Science online learning during the covid-19 pandemic: difficulties and challenges

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Abstract. Students, parents, and teachers in Indonesia get the tremendous effects of the coronavirus (Covid-19 Pandemic) when schools are closed and the rules of Large-Scale Social Restrictions (LSSR) were set to overcome the global pandemic. While the government is doing its best to handle the outbreak of the epidemic, teachers respond and strive to provide qualified education for their students during these difficult times. Sciences should be learned through minds-on and hands-on, hence teachers must be able to create virtual classroom conditions that help students maintain learning momentum while they cannot interact each other physically. This study aimed to identify the difficulties experienced by science teachers during online learning and describe the efforts of science teachers to conduct online learning during the Covid-19 pandemic. The research data were obtained through a survey using a semi-structured online questionnaire. The respondents were 82 junior high school teachers and 104 biology high school teachers in Indonesia. Data analysis used a quantitative descriptive approach. The results showed that the majority of science teachers (77.5%) got difficulty in managing online learning. This difficulty was identified in three main factors namely technology, students, and teachers. Internet access was a technological factor that causes the greatest difficulty (42.4%) in online learning. Other difficulties came from the students by 21.5%, including low motivation, time management skills that were not optimal, and the lack of communication devices such as smartphones. The third factor, namely teachers, contributed 36.1% of difficulties, especially related to the explanation of concepts and the use of online learning applications. Based on these difficulties, 77.4% of teachers made an effort to carry out online learning optimally by presenting the material and providing slide presentation, discussion, as well as learning evaluation. A small percentage of teachers (22.6%) used online classes only for task assignments and learning evaluation. The efforts of science teachers to manage online learning have not optimized students’ varied learning experiences because science can’t be learned by reading and discussion only, but also by hands-on activities.

1. Introduction
Since Covid-19 pandemic takes place, Indonesia has to apply large-scale social restriction (LSSR) that some students, parents, and teachers feel such a terrifying effect of school closing due to LSSR. Teachers give so much effort to provide qualified education for their students in order to keep doing learning activity during this difficult time. Online learning is a choice that should be taken to make virtual class. Online class involves all of the educational situation where communication equipment and information technology are applied significantly.

Online learning is a challenge of learning in this modern era as an effect of rapid change in information technology. The main factors that support online learning are internet connection and computer or cellular media. Besides, the important aspect supporting online learning is information or knowledge that is available for user and unlimited by time and geographical neighborhood. Much of
research relates the concept of online learning, for example, to participation of online students [1]; multimedia [2]; application, methods, and learning process [3]; learning strategy, learning method, and content spread and connection [4]; cognitive learning strategy, e-learning preparation, and students’ motivation [5].

Transition from traditional class into virtual class, supported by sophisticated communication technology, gives new challenge to teachers and students for a brand-new teaching and learning. Students can hold successful online learning by considering the factor of technology literacy needs, e-learning preparation, experience, communication skill, and class environment’s isolation [6]. In the other side, online learning can be done if teachers involve students actively in learning process. So, teachers can implement online learning effectively by considering some aspects: active learning, motivation, and feedback [7].

Science is a subject learned by middle and senior high school. Science learning involves students by giving them probability to check their own ideas and assembling their own understanding. So, it is a necessary for a teacher to be able to make authentic experience activity, to educate and to facilitate students’ learning, also to support students to do hands-on / minds-on learning in order to help them making their own understanding [8]. Hands-on experience or practical work is one of the situational factors that is often considered as awakening point for interest and motivation of students to learn science [9], and it can develop students’ scientific knowledge and knowledge of science [10].

Considering that online learning in this Covid-19 pandemic time is unexpected, so the teachers and students cannot prepare it well. This condition is possible for every science teacher getting difficulties because the faced challenge is not only focused on online learning implementation, but also implementation of hands-on/hands-on activity in science learning. Based on every consideration above, this research was purposed to identify difficulties happened to science teacher during online learning and to describe effort from science teacher in order to hold online learning during Covid-19 pandemic. The research result was expected to give proper information about teacher’s difficulties from successful online learning implementation in order to be considered as improvement of following online learning even after the end of Covid-19 pandemic.

2. Method
This research was included in survey research and purposed to identify difficulties and challenge faced by science teacher in online teaching during Covid-19 pandemic.

2.1. Research Participants
The survey participants were 177 teachers from Indonesia, consisting of 78 middle school teachers and 99 high school teachers. The schools where participants work was not similar and spread in various place in Indonesia, both of city and district. According to the gender of participants, it was mostly from female with 81.92%, while male got 18.08%. The average of participants’ age was 38 years, with 55 years as the oldest and 22 years as the youngest. The demographic distribution of participants was shown in Table 1.

| Component          | Middle school teacher (N) | High school teacher (N) | Total | Percentage (%) |
|--------------------|---------------------------|-------------------------|-------|----------------|
| Gender             |                           |                         |       |                |
| Male               | 12                        | 20                      | 32    | 18.08          |
| Female             | 66                        | 79                      | 145   | 81.92          |
| Group of Age (year)|                           |                         |       |                |
| 22-30              | 18                        | 33                      | 51    | 28.81          |
| 31-39              | 23                        | 11                      | 34    | 19.21          |
| 40-49              | 23                        | 34                      | 57    | 32.21          |
| ≥ 50               | 14                        | 21                      | 35    | 19.77          |
2.2. Research Instruments
Data collecting technique used online survey by using questionnaire. Questionnaire was distributed in the end of April 2020, seven weeks after Indonesia government decided to dismiss students and apply online learning. The purpose was clarified to participants and they were asked to give accurate information about difficulties and effort to manage learning during Covid-19 pandemic.

Questionnaire was arranged in semi-structured form, consisting of four closed questions with 2-3 choices of answer and four opened questions. Closed question was for obtaining data about teacher’s participation before and during Covid-19 pandemic time, and opened question was for exploring teacher’s difficulties in managing learning and their effort to overcome the difficulties during online learning. Questions was below:
1. Have you ever actively done online leaning before pandemic? (yes and actively done; yes, but not too active; not yet)
2. How is the online learning going during pandemic? (always; sometimes; never)
3. Does teacher get difficulties during online learning? (yes; no)
4. If teachers got difficulties, so mention kind of difficulties they got.
5. Does student get difficulties during online learning? (yes; no)
6. If students got difficulties, so mention kind of difficulties they got.
7. What kind of activity done by teachers in online learning?
8. How does practical activity is managed during online learning?

2.3. Data Analysis
Data obtained was analyzed based on the quantitative descriptive approach. The frequent was shown as absolute number [N] and percentage [%].

3. Results and Discussion
3.1. Online Learning Implementation
Participants’ response result showed that before Covid-19 pandemic took place, most of the teacher from junior high school (31.07%) and senior high school (23.16%) had not held online learning yet. Teachers that applied online learning in the school during Covid-19 pandemic time were senior high school teachers (28.25%), although several of them did not do online learning everyday (4.52%). Condition during Covid-19 pandemic time made all of junior high school teacher (42.37%) and senior high school teacher (54.805) always implement online learning. There was a few numbers of junior high and senior high school teacher that sometimes did this online learning.

![Figure 1. The comparison of online learning implementation, before and during Covid-19 pandemic](image-url)
3.2. Difficulties from Teacher in Managing Online Science Learning

The online survey result showed that most of science teachers of junior high and senior high school (77.5%) felt difficulties due to implementing online learning during Covid-19 pandemic. Figure 2 showed that the difficulties felt by teachers was divided into three main factors: technology (42.4%), students (36.1%), and teacher (21.5%). Technology factor that becomes a difficulty for teachers and students was lack of internet connection, while internet is one of the main needs to attend online learning.

![Figure 2. Teacher’s difficulties in managing online science learning](image)

The other difficulty faced by teacher in online learning came from students and the individual teacher (Figure 3). Both of teacher and students faced the biggest problem in technical aspect, the lack of application operating skill by teacher (45.45%), and the lack of students’ communication equipment (42.27%). The other technical difficulty was the lack of students’ technology skill (17.52%). The other non-technical difficulty sourced by students was the lack of motivation (20.62%) and discipline (19.59%) during online learning, while the difficulty sourced by teacher was concept explanation (40.91%) and practical work implementation (13.64%).

![Figure 3. Difficulties of online learning sourced by students and teacher](image)

3.3. Teacher’s Challenge to Overcome the Difficulties of Science Learning Sourced by Students

According to the participants, the student-based learning difficulties were the lack of motivation and discipline. Therefore, the second survey was done to obtain data about how was teacher afforded to overcome this problem. Since motivation is one of the important things in online learning, teacher should help students to keep motivated in online learning [11]. The result of survey showed the way to increase teacher’s motivation by developing togetherness in online learning environment; giving meaningful feedback, appreciation, and achievement; and also making online learning fun.
Figure 4. Sort of teacher’s effort to overcome the difficulties of online learning from students

Figure 4 showed that in some efforts to increase motivation, there was a way chosen by teacher: by giving positive feedback using video, GIF, and fun picture (58.52%), posting simple video of ‘welcome to the class’ everyday, greeting students, and explaining learning purpose (39.45%), giving written feedback (25.64%), communicating to every single student (25.64%), and explaining material by video (27.27%). Beside motivation, teacher afforded to give student’s discipline by involving parents’ role in home during online learning. Association activity chosen by most of teacher was by making simple activity in daily life (30.25%) and giving simple orientation of online learning to parents (22.65%).

3.4. Teacher’s Challenge to Manage Online Science Learning
The first difficulty in online learning caused by teacher was concept explanation and practical work implementation. The result of this research showed that to overcome difficulties of explaining concept to students, teacher used more often learning by chatting (24%), online discussion (21.14%), recorded video (17.71%), and PowerPoint presentation (13.72%) (Figure 5).

Figure 5. Sort of teacher’s effort to overcome the problem of explaining concept
Practical work is a hands-on activity that supports students’ understanding about concept of science. This activity became main problem of teacher to do it during Covid-19 pandemic since schools are closed. Most of the teacher chose to change practical work with another task (50.85%), even the teachers that erased practical work were exist (19.21%) (Figure 6). There were only a few teachers that use virtual laboratory to implement practical work (3.39%).

![Figure 6. Sort of teacher’s effort to overcome the problem of practical work implementation](image)

Online learning mixes two main subject, learning and information and communication technology (ICT). ICT is used to explain information about learning and give access to learn. Therefore, students must have massive technical skill and internet connection with high bandwidth to download learning material and upload their tasks or work by e-system [12]. The result of research showed that most of the student did not have communication equipment and had not mastered technology yet. The same way was showed by the result of research from [13], the factor that became the worst problem from e-learning was the lack of facility and skill of operating modern IT gadget. This problem described that the students were not ready to attend and involve fully in online learning, considering that the condition of Covid-19 pandemic was not expected.

Beside the low quality of infrastructure network and the lack of ICT knowledge, the lack of human resource also became the challenge of receiving online learning [14]. The result of research showed that before Covid-19 pandemic, most of the junior high and senior high school teacher never applied online learning. As the result, teacher had weakness to make a successful online learning. It showed by survey result that teacher sometimes alter practical work with another task that did not train, hands-on activity, while to develop scientific knowledge and knowledge about science, practical work should exist [10].

Beside of the importance of practical work role in science learning, Holster Mann stated in his research’s conclusion, there are so many hands-on activity offering their own potential to affect students’ interest positively in those activities [15]. Nonetheless, teacher should be given positive response because of their effort to succeed online learning by applying active learning, such as discussion with multimedia combination.

The weakness of another resource in online learning during Covid-19 pandemic was students. The result showed that students held low motivation and lack of discipline that made teacher difficult to make an optimal online learning. Osman et al. stated that e-learning application was rich of system quality, facility quality, and content [16]. But, if the students’ behavior as subject of learning was not proper, it could lower e-learning effectiveness. Self-motivation is one of the main factors of student success in e-learning [17]. Research of students’ motivation change done by Kim & Frick showed that most of the student had stable motivation and kept increased, while the other students got their motivation lowered [18]. The lowered motivation was caused by, for example, how students were faced to lesson of how to use technology while having to giving their attention of what they hoped to learn.
4. Conclusion

This research reported about the difficulties faced by science teachers in succeeding online learning. The difficulties faced by teachers was caused before Covid-19 pandemic: they never held online learning. Teacher had not possessed experience and forwardness to succeed online learning. Teachers’ difficulties came from the factor of technology, students, and teacher. Most of the participant stated that internet connection availability was the main problem in online learning. The other difficulty was difficulties came from the factor of technology, students, and teacher. Most of the participant stated that learning. Teacher had not possessed experience and forwardness to succeed online learning. Teachers’ difficulties were applying active learning, using multimedia, associating with parents, giving achievement, and communicating to every student personally. This research was only from online survey to teachers as participant, yet was not applied to students. Therefore, to make the research more accurate, it is needed to explore students’ difficulties by their own opinion. Besides, this research did not aim to how teachers’ effort was; approved as the right solution to succeed online learning or not.

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[19]. For school in Indonesia, online learning during Covid-19 pandemic was the first option to be applied, so the requirement of online learning had not been fulfilled yet, such as internet access, students’ technology operating skill, and application operating skill of teacher.