



## Variations in Implementation of Biology Online Teaching and Learning in Covid-19 Pandemic: A Case Study at Senior High Schools in Palembang, South Sumatra

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**Abstract.** In Palembang, almost all the school have been implemented virtual learning, but not every school has complete facilities to support it. In fact, the completeness of facilities such as smartphones, laptops, a stable internet network, and skills in using various digital platforms greatly affect the independence and learning achievement of students. This study aims at discovering the profile of virtual Biology teaching and learning implementation in senior high schools throughout Palembang. This descriptive study was conducted from February to March 2021 with a random sampling technique. The number of 343 student samples was determined using the Slovin formula with an error tolerance of 5%. The samples were five schools in Palembang city, South Sumatera District with varying (A, B, and C) school accreditation levels. Data were collected in two ways, (1) a google form with 45 questions and (2) a six-question interview with Biology teachers from each school. The resulted data were analyzed descriptively. The descriptive analysis of the students' responses was done by summarizing and presenting them in diagrams. The results showed that in A, B and C accredited high schools, students have similarities in the use of smartphones and laptops in online learning. The most used applications in online learning were WhatsApp and Zoom Meeting. The results of the questionnaire showed that students at all accredited high schools were not accompanied by their parents since they were independent enough. They, furthermore, experienced obstacles such as difficulty understanding the material, lack of concentration, boredom, and unstable internet network

**Keywords :** Online Learning, South Sumatera, Biology

### Introduction

Indonesia is experiencing a change in learning patterns since March 2020 due to the impact of the Covid-19 pandemic. This has caused the government to issue a new policy limiting social interaction in general including in the education process. This restriction policy causes all learning activities to be carried out online. The online learning policy certainly offers several advantages some of which are practicality and flexibility. Learning can be carried out without local and temporal limitations that it saves more time and can be done at any given time. It also can help students develop digital skills and digital literacy/competence (Greenhow & Gleason, 2012) and can also improve the

quality of learning and student learning outcomes (Stainbank & Gurr, 2016). Furthermore, it is also stated that the use of social media can increase students' learning achievement (Suryaningsih, 2019).

On the other hand, several studies show some of its drawbacks. One study reported that students performing multiple tasks have worse academics than students who do assignments while attending direct learning activities (Bellur et al., 2015; McCoy, 2016; Ravizza et al., 2014). Modern technology has provided many tools to facilitate the dissemination of knowledge (Kochan, 2021). In other studies, the weakness was worsened by the obligation of students to provide adequate facilities such as gadgets, laptops, a good internet connection, as well as their own ability to take advantage of these facilities. In fact, the completeness of these facilities affects the independence and learning achievement of students (Handarini & Wulandari, 2020; Anggrawan, 2019)).

Online learning can take place using several social media platforms such as Google Classroom, Google Drive, Google forms, WhatsApp Group, YouTube, Instagram, and Zoom Meeting (Mulyono et al., 2021). The platforms are preferred because they are considered easy, practical and economical. The platforms have also included discussions, quizzes, individual assignments, lectures, learning videos, and group assignments. Despite its weaknesses and limitation, online learning is still carried out. Online learning has both positive and negative impacts on education in Indonesia. The negative includes lack of effectiveness and time efficiency, student interest, and understanding of the material (Wardany et al., 2021). Research conducted by (Adi et al., 2021; Febrianto et al., 2020 and Hermawan, 2021) also revealed that the negative impacts of distance learning were sometimes problematic signals, comprehension of material and limited facilities for temporary learning. The positive impact of distance learning from the students' side is that learning is more practical and relaxed.

There was a lot of research on how the implementation of biology learning during covid was, such as the impact of using the LMS learning platform on covid-19 (Hasan 2022), the implementation of biology learning at universities (Sadikin & Hamidah, 2020; Pratiwi & Harahap, 2022; Niyonsaba & Paidi, 2021; Humphrey & Willes, 2021), but they are more concerned with the perceptions and conditions of students when participating in online biology lessons. Even though the description of the diversity of online biology learning with different school backgrounds can be input for other researchers and policymakers about the gap conditions in these different schools which can ultimately improve the learning loss that occurred due to the COVID-19 pandemic in Indonesia as research conducted by Owusu-Fordjour et al., (2020) in Ghana & Brown et al., (2020) in Australia, the detailed conditions of the diversity of platforms used in each biological material, the condition of the facilities available, and the support of parents at schools with different accreditations have not yet been researched, especially in Palembang, South Sumatra.

By considering the advantages and disadvantages of online learning occurring at certain places, it is possible for the same pattern to occur in other places. This is also possible to apply in several schools and subjects in Palembang. However, several studies at certain levels and schools have not been carried out widely enough, let alone focusing on certain subjects such as Biology. The importance of conducting this study in the city of Palembang at the high school level is due to its diverse character, namely accreditation, implementation of the 2013 Curriculum (K-13) and Cambridge Curriculum, as well as their status either public and private schools. So, it is necessary to investigate the profile of the implementation of online learning in senior high schools in Palembang.

Based on this, this study focused on A, B, and C accredited senior high schools in the city of Palembang, South Sumatera Indonesia with the consideration that teachers and students are in the possession of gadgets, laptops, internet, and the ability to utilize information technology properly. This research was conducted to discover the profile of

the implementation of online learning measured with the facilities used, the choice of applications used, parental support, and obstacles in online learning.

## Methods

It is descriptive research carried out from February to March 2021. The population was all senior high schools in South Sumatera. With simple random sampling, a method with no consideration for the existing strata in the population (Sugiyono, 2019). The samples school with varying (A, B, and C) accreditation levels were chosen. The student samples from each school were taken using the proportional random sampling technique. Proportional Random Sampling is taking samples from members of the population evenly to each school so that all respondents have the same opportunity to be the research sample. To determine the sample of students, the Slovin formula with an error tolerance of 5% was used so that a sample of 343 students was obtained (Sugiyono, 2019). Data collection was carried out by giving questions in the form of online learning questionnaires for students via google with 45 items and by teachers interviews with 6 questions. The google form link was given to the teachers and then they distributed it to students. The interviews were conducted directly with biology teachers in each school. The resulted data were analyzed descriptively. The descriptive analysis of the students' responses was done by summarizing and presenting them in diagrams. The data analysis results were displayed in graphs for development in the discussion. Furthermore, the results of the interviews were used to strengthen the results of the student questionnaires.

Table 1. Student Questionnaire Specification

| Indicator        | Scope of Questions   | Number of Questions |
|------------------|--|---------------------|
| Facilities       | The facilities used during online teaching and learning.                                 | 1                   |
|                  | Availability and condition of the facilities   | 7                   |
| Applications     | How to carry out the online learning process on certain teaching and learning materials. | 16                  |
|                  | How to interact with teachers in online learning on certain materials.                   |                     |
|                  | Applications used during online learning on certain materials.                           | 16                  |
| Parental Support | Personals who assist in the online learning process.                                     | 1                   |
|                  | The reason for not accompanying.   | 1                   |
|                  | Type of mentoring activity.  | 1                   |
|                  | The support provided by the school during learning from home.                            | 1                   |

| Indicator                   | Scope of Questions                                       | Number of Questions |
|-----------------------------|--|---------------------|
| Barriers to Online Learning | Barriers experienced during the online learning process. | 1                   |

Table 2. Interview with Teachers Specifications

| Indicators                  | Questions   |
|-----------------------------|---|
| Facilities                  | What hardware tools are used in carrying out online learning.     |
| Applications                | How to carry out the online learning process.                     |
| Parental support            | Parental support in the implementation of online learning.        |
| Barriers to Online Learning | Weaknesses in online learning.                                    |
|                             | Barriers encountered during online learning.                      |
|                             | Solutions to overcome weaknesses and barriers in online learning. |

## Results and Discussions

### Tools for Online Learning

The results of students' answers about the facilities used in high school online learning in Palembang District were converted into percentage. Furthermore, the conversion results were presented in a "radar" graphic form. The graph is shown in Figure 1.

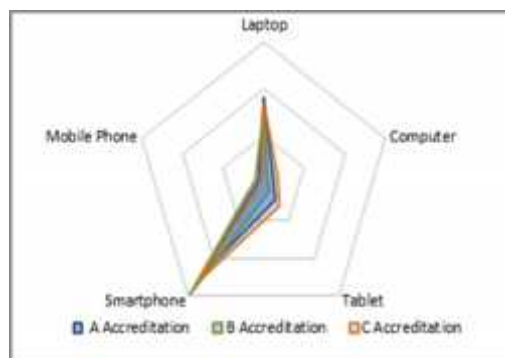


Figure 1. Percentage of Online Learning Facilities

Based on Figure 1, the facilities used by high school students in Ilir Barat I District are in the same, i.e., smartphones and laptops. The uses of smartphones and laptops at

A-accredited senior high schools were 47.44% and 36.3% respectively. Furthermore, the use of them for B-accredited senior high schools were 58.9% and laptops by 30.66% and for B-accredited senior high schools were 52.38% and laptops by 33.83% respectively.

Based on Figure 1, the study verifies that the facilities most frequently used by students in A, B, and C accredited high schools in online learning are identical, i.e., laptops and smartphones. The similarity is due to several factors: 1) Parents' economic factors; 2) students' nature in using laptops and smartphones in everyday life; 3) students' convenience in using these laptops and smartphones. This is because students, as millennials, are easily exposed to sophisticated technological developments and also technology is needed and even becomes a requirement in education (McBrien et al., 2009). The results from the interview showed that parents were able to provide good facilities for their children to support online learning. Besides that, currently digital devices such as smartphones are relatively inexpensive. Although some students do not have the two digital devices, only one digital device such as a smartphone is required to participate in online learning. As it is similarly expressed that most students have smartphones (Park, 2011). Digital devices such as smartphones, laptops, computers and other devices that function to access information globally and universally are needed in online learning (Gikas & Grant, 2013). The use of laptops and smartphones in carrying out online learning can improve student learning outcomes (Park, 2011). Laptops and smartphones have the ability to access the internet, allowing students to take part in learning activities carried out in the form of video conferences or through online classes using certain applications (Gikas & Grant, 2013). Facilities in the form of smartphones provided by parents of students greatly support the implementation of online learning. Based on the research results, differences in accreditation do not cause differences in the means used to carry out online learning. The quality of online learning facilities in schools accredited A, B and C can be categorized as similar because the facilities owned by students and teachers were fairly good.

Based on the data, it was also found that almost all students (90.9%) access the internet using mobile phones, and only a small proportion use laptops when learning online, this is related to the availability of internet networks that are easily accessed by mobile phones compared to laptops or computers. The same thing was found in studies in other countries such as in Yemen (Tuparova et al., 2018) and in Turkey (Dolgunsöz & Yildirim, 2021). These were because not all places have public internet networks that students can access (Hamid et al., 2020), and another thing is that mobile phones have become an inseparable part of everyday life taken anywhere and they are very sophisticated and fast better than laptops and they are easier to carry anywhere while studying (Sharples et al., 2005; Pew Research Center, 2017)

### Applications in Online Learning

The results of the conversion in the form of percentages for application indicators used in online learning in class X material are displayed in Figures 2, 3, 4, 5, and 6.

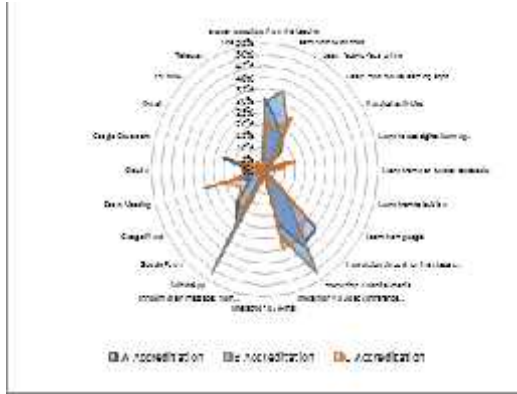


Figure 2. Percentage of Applications of Scope of Biology Materials

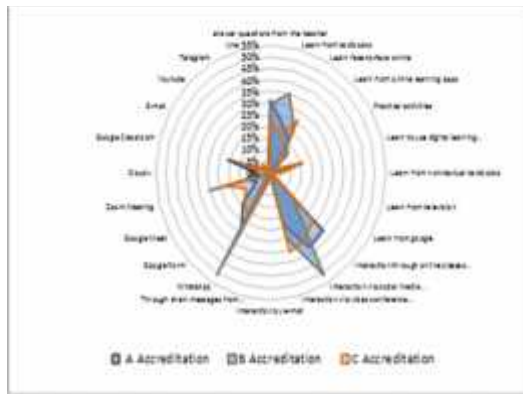


Figure 3. Percentage of Biodiversity Level Material Applications in Indonesia

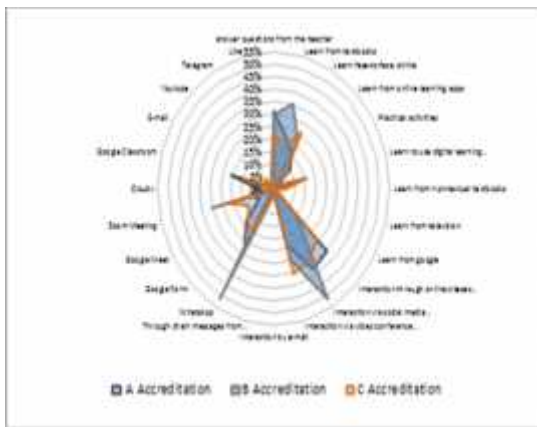


Figure 4. Percentage of Virus Material Applications

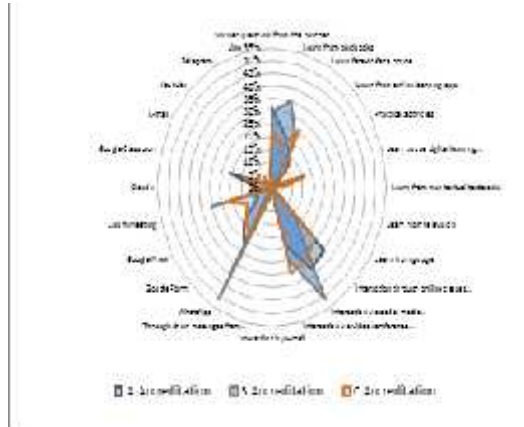


Figure 5. Percentage of Archaeobacteria and Eubacteria Material Applications

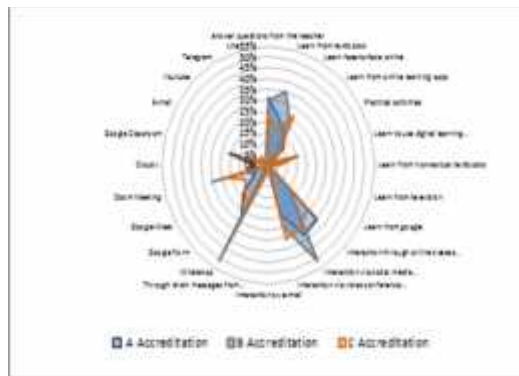


Figure 6. Percentage of Protist material applications

Based on Figures 2 to 6, the applications used by class X students in A, B, and C accredited high schools in Ilir Barat I District in the process of teaching and learning of these materials on the scope of biology, the level of biodiversity in Indonesia, viruses, archaeobacteria and eubacteria, and protists were almost identical. In A-accredited senior high schools, the teaching and learning was carried out by working on the questions given by the teacher by interacting via whatsapp and google classroom. While for B-accredited senior high schools, it was is carried out by learning from textbooks with interaction via whatsapp and zoom meetings and for C-accredited senior high schools, it was carried out by face-to-face online learning with interaction via whatsapp and zoom meetings. The results of the conversion in the form of percentages for application indicators used in online learning in class X material are displayed in Figures 7, 8, 9, 10, 11, and 12.

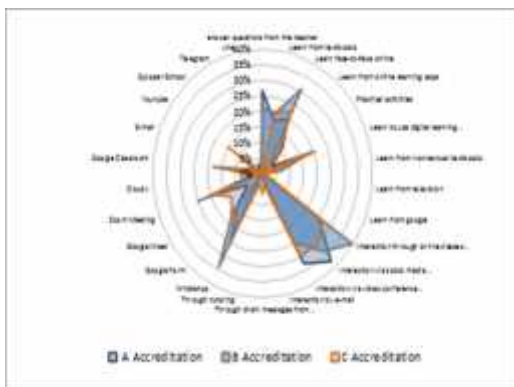


Figure 7. Percentage of Cell Material Applications

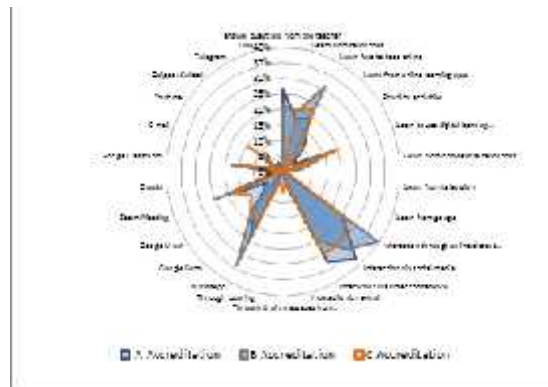


Figure 8. Percentage of Application of Tissue Structure and Function in Plants

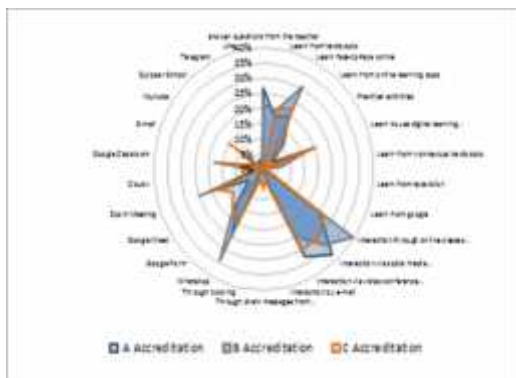


Figure 9. Percentage of Application of Tissue Structure and Function in Animals

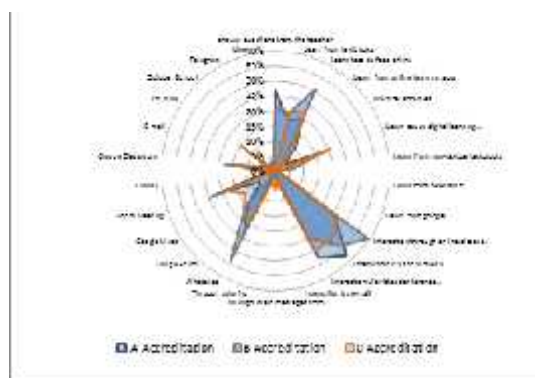


Figure 10. Percentage of Motion System Material Applications in Humans

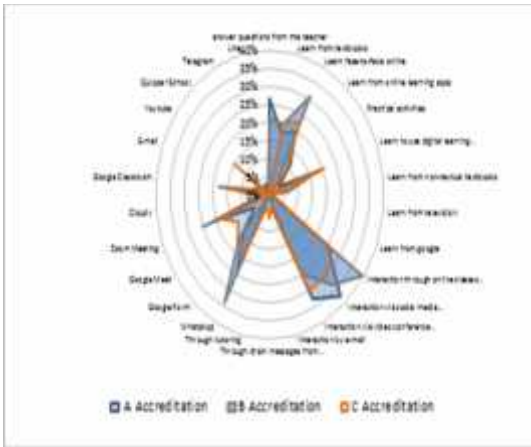


Figure 11. Percentage of Circulation System Material Applications in Humans

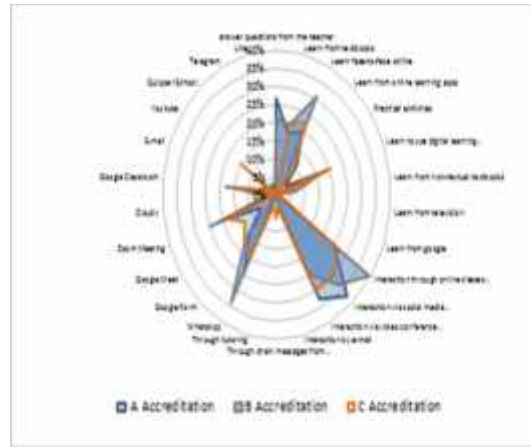


Figure 12. Percentage of Digestive System Material Applications in Humans

Based on Figure 7 to 12, the applications used by class XI students at accredited A, B, and C high schools in Ilir Barat I District in cell material, tissue structure and function in plants, tissue structure and function in animals, locomotor systems in plants, circulatory system in humans, and digestive system in humans were in the same category. In A-accredited senior high schools, the teaching and learning was carried out by working on the questions given by the teacher by interacting via whatsapp and zoom meeting. While for B-accredited senior high schools, it was is carried out by learning from textbooks with interaction via whatsapp and zoom meetings and for C-accredited senior high schools, it was carried out by face-to-face online learning with interaction via whatsapp and zoom meetings. The results of the conversion in the form of percentages for application indicators used in online learning for class X material are displayed in Figures 13, 14, 15, 16 and 17.

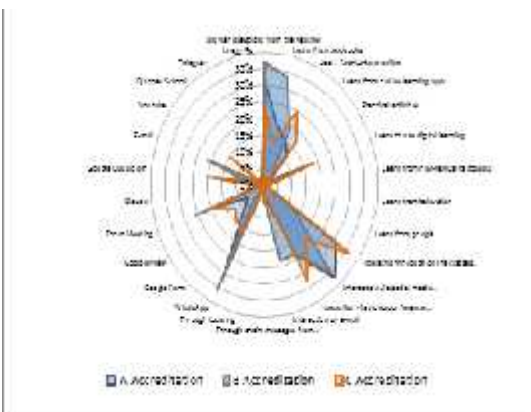


Figure 13. Percentage of Applications for Growth and Development Materials

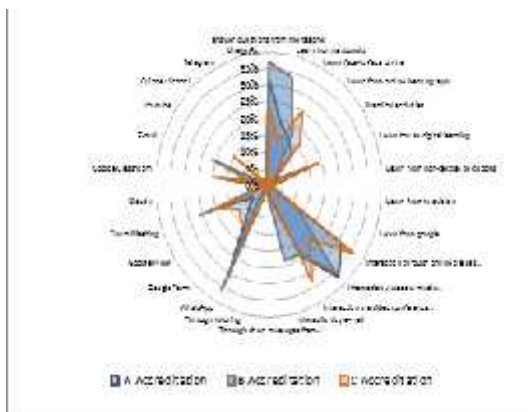


Figure 14. Percentage of Cell Metabolic Material Applications



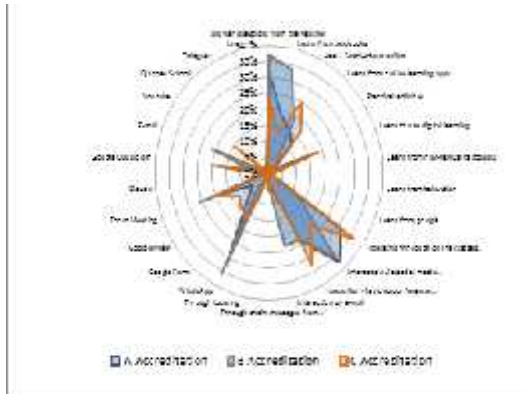


Figure 15. Percentage of Applications of Genetic Materials

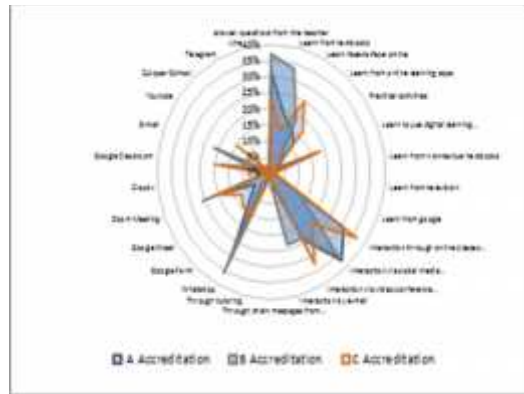


Figure 16. Percentage of Cell Division Material Applications

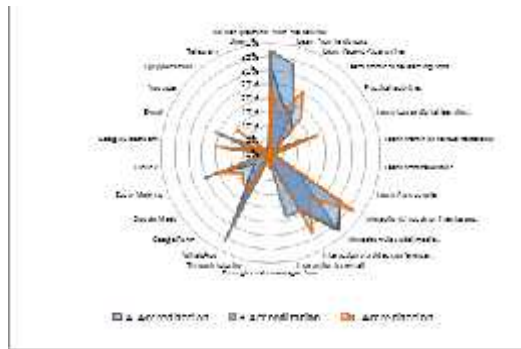


Figure 17. Percentage of Mendel's Legal Material Applications

Based on Figures 13 to 17, the applications used by class XII students at accredited A, B, and C high schools in Ilir Barat I District in the delivery of growth and development, cell metabolism, genetic, cell division, and Mendelian law materials are in the same category. In A-accredited senior high schools, the teaching and learning was carried out by working on the questions given by the teacher by interacting via whatsapp and zoom meeting. While for B-accredited senior high schools, it was carried out by learning from textbooks with interaction via whatsapp and zoom meetings and for C-accredited senior high schools, it was carried out by face-to-face online learning with interaction via zoom meetings and google classroom.

Based on the results of the research in Figure 2 to Figure 17, the implementation of online learning at A, B, and C-accredited senior high schools in Ilir Barat I sub-district has the same pattern, which is carried out face-to-face with teachers online through the zoom meeting application, and the assignments were given through WhatsApp or Google Classroom applications. The WhatsApp and Google Classroom applications are relatively easy to use, are quite popular and only require 3G network for use. It is unlike other applications (zoom meeting, google meet and cloudx) which require a 4G network connection (higher internet speed) to be use (Irfan & Ariandi, 2021). There is no significant difference in the implementation of online learning for A, B, and C accredited schools. However, A accredited schools assigned their assignments through Google Classroom while B and C accredited schools assign the assignments via WhatsApp or e-learning.

The material taught does not affect the teacher's decision in A, B, and C accredited SMA in choosing the application to use. Teachers do not use different applications in carrying out online learning because they are commonly used and are not too complicated. One study reported similar results that teachers do not consider the suitability of the material being taught with the application used (Greenhow & Gleason, 2012). The teacher utilized the WhatsApp platform for every online learning implementation and sent learning videos if students did not understand them. Other study revealed that online learning was always carried out using the WhatsApp platform (Madge et al., 2019). However, there was one teacher at an A-accredited high school who employed a different application in online learning in avoiding students' boredom and promote active learning. The use of applications, teacher creativity, learning media and learning methods that are less varied causes learning to be unattractive and will demotivate students. Learning media and teacher creativity are very influential in helping students to succeed. The choice of platform in the implementation of online learning was not determined by school accreditation, but by the teachers' decision.

One research result (Madya & Abdurahman, 2020) concludes that the widely used applications are WhatsApp, Google Classroom, and Zoom. Online learning strategies can be carried out in creative, innovative, and simple learning methods and by utilizing various learning applications. The Ministry of Education and Culture has inaugurated 12 platforms for use since they are easy to access, such as: Rumah Belajar, Meja Kita, Icando, IndonesiaX, Google for Education, Microsoft Office 365, Quipper School, Ruang Guru, Sekolahmu, Zenius, Cisco Webex (Novita, 2020). Most learning implementations were carried out using the WhatsApp application (Dewi, 2020; Gunawan et al., 2020; Purwanto et al., 2020) considering that teachers and students or their parents have this application that is easy to access, free and can be used in class groups (Batra, 2016; Pindayi, 2017; Udenze & Oshionebo, 2020; Dahdal 2020).

The results of similar research reported that the use of the WhatsApp platform in a problem-based learning model can improve learning outcomes (Madge et al., 2019). In addition, WhatsApp platform, google classroom, zoom meeting and e-mail were used in the online learning process because these applications have enormous benefits, in terms of paper efficiency, simple and attractive display, user flexibility, and the process of organizing tasks (Novianti & Garzia, 2020)

### Parental Support in Online Learning

The results of the analysis of student questionnaires been converted into percentages for indicators of parental support in online learning can be seen in Figure 18.

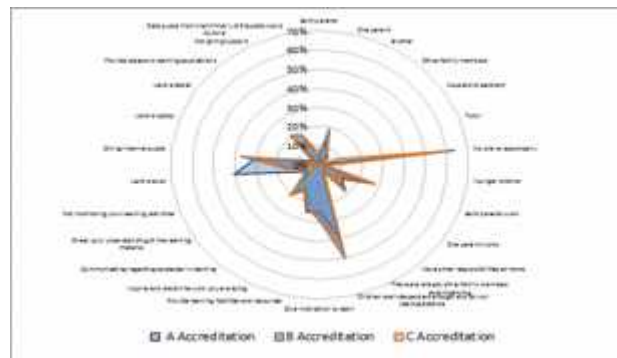


Figure 18. Parental support in online learning

Based on the data in Figure 18, more than 60% of students in schools accredited A, B, and C were not accompanied by their parents in carrying out online biology learning. Students felt that they are quite independent that they do not need their parents accompaniment. However, in supporting online learning, they provide learning facilities, resources, and motivation. Apart from this, schools also provide support in form of lending books, providing internet data connection, and providing access to learning applications (online) for free.

Based on Figure 5, in supporting the implementation of online learning, parents of accredited A, B, and C school students do not have significant difference. Even though they have different accreditations, parental support in the online learning process is similar. This strengthens the assumption that although schools accredited B and C are private schools, parental support in the form of mentoring during learning is not much different between accreditations A, B, and C. It is because the students were independent enough and did not need assistance from their parents who have other activities. As a result, they support online learning by providing facilities. As also revealed in similar study that parents provided learning facilities in carrying out online learning and provide motivation to their children (Novianti & Garzia, 2020). Thus, parents play an important role in the implementation of online learning, especially in providing facilities in carrying out online learning.

#### Barriers to Online Learning

The results of the conversion into percentages for indicators of obstacles in online learning can be seen in Figure 19.

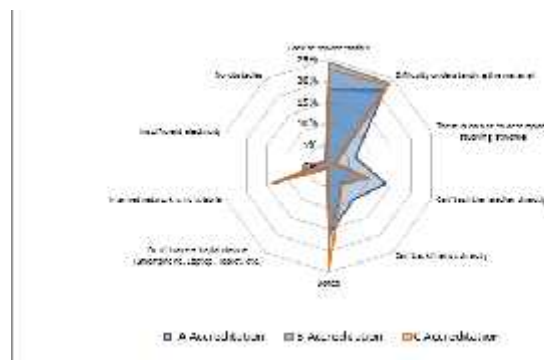


Figure 19. Percentage of Barriers in Online Learning

Based on Figure 19, the obstacles that are most frequently faced by the student were lack of concentration, difficulty in understanding the material, boredom, inability to directly ask the teacher, and unstable internet network. These obstacles were experienced by almost all senior high school students in Ilir Barat I District.

Based on Figure 19, the barriers most often faced by students in carrying out online learning were lack of concentration, difficulty in understanding the material, boredom, inability to directly ask the teacher, and unstable internet network. These were felt by almost all senior high school students in Ilir Barat I District.

Based on the results, the teacher argued that online learning is less effective because they cannot see directly the students' understanding of the learning material. The lack of interaction with students has also caused them to have a tendency to listen to the teacher's explanations and be less active in the learning process. Other barriers include lack of time to deliver material and low frequency of collected assignments. Furthermore, unsuitable assessments for online learning have also caused teachers to be

unable to directly supervise student activities during the learning process. Similar obstacles were also experienced by teachers when carrying out online learning, including obstacles related to learning applications, internet networks, and learning management (Kochan, 2021). The results of the study also reported that a lot of students had difficulty understanding online learning materials. Learning is delivered in the form of reading that is not easily understood thoroughly by students. Materials and assignments are not enough because they need a direct explanation from the teacher (Matias & Wolf, 2013).

The implementation of online learning at accredited A, B, and C high schools in Ilir Barat I District has been hampered by an unstable internet network. These obstacles were experienced by students from outside the city of Palembang, namely from schools accredited B and C. If students from accredited C schools did not participate in the learning process, the teacher would call students to take part in learning. This did not happen to A and B-accredited schools. In a similar study, it was discovered that students experience limited internet connection and boredom in the implementation of online learning (Novianti & Garzia, 2020).

Obstacles in online learning are not only experienced by students and teachers, but also experienced by parents of students (Novianti & Garzia, 2020). Constraints experienced by students are limited facilities and internet networks. Lack of communication between students and teachers has caused less active learning. The obstacles experienced by teachers are the weak ability of digital technology and limited supervision of students. Furthermore, the obstacles experienced by parents are limited time to assist children in carrying out online learning. Some of these obstacles can be overcome by increasing competence in mastering information technology, involving parents in supervising students and giving assignments directly.

Barriers to online learning were also expressed by Adi et al., (2021) that cover several problems including insufficient network in rural areas, low understanding of the learning material, and expense in internet access. Firstly, the network was insufficient because some students live in rural areas where the internet network is less stable. Second, students do not understand the learning material because some teachers do not explain the material in-depth, besides that they only provide material in file format. Third, the internet quota is expensive. Research Arifa (2020) reveals that one of the obstacles faced in the learning process from home is the limitation of the internet, both from the availability of networks and prices to buy access to online learning.

## Conclusion

Based on the results of the study, it was concluded that: the facilities used in biology online learning at senior high schools in Ilir Barat I District were the same, namely smartphones and laptops. They were chosen because they are considered easy to use, and almost every student has a smartphone and laptop. Applications used in senior high school biology online learning in Ilir Barat I District were WhatsApp, zoom meeting and google classroom. The application used by the teacher was categorized as the same because the teacher did not consider the suitability of the application with the material being taught. The support of parents of senior high school students in Ilir Barat I District in carrying out online biology learning were in providing the learning facilities, resources, and motivation. Barriers faced by senior high school students in Ilir Barat I District when learning biology online were difficulty understanding the material, lack of concentration, boredom, unstable internet network, and inability to directly ask the teacher. Internet network constraints were experienced by many students in B and C accredited schools because many of whom live outside the city of Palembang.

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