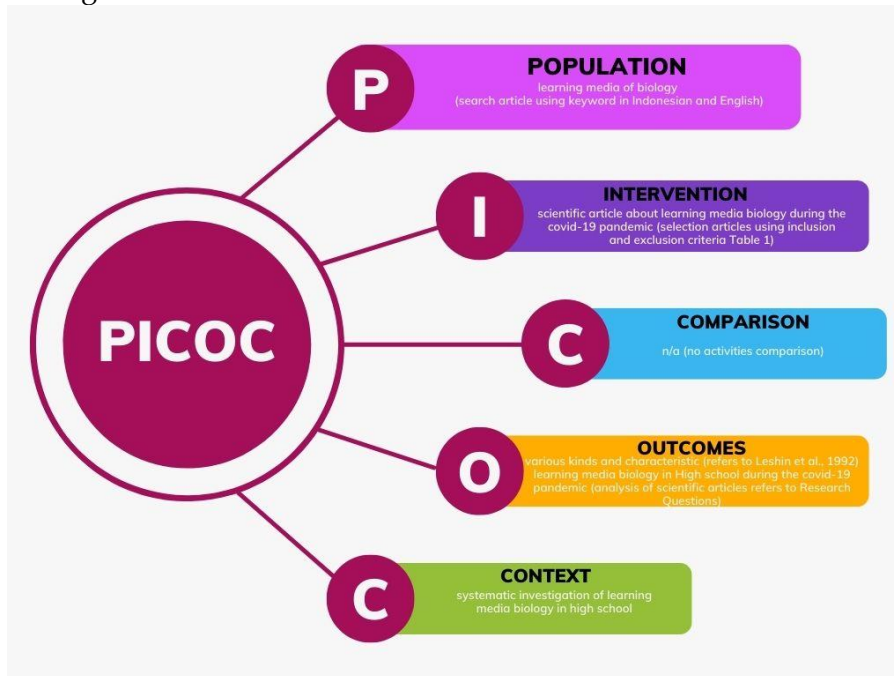


Figure 1. The PICOC framework realization

Scientific article search using keywords in Indonesian and English, namely (learning media; interactive; biology; high school; Madrasah Aliyah; MA; pandemic period; covid-19; online; distance learning). The database used is Google Scholar and Dimensions, filtering articles using inclusion and exclusion criteria (Table 1). Analysis refers to Research Questions are 1) Which scientific articles discuss high school biology learning media during the covid-19 pandemic, 2) What high school biology learning media are most often used during the covid-19 pandemic, 3) What are the characteristics of high school biology learning media obtained during the covid-19 pandemic.

Table 1. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
1. Scientific articles related to the biology learning media during the covid-19 pandemic	1. Close access
2. Learning media is used at the high school or Madrasah Aliyah (MA) levels	2. Scientific articles that do not discuss biology learning media
3. The limit year to scientific articles used is from 2020 to 2021, in the form of	3. Scientific articles that discuss the level of Higher Education / Vocational High School / Junior High

Inclusion criteria	Exclusion criteria
national/international journals/proceedings/thesis	School / Elementary School / Kindergarten).
4. Article in Indonesian and English	
5. Research conducted in Indonesia	

## Results and Discussion

The search results in "Google Scholar" and "Dimensions" using the filter year 2020-2021 obtained 74 articles. Based on the search results, filtered with inclusion and exclusion criteria (Table 1), the result obtained 29 articles with groupings such as Table 2. Articles that do not meet the criteria are a lot because the research on the article was carried out before the covid-19 pandemic, and the level of education is not at high school or Madrasah Aliyah (SMA/MA).

Table 2. Article demographics from the filtering process

Kind of scientific article	Source	Total
International journal	(Ristanto et al., 2021)	1
Accredited national journal	(Aripin & Suryaningsih, 2020; Budiayasa, 2021; Darmawan & Nawawi, 2020; Haka, Majid, et al., 2021; Haka, Suryaasih, et al., 2021; Hariyadi, 2021; Irwandi & Lusilawat, 2021; Nurbaetina & Roviati, 2021; Putri & Ardi, 2021; Ramadan et al., 2021; Saraswati et al., 2021; Sriwiyati, 2021; Talakua & Elly, 2020; Utami et al., 2020; Wicaksana et al., 2020; Zulfarina et al., 2021)	16
National journal (Not accredited)	(Kania et al., 2021; Liunsanda et al., 2021; Mahendra, 2021; Pawicara & Conilie, 2020; Prihatiningtyas et al., 2021; Riska et al., 2021)	6
Thesis	(Dewi, 2021; Nurdayanti et al., 2021; Pamungkas, 2021; Syahpitri, 2021; Tandirerung, 2021)	5
Proceeding	(Raneza et al., 2021)	1
Total		29

The scientific articles in Table 2 were reviewed and obtained two results: 1) types of high school biology learning media during the covid-19 pandemic, 2) characteristics of high school biology learning media during the covid-19 pandemic. The types of high school biology learning media during the covid-19 pandemic are available in Table 3.

Table 3. The variety of learning media

Criteria (Leshin et al., 1992)	Varian of learning media	Count
Visual-based	VLab-Bio (Aripin & Suryaningsih, 2020), game-education (Dewi, 2021), digital comic (Raneza et al., 2021)	3
Audio visual-based	Macromedia Flash (Darmawan & Nawawi, 2020), Video and Powerpoint (Utami et al., 2020), Adobe Flash (Putri &	14

Criteria (Leshin et al., 1992)	Varian of learning media	Count
Computer-based	Ardi, 2021), E-Modul (Haka, Majid, et al., 2021; Prihatiningtyas et al., 2021), Kahoot base <i>Digital Game Based Learning</i> (Nurbaetina & Roviati, 2021), <i>android application</i> (Pamungkas, 2021; Syahpitri, 2021), Interactive Multimedia Apps (Haka, Suryaasih, et al., 2021), Movie Learning (Riska et al., 2021), E-Magazine base Augmented Reality (Zulfarina et al., 2021), Interactive Learning Videos (Mahendra, 2021), <i>WhatsApp</i> (Irwandi & Lusilawat, 2021), <i>Digital Flipbook Immunopedia</i> (DFI) (Ristanto et al., 2021). Instagram (Veygid et al., 2020), <i>Mobile Learning</i> (Saraswati et al., 2021; Talakua & Elly, 2020), Google Classroom (Budiyasa, 2021; Hariyadi, 2021; Kania et al., 2021; Liunsanda et al., 2021; Sriwiyati, 2021), and Edmodo (Ramadan et al., 2021; Tandirerung, 2021; Wicaksana et al., 2020), <i>Portable Moodle</i> (Nurdayanti et al., 2021).	12
Total		29

The types of high school biology learning media during the covid-19 pandemic obtained from scientific articles there are three types of learning media, namely visual-based, audio visual-based, and computer-based (Leshin et al., 1992). Audio visual-based learning media and computer-based are the types of learning media that are most widely used in biology learning during the pandemic. Umam (2013) said that digital media could present learning material in contextual, audio, and visual ways interestingly and interactively. This means that digital media, especially two dimensions, can present biology subject matter interestingly and interactively so that students are more interested and not bored in learning online.

Learning media-based e-learning can also facilitate teachers and students in online learning. This is because e-learning has advantages; as Saputra (2020), the advantages of e-learning are flexibility in terms of time and facilities. The learning atmosphere does not have psychological barriers. It makes it easier for teachers to rejuvenate the material and get used to using ICT for teachers. A review shows that e-learning-based learning media, namely Google Classroom, had the highest number of 1.5% of all high school biology learning media used during the covid-19 pandemic.

The types of high school/MA biology learning media during the covid-19 pandemic contained in scientific articles, a review was carried out to determine the characteristics of the learning media obtained. The characteristics of high school/MA biology learning media during the COVID-19 pandemic and the study results are available in Figure 2.

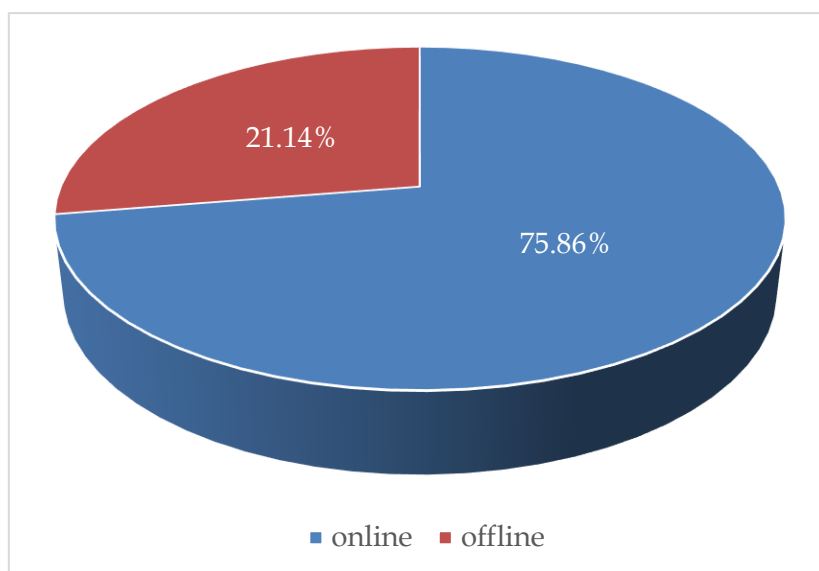


Figure 2. Learning media based on access

The characteristics of high school biology learning media obtained during the covid-19 pandemic (Figure 2 and 3) can be distinguished from how they are used online/offline and installed or not installed. Online learning media means that using these media requires an internet network (such as Edmodo, google classroom, VLab-Bio), while offline media means that using these media does not require an internet network (such as video adobe flash, e-modul android). Based on Figure 2, it can be seen that the learning media used in high school biology learning during the COVID-19 pandemic used more online learning media than offline. Meanwhile, based on Figure 3, the media used more does not require an install process on the device (such as adobe flash, video, power point etc).

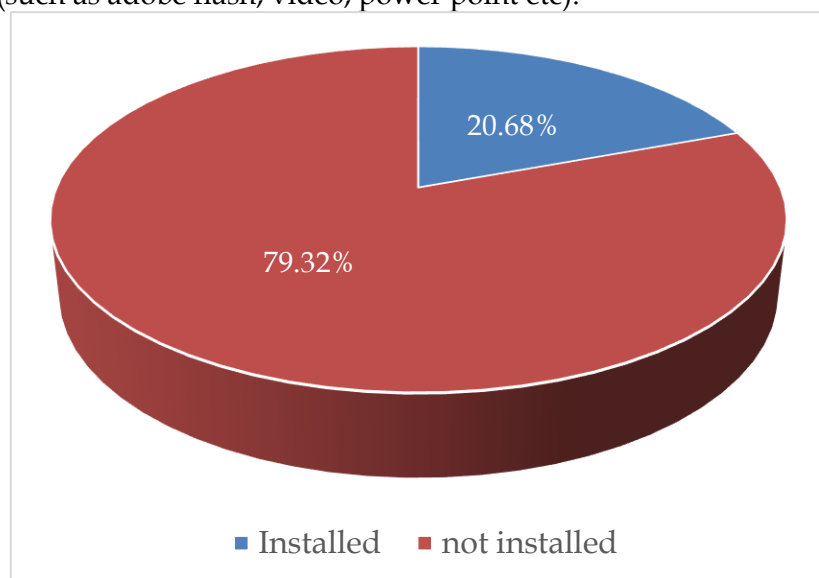


Figure 3. learning media based on the need to install on the device

Online learning media that require a dominant internet network are in the form of a web so that their use does not need to be installed. Fauziah (2015) said that Web-based learning is a learning activity using media sites (websites) that can be accessed via the internet. Web-based learning is an application of electronic learning (E-learning) (Fauziah, 2015). One type of e-learning is Google Classroom. Google Classroom is an online learning media that requires a web-based internet network to support the distance learning process during the COVID-19

pandemic. Google Classroom enables learning and teaching activities to be more productive and meaningful by simplifying tasks, increasing collaboration, and fostering communication (Atikah et al., 2021). Teachers can create classes, give assignments, provide input and see everything in one place (Atikah et al., 2021). This means that using Google Classroom makes the online or distance learning process more effective; that is why Google Classroom has become a high school biology learning medium during the COVID-19 pandemic.

Online learning using the web-based internet can make it easier for students to learn because it is flexible and can be accessed anytime and anywhere. Fauziah (2015) said that the internet minimizes limitations (distance, space, and time) in delivering information worldwide. This means that by using the internet, students can access information about biology learning widely without any limitations. The characteristics of biology learning media cannot be separated from the subject matter used in its application. Biology subject matter used in learning media (Table 3) is available in Table 4.

Table 4. The result analysis of Biology material

Class	Biology material	Count
Class X	Virus (Darmawan & Nawawi, 2020; Prihatiningtyas et al., 2021; Riska et al., 2021)	3
	Biodiversity (Utami et al., 2020; Wicaksana et al., 2020)	2
	Kingdom Animalia and ecology (Kania et al., 2021)	1
	Protists (Hariyadi, 2021; Putri & Ardi, 2021)	2
	Bacteria (Aripin & Suryaningsih, 2020)	1
	The scope of biology (Mahendra, 2021; Nurbaetina & Roviati, 2021; Raneza et al., 2021)	3
Class XI	The Immune system (Ristanto et al., 2021)	1
	Cells (Budiyasa, 2021)	1
	Organ systems (Sriwiyati, 2021)	1
	Human circulatory system (Haka, Suryaasih, et al., 2021)	1
	Human digestive system (Tandirerung, 2021; Zulfarina et al., 2021)	2
	Human respiratory system (Irwandi & Lusilawat, 2021; Nurdayanti et al., 2021)	2
Class XII	Human reproductive system (Saraswati et al., 2021)	1
	Gene substance (Liunsanda et al., 2021)	1
	Biotechnology (Haka, Majid, et al., 2021)	1
Undefined	Metabolism (Dewi, 2021; Pamungkas, 2021)	2
	Undefined (Pawicara & Conilie, 2020; Ramadan et al., 2021; Syahpitri, 2021; Talakua & Elly, 2020)	4
Total		29

Learning media is undoubtedly related to the subject matter. The biology subject matter used in the application of high school biology learning media during the Covid-19 pandemic can be seen in Table 4. The subject matter includes classes X, XI, and XII. As seen in Table 4, the most dominant biology subject matter in applying high school biology learning media during the pandemic was classes XI and X, with a total of 9 and 6. Then an analysis was carried out on each biology sub material for class XI and X using Core Competencies (KI) and Basic Competencies (KD) SMA 2013 curriculum. The results showed that the Virus material and the Class X Biology Scope were the most widely used biology subject material in the application of high school biology learning media during the covid-19 pandemic.

Based on the data (Table 4), the biology subject matter used in applying high school biology learning media during the COVID-19 pandemic tends to be abstract biology material. Abstract means that it is difficult to show in real terms, so it requires media assistance in its application. Viruses are abstract materials. Cahyoratri (2018) said that viruses could only be observed using an electron microscope, which is very expensive.

Media presence in science learning, especially biology, has a crucial role (Wahyuni et al., 2013). Biological material that is difficult to show in a natural, abstract, microscopic size and difficult to convey in words will be easy to convey and interesting for students (Wahyuni et al., 2013). Therefore, abstract biology materials are often used in applying senior high school biology learning media during the pandemic in scientific articles used in this study. The limitations of this systematic literature review are collecting data from google scholar and dimensions; furthermore, the researcher cannot access products in each article.

## Conclusion

The innovation of senior high school/MA biology learning media in Indonesia during the COVID-19 pandemic has characteristics that can support the distance learning process well. The learning media is primarily audio-visual-based; learning media dominant access required internet but is not required installed on smartphones or PC; besides this, learning media innovations are rarely visible in class XII.

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