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Chemistry Learning via Distance Learning during the Covid-19 Pandemic

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Abstract: This research is a descriptive study that describes the learning of chemistry during the Covid-19 pandemic. The respondents in this study were 127 high school students from the West Java and Banten provinces. A Google Form questionnaire was used to collect the data. The results showed that the most widely used online class applications were WhatsApp Group feature, Google Classroom, and Zoom. Students also used printed textbooks, e-books, and student worksheets as learning media. Students did laboratory practice at home using easily found tools and materials. However, a small portion of the respondents (< 11 %) used materials purchased from a chemical store, and another small portion of the respondents (< 14 %) used virtual laboratories. They reported the results of their practice by making a laboratory practice report as well as through video activities and Microsoft PowerPoint for presentation. Students learn from home with varying durations. Most students experienced obstacles during the learning process so that they prefer learning face-to-face in class as usual. Therefore, the teacher must prepare a variety of strategies for distance learning so that the students can learn chemistry from home with fun. Some strategies that can be applied are providing audio-visual learning media or computer/android-based games for chemistry, using the online class application that accommodates interactions similar to face-to-face learning, providing laboratory practice using tools and materials that can be easily found around the house, providing virtual lab application, and providing more opportunities for students to ask questions about chemistry topics that they do not understand.

INTRODUCTION

Nowadays, the world is seriously facing the pandemic of Coronavirus disease 2019 (Covid-19). The case of the virus that attacked the respiratory system was first reported in Wuhan, China in December 2019 and has now spread to more than 162 countries, including Indonesia (Abidah et al., 2020; UNESCO, 2020; Xu et al., 2020). South Korea, Iran, Italy, and other European countries experienced sharp increases in the cases (Yang et al., 2020). Indonesian government noted that 34 provinces in Indonesia have been exposed to Covid-19 with details of 257 districts experiencing positive cases (BNPB, 2020). To control the transmission of the virus, governments in various countries have implemented various policies related to the Covid-19

emergency response period by calling on citizens to conduct physical distancing. This is also enforced in Indonesia. Both the central and regional governments require the citizen to conduct physical distancing by avoiding places that allow large numbers of people to gather, including work from home and pray from home policies. The Covid-19 pandemic also had an impact on education. The central government and regional governments issued a policy to change learning activities that are usually carried out in the classroom into learning from home during the Covid-19 pandemic period. This was done as an effort to prevent the spread of Covid-19. As a result, educational institutions carry out distance learning. The same thing has been done by various countries affected by this pandemic, locking, or quarantine policies carried out to reduce the interaction with many people that can provide access to the spread of Covid-19. The waves of school closures encourage the use of online educational platforms (Fernando M. Reimers & Schleicher, 2020).

There has been little or no literature on COVID-19 concerning educational studies (Sintema, 2020). The only literature available is directly related to medical studies (Chinazzi et al., 2020; Hopman et al., 2020; Kraemer et al., 2020; Xu et al., 2020; Zu et al., 2020; Zunyou & JM, 2020). Chemistry learning which is part of the school curriculum is also affected by learning from home policy. This needs to be a concern because it is related to the characteristics of chemistry. Chemistry is part of natural sciences that studies phenomena. Chemistry is abstract (Jong & Taber, 2007). Studying chemistry requires the ability to connect three levels of representation, namely the macroscopic, sub-microscopic, and symbolic levels (Johnstone, 1991). Chemistry is a difficult subject to learn so it makes teaching chemistry difficult too. How to teach chemistry effectively requires knowledge and understanding of the difficult parts of chemistry as well as various strategies to overcome these difficulties (Boesdorfer, 2019). Therefore, studying chemistry is not enough just to study concepts theoretically, but it also needs to be done in laboratory practice. Based on the characteristics of chemistry learning, this study examined how chemistry learning has been carried out remotely in the West Java and Banten provinces. Therefore, this study was important to de conducted because the result could be used by chemistry teachers to step up their preparedness.

For teachers, the Covid-19 pandemic is a quintessential adaptive and transformative challenge (Reimers et al., 2020). Chemistry teachers have their challenges to plan, prepare, and carry out chemistry learning that is full of distance learning during the Covid-19 outbreak. This situation needs to be examined to become one of the references in the implementation of chemistry learning in special conditions.

Contribution to the literature; 1) This study investigated the potential impact of the Covid-19 pandemic on chemistry learning, especially in the West Java and Banten provinces, Indonesia. 2) This study highlighted the Indonesian government response to the Covid-19 pandemic by closing schools as an effort to protect children from the risk of Covid-19. 3) This study proposed suggestions for stepping up preparedness by bringing in pedagogical strategies to ensuring that students can learn chemistry at home with fun and reduce their obstacles.

This study aims to find out how distance learning chemistry is carried out at the high school level during the Covid-19 pandemic period. The research questions include; 1) How the use of online class applications in chemistry learning during the Covid-19 pandemic period. 2) What kind of learning media and supporting learning resources were

used during the Covid-19 pandemic period other than the online classroom application. 3) How the laboratory practice activities carried out during the Covid-19 pandemic period. 4) What kind of learning from home activities carried out by high school students during the Covid-19 pandemic period?

METHOD

This research is a descriptive study that seeks to describe the chemistry learning during the Covid-19 pandemic period. Respondents in this study were 127 high school students from the provinces of West Java and Banten. The selection of respondents uses purposeful sampling techniques where respondents are deliberately chosen to be investigated (Creswell, 2012).

The instrument used in this study was a questionnaire contained questions about the use of online class applications, learning media, and supporting learning resources, laboratory practice activities at home, learning duration, and learning obstacles. The questionnaire also contained questions about students' opinions on preferred learning (distance learning or face-to-face learning) and their reasons. The questionnaire was validated by seven validators. The questionnaire was in the form of Google Form and was distributed through the WhatsApp application. The results of the questionnaire were analyzed qualitatively.

RESULT AND DISCUSSION

Based on the results of judgment from seven validators, the instrument was then calculated using the Content Validity Index with the obtained average of 0.96. it can be that the instrument was valid. The policy of the central government and regional governments to limit social interaction of the community raises the policy of implementing distance learning activities. Based on the results of filling out the questionnaire, all respondents answered that they used online class application on chemistry learning during the Covid-19 pandemic period as shown in Figure 1.

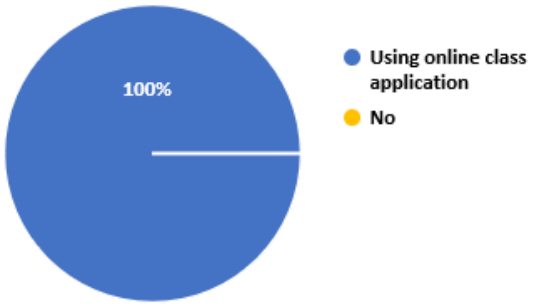

Figure 1. Online Class Applications Used on Chemistry Learning

This shows that the use of information and communication technology (ICT) and the internet in chemistry learning have become commonplace even a necessity. The use of ICT and the internet in chemistry learning has been widely implemented to help students to enhance the comprehension of chemistry concepts, students' attitudes and interests, and other skill achievements that can be stimulated in learning (Bayram & Comek, 2009; Charlesworth & Vician, 2003; David A. Falvo, 2008; Fitriyana et al., 2018; Frailich et al., 2007; Patterson, 2000; Penn et al., 2000; Pursell, 2009).

Online class applications used by students are shown in Figure 2.

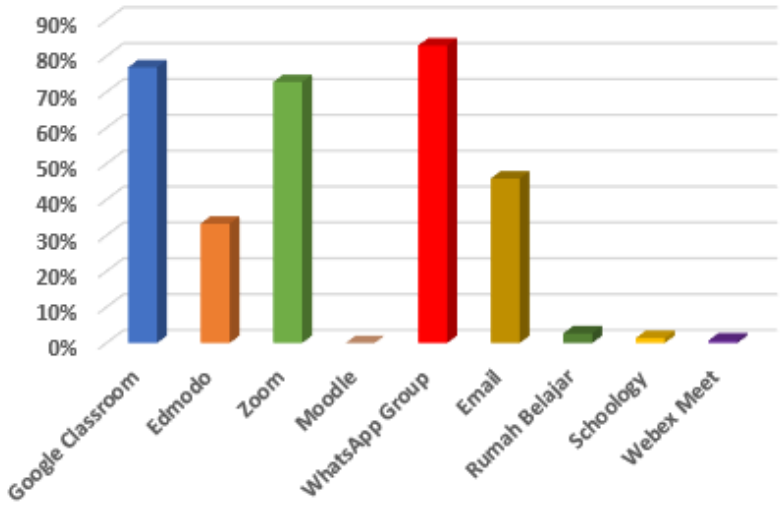

Figure 2. Various Online Class Applications Used by Students

Figure 2 shows that the most widely used online class applications are WhatsApp with WhatsApp Group feature (83 % of respondents), Google Classroom (77 % of respondents), and Zoom (73 % of respondents). The reason for choosing WhatsApp Group as the most widely used among others because all students have been used the WhatsApp application so there is no need to install additional applications and it is easy to use because they are accustomed to using it every day. Also, the WhatsApp application can still operate properly even though the internet network is less stable. The WhatsApp application also allows teachers to share learning content files with students in the form of documents or videos so that students can download them to be studied and can even repeat learning content that is felt to be poorly understood without disrupting other students learning activities. The use of WhatApps Group as a learning tool because of its ease of use and is proven to have a positive effect on student learning outcomes and effective as well as other skills that can be stimulated in learning (Kartikawati & Pratama, 2017; Linda & Ri'aeni, 2018; Suryadi et al., 2018; Widhiyasari et al., 2019).

However, WhatsApp with WhatsApp Group feature has several shortcomings, for example, the lack of organization of the learning content files distributed by the teacher, and messages that are piled up so that it takes time to sort through the information. Also, the WhatsApp application cannot accommodate video conferencing for all class participants. Some drawbacks of the WhatsApp application cause Google Classroom to be chosen as an online class application because it can organize learning better than the WhatsApp Group. Google Classroom is also easy to use. Teachers can arrange classes, provide learning content files, make announcements, accommodate communication between teacher and students when discussing ideas related to the topics being discussed, manage student assignments including quizzes, and it is also can improve student abilities (Al-Maroof & Al-Emran, 2018; Deiniatur, 2019; Harjanto & Sumarni, 2019; Shaharanee et al., 2016; Sukmawati & Nensia, 2019). Managing student assignments using Google Classroom is better than WhatsApp because the teacher can set the deadline for receiving assignments automatically.

However, there is still a weakness of the Google Classroom application. It cannot accommodate video conferencing, so another application that can accommodate video conferencing activities is selected, namely the Zoom application. By conducting video conferencing, interaction during distance learning is more 'real' because all class participants are connected via video, so it is also possible to do presentations, questions, and answers as well as learning in the classroom. Zoom application can be used as a virtual live classroom because this application allows group collaboration through video conferencing, transfer and sharing of learning content files, and communicating with instant messages (Sayem et al., 2017). Video conferencing allows students to meet face-to-face with the teacher and classmates to make students more involved in distance learning conducted (Basko & Hartman, 2017). However, the use of the Zoom application still has weaknesses, including the need for a stable internet network and requires a large internet quota. In areas that have unstable internet networks, it will cause obstacles in the learning process using the Zoom application because it causes intermittent video.

Chemistry learning during the Covid-19 pandemic period not only using online class applications but also using learning media and supporting learning resources. Figure 3 shows the learning media and supporting learning resources that are used by students.

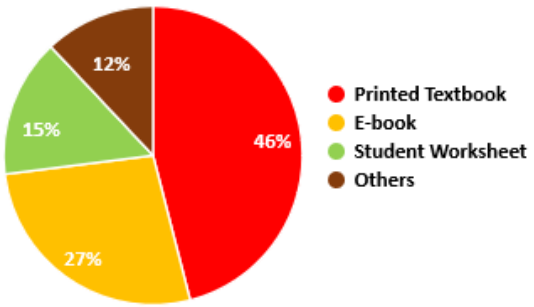

Figure 3. Learning Media and Supporting Learning Resources

Based on the data in Figure 3, the printed textbook is the most widely used, the e-book is in the second place, and the student worksheet is on the third place. This shows that printed textbook is the learning media and the main learning resources used by students. Textbooks are a source of learning for students to gain knowledge (Gegios et al., 2013) The other learning media and supporting learning resources used by students include videos from YouTube, and information from the web through a search on Google.

Teachers are challenged to teach laboratory practice due to the COVID-19 outbreak (Sahu, 2020). Learning chemistry is inseparable from laboratory practice activities. Under normal conditions, laboratory practice activities are carried out in the laboratory. However, there is not possible doing laboratory practice in the laboratory during the Covid-19 pandemic period because of distance learning policy. Chemistry learning is done at home.

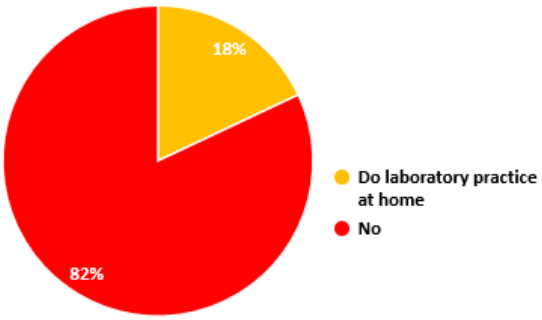

Figure 4. Implementation of Laboratory Practice Activities at Home

Figure 4 shows that only 18 % of respondents do laboratory practice activities at home. The tools and materials used for laboratory practice activities at home are shown in Figure 5.

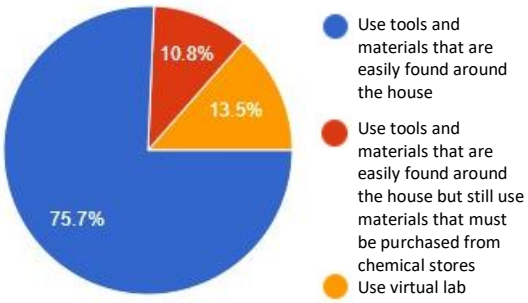

Figure 5. Tools and Materials Used for Laboratory Practice at Home

It shows that most students who do laboratory practice at home (75.7 %) use tools and materials that are easily found around the house. However, 10.8 % of students who do laboratory practice at home use tools that are easily found around the house but still use materials that must be purchased from chemical stores. This is an obstacle for students because sometimes the materials needed are also not available at the nearest chemical store from home. Therefore, to overcome the constraints of practical tools and materials, students are asked to do laboratory practice with a virtual lab. The way to report the results of the laboratory practice at home can be seen in Figure 6.

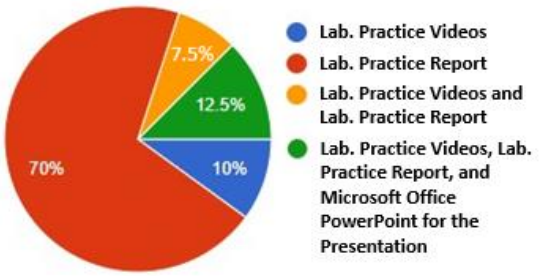

Figure 6. The Way to Report the Results of the Laboratory Practice at Home

Figure 6 shows that 70 % of respondents who do laboratory practice activities at home must report the results of their laboratory practice in the form of laboratory practice reports, 10% in the form of laboratory practice videos, 7.5 % in the form of laboratory practice videos and laboratory practice reports, and 12.5 % in the form of laboratory practice activities video, laboratory practice reports, and Microsoft Office PowerPoint for presenting the results of their laboratory practice.

Aspects of the conditions of learning from home activities conducted by students include the duration of student learning and mentoring as well as the constraints. Figure 7 shows the duration of students' learning.

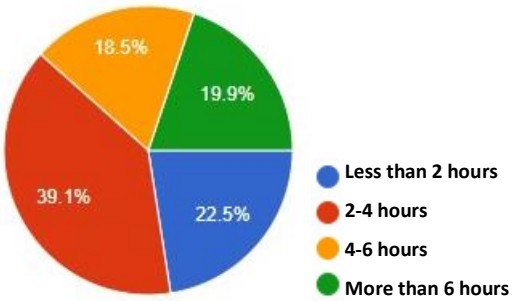

Figure 7. Duration of Learning

Figure 7 shows that 39.1 % of students had a duration of learning at home between 2-4 hours, 19.9 % of students had a duration of learning at home for more than 6 hours, and 18.5 % of students had a duration of learning at home for 4-6 hours. What was surprising was that 22.5 % of students had a duration of learning of fewer than 2 hours. The reason for those who study less than 2 hours in their homes is that they feel bored studying alone and when they have not understood the learning materials, they cannot ask and get answers directly from the teacher as well as learning in class. This is consistent with the results of the respondents' answers related to the tutoring process at home which is shown in Figure 8.

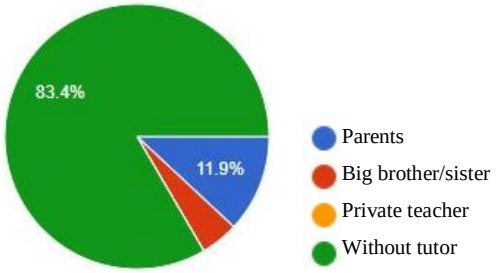

Figure 8. Student's Tutor during Learning from Home

It can be seen that the majority of students (83.4 %) are not guided by anyone while learning at home. Figure 9 shows that only 25.7 % of students can learn at home without experiencing obstacles.

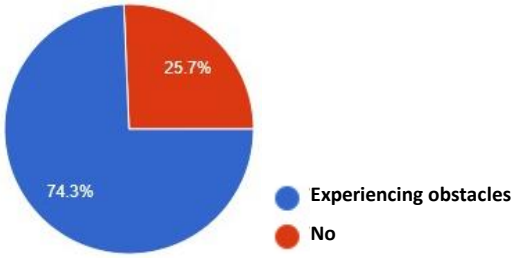

Figure 9. The Number of Students Experiencing Obstacles

Figure 9 shows that 74.3 % of students experiencing obstacles when learning at home. The obstacles they experience such as unstable internet networks, internet quota runs out, nobody helps them when they are not understanding the chemistry concept and cannot ask teachers directly about the difficulties, teachers explain the chemistry topics not as detail as at classroom, their parents ask them to do household activities on learning time, bothered by younger siblings while learning, and there are conflicting online learning schedules. These obstacles make 92.8 % of students prefer to learn face to face in the classroom as usual to distance learning at home as shown in Figure 10.

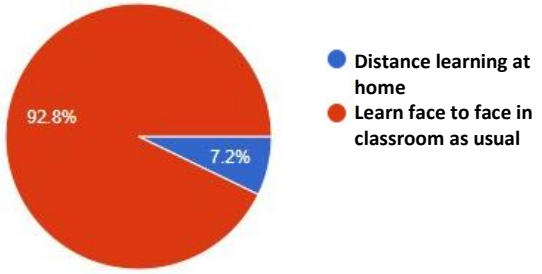

Figure 10. Student Opinions about Preferred Learning

In addition to the learning obstacles that have been mentioned, there are other reasons students prefer learning face to face in the classroom as usual to distance learning. Face to face learning in the classroom allows them to better understand the chemistry contents being taught because the teacher explains in more detail and when there are concepts that are not understood, they can directly ask the teacher and the teacher can immediately repeat explain the concept again. Students also feel that online learning is carried out with the teacher's learning activities only briefly, but the task given by the teacher is very much. Also, students who do not do laboratory practice at home want to study at school so they can do laboratory practice in the laboratory so they better understand the concepts discussed through laboratory practice activities. Students also feel more enthusiastic about learning in the classroom because they can learn together with their friends directly. The implementation of laboratory practice at home is often cited as a key obstacle in developing an effective distance learning because students cannot perform laboratory practice with sufficient precision to collect quantitative and useful data (Casanova et al., 2006; Patterson, 2000). So, ICT may never be an effective replacement for all live classroom instruction (He et al., 2012). The students experience obstacles during online learning such as lack of time, bad experiences, inadequate background in

the topic, and not being able to raise their hands and ask the teacher a question (Shapiro et al., 2017).

CONCLUSION

Based on the results of research and discussion that has been presented, it can be concluded that chemistry learning by distance learning during the Covid-19 pandemic period was carried out with online class applications. Students also use printed textbooks, e-books, and student worksheets as learning media and supporting learning resources. Most students learn chemistry without laboratory practice activities. A student who do laboratory practice at home using tools and materials that are easily found around the house, but a small portion uses materials purchased from a chemical store or using a virtual lab. Students reporting the results of their practice by making a laboratory practice report as well as through video activities and Microsoft PowerPoint for presentation. Students learn from home with varying durations. Most of the students learning at home without a tutor, but a small proportion of them are guided by parents and older siblings. Most of the students experiencing obstacles when they are learning at home. This makes some students prefer learning face to face in the classroom as usual to distance learning.

Results seem to suggest that teachers must step up their preparedness for distance learning chemistry by bringing in pedagogical strategies aimed at ensuring that students can learn chemistry from home with fun and reduce their obstacles. Pedagogical strategies that can be applied include providing audio-visual learning media or computer/android games for chemistry, using an online class application that accommodates interactions similar to face-to-face learning, providing laboratory practice using tools and materials that are easily found around the house or providing virtual lab application, and providing more opportunities for students to ask questions about chemistry topics they do not understand.

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