The Mathematics Instruction in Rural Area during the Pandemic Era: Problems and Solutions

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The Mathematics Instruction in Rural Area during the Pandemic Era: Problems and Solutions

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Abstract: The pandemic era had an enormous influence on teaching and learning activities in all regions of the world. For urban areas that generally already have a variety of adequate facilities and infrastructure, it still has an impact on their learning activities. However, this outbreak in rural areas with limitations in teaching and learning activities has its own story. Therefore, this study aims to identify the problems encountered and the solutions implemented by teachers, lecturers, and students in the implementation of mathematics learning during the COVID-19 pandemic in one of the rural areas in Indonesia, namely Manokwari, West Papua. Teachers, students, and lecturers were all purposefully selected as research subjects for the study, which was conducted using qualitative research techniques. Data was collected through structured interviews using the WhatsApp application, then analyzed to construct narratives, tables, and images. The results showed two main problems in implementing the online mathematics learning system in West Papua, namely accessibility to Information Communications Technology (ICT) equipment and the ability to use ICT equipment in carrying out mathematics learning online. The results also show that online mathematics learning is necessary to require government involvement in planning, implementing, and evaluating online mathematics learning systems. Yet, blended learning is a learning system that is suitable to be applied in West Papua during this pandemic situation.

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The disease caused by Covid-19 has spread from Wuhan to all of China (Lipsitch et al., 2020). The virus that emerged in December 2019 has spread rapidly, with cases now confirmed in multiple countries, include Indonesia. WHO later declared the disease as a Pandemic.

As a Pandemic, this disease has spread to almost all countries globally, including Indonesia. President of the Republic of Indonesia, Ir. Joko Widodo, reported that the first Indonesian citizens infected with the virus were two people in Depok, West Java, on March 2, 2020. Since then, the number and distribution of infections have increased. Recorded until May 22, 2020, there have

been 395 regencies in all provinces in Indonesia. Distribution COVID-19 positive in Indonesia is presented in Figure 1.

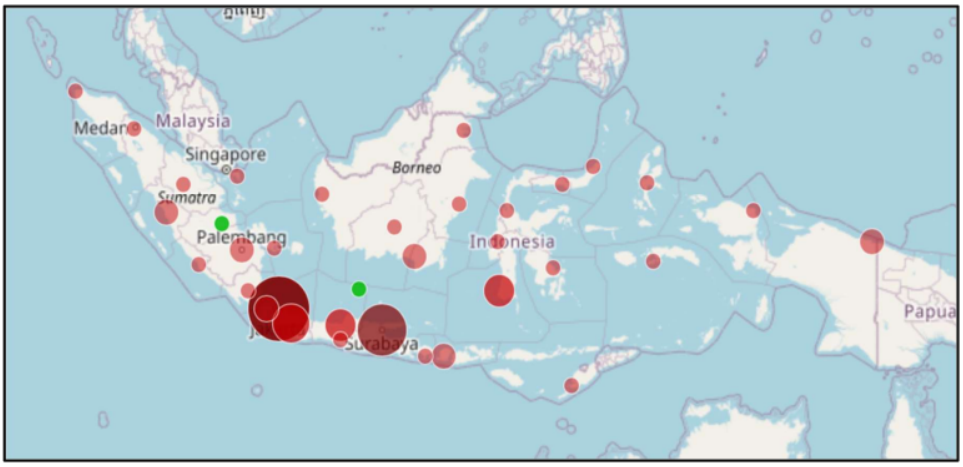

Figure 1: Distribution of Covid-19 cases in Indonesia

Figure 1 provides information that residents in all provinces and large islands in Indonesia have confirmed COVID-19. This information shows that all Indonesians, from East to West, from North to South, will suffer the consequences of this pandemic without exception. Furthermore, the number of people who confirmed positive for this virus, the number who died, recovered, and treated was presented in Figure 2.

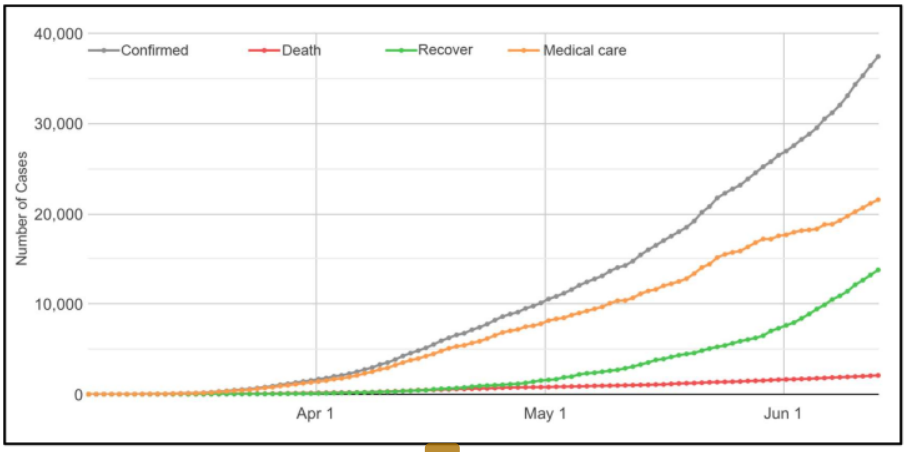

Figure 2: National trends of Covid-19 cases in Indonesia

In contrast, Figure 3 offers information about increasing the number of coronavirus sufferers every day. Based on Figure 2 and Figure 3, it appears that the government cannot predict the end of the outbreak of Covid-19 in Indonesia. This fact is contrary to previous research reports that conducted studies to indicate that this pandemic will end in Indonesia before June 2020 (Susanto, 2020; Nuraini et al., 2020; Dwiputra, 2020). However, based on these data, these predictions are unlikely to occur. This pandemic can continue until the end of 2020, maybe even in the next few years, if the government and Indonesia's people are not severe in handling it.

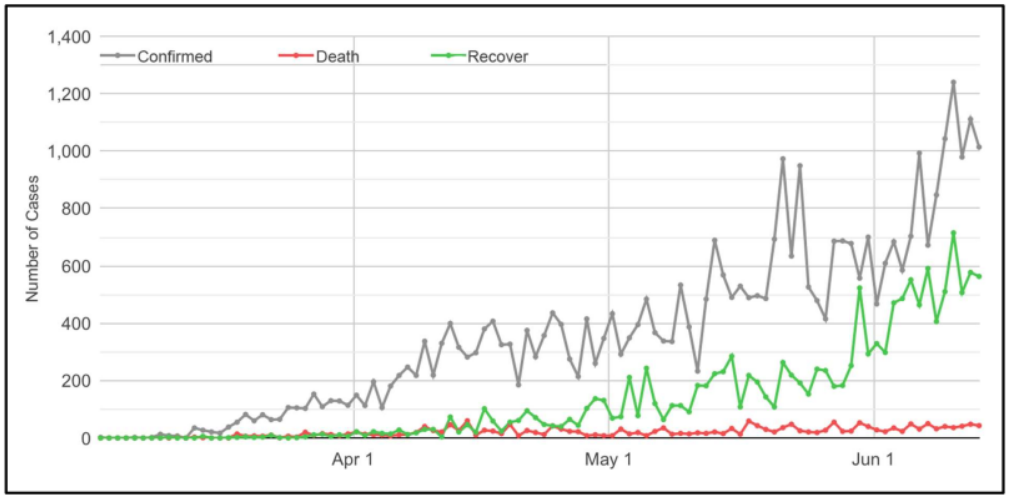

Figure 3: Daily distribution of cases of Covid-19 in Indonesia

On the other hand, this pandemic has influenced Indonesia aspects, including Education (Hamid, 2020; Nadeak, 2020). There are direct impacts on teachers (schools), students, and parents (Giles, Park, & Wang, 2019; Wargadinata et al., 2020). A face-to-face learning system that has been going on all of sudden has to be replaced immediately by online learning systems (Owston & York, 2018; Krishnamurthy, 2020). Furthermore, the instruction has shifted from teaching face-to-face to teach online due to the COVID-19 outbreak. The tools, models, and learning systems that have been applied and studied by teachers must be replaced with an online learning system (Farhan et al., 2019; Al Masarweh, 2019; Thongsri, Shen, & Bao, 2019; Al-Fraihat, Joy, & Sinclair, 2020). Therefore, teachers and students have to change and adapt to the learning models and tools to carry out the online learning process correctly.

There are several problems faced in some rural areas, including Manokwari, West Papua. The limited infrastructure of Information Communications Technology (ICT) for teachers and students is also a problem in the online learning system. The distribution of ICT facilities is another factor that hinders the implementation of online learning systems in West Papua. The online learning

system is limited. Instruction cannot be executed according to the curriculum. Teachers, including students and parents, have a large workload because they are unfamiliar with the online learning environment. Instruction does not take place in the same way as it does in the face-to-face study. Furthermore, teachers have given some assignments, and students have worked without explanation before. Thus, a representative solution is needed to resolve this problem. This is because the obstacle in rural areas has a unique character compared to urban communities.

In this paper, five main topics will be discussed. First, how teachers, lecturers, students, and parents in West Papua, especially in Manokwari, address the changes of the learning systems. Second, what learning model are used in Indonesian West Papua during the COVID-19 period, third, what students think about the learning system. Fourth, the effectiveness of the learning system. And last, various steps taken by the government, schools, teachers, parents, and students to improve the quality of mathematics instruction in West Papua during the Pandemic period. Problems and solutions will be explored and explained in the next section.

RESEARCH METHODS

The study was conducted using qualitative methods with a descriptive approach. In this study, research subjects describe their experiences and knowledge about research objects, teaching, and mathematics learning in the COVID-19 period. Data collection was carried out through structured interviews with teachers, lecturers, and students, using the WhatsApp (WA) application.

Sampling was done among mathematics teachers and lecturers from junior high school, senior high school, or university who were teaching mathematics before and during the pandemic. The selection of students also used the same criteria, namely, students at a particular level of education who studied mathematics before and during the pandemic. There were ten teachers, two lecturers, and nine students who are the subjects of this study.

Interviews were conducted using the WA application. This research critical question was: “Please Mr. / Mrs. share experiences and problems in mathematics instruction during COVID-19 period.” The item then continued to find out more in detail about the learning system chosen, the reasons for using the method, various obstacles encountered, the solutions implemented, and the suggestions for further improvement of the online learning system for mathematics instruction in Manokwari, West Papua.

In addition to the primary data, secondary data from the literature, especially about learning mathematics and COVID-19, was used in this study. The data was analyzed and presented in tables and narratives.

RESULT AND DISCUSSION

During the COVID-19 pandemic teachers, lecturers, and students in Manokwari use the internet-connected smartphones and laptops to learn. These ICT tools run the software, such as WhatsApp, Zoom Conference, Google Classroom, Video Tutorial, and e-learning. E-learning is an online learning system used to complement face-to-face learning systems at the University of Papua.

Teachers, lecturers, and students face several challenges when implementing an online learning system. Various solutions have been implemented by teachers, lecturers, and students so that mathematics learning can be delivered in West Papua during this situation, as discussed further.

Problems and Solutions of the Online Learning System in West Papua

The first problem encountered by teachers, lecturers, and students in West Papua in implementing the online learning system for mathematics instruction was distributing information and communication infrastructure. Some Manokwari locations are far from the internet tower, so they cannot access the internet signal. In some places, the internet signal cannot be obtained at any time except in the evenings or mornings.

The second problem is the accessibility of information and communication technology (ICT) devices, smartphones, and laptops. Not all students (and parents) have smartphones that can be used to support online learning activities. The devices are limited and are used interchangeably, especially for parents who have more than one child attending school or college. Besides, some students have ICT tools and cannot access the Internet because it requires expensive financing.

To overcome these problems, the teachers carry out mathematics instruction in students' homes. However, the instruction outside of the school is an additional burden for the teacher. The teacher has to go to every student's house because there is a ban on gathering. Learning activities for 80 - 90 minutes at school, the teacher must do about 180 - 240 minutes when visiting students' homes. Teachers visits were becoming more frequent if students were not home during the session. Therefore, during the visit, the teachers provided well-prepared instructional materials. When using these instructional materials, students were expected to comprehend the content well. Yet, if students do not understand it, the teacher can go over it in the next visit.

The summary of teachers activities to overcome students difficulties accessing the Internet and ICT equipment are presented in Figure 4. It shows that teachers, even school principals, come to the homes of students who do not have access to the online learning system. The teacher visits students in their families to explain the subject matter, provide lesson material, deliver test material, and monitor the midterm and final exam. However, the activity of these teachers is a short-term solution. In the future, the answer is an improper step. The government needs to solve this problem to implement the online learning system in West Papua.

Figure 4: Mathematics instruction activities in students' homes

Especially for the lecturers at the University of Papua, ICT development has been in their learning activities. Lecturers have used several Online Learning Systems (OLS), such as WhatsApp, Zoom conference, Google Classroom, tutorial video, and e-learning. However, in practice, the OLS was not explicitly designed by the lecturer to be used separately from conventional lectures that prioritize face-to-face learning (offline learning). Lecturers use OLS and face-to-face learning alternately in their learning activities. In this case, OLS is positioned as support in their learning activities.

The next major issue is how to use ICT devices as a learning tool. Not all teachers, lecturers, and students are accustomed to utilizing this technological device in the online learning system. They are used to using smartphones and are limited to sending and receiving messages, especially using the WA application. Librero et al. (2007) explain that the cellular phone is not designed to be used in education, but it can be used as a learning tool. Teachers have to explore mobile phones' potential as a crucial device in the educational systems of developing countries.

To implement online learning with applications WA, mathematics teachers establish WhatsApp Group (WAG). The use of WAG is familiar for teachers and students in West Papua. They used to use WAG in their daily activities. This situation is in line with Sutikno et al. (2016) 's research results, which states that WA is the best apps for instant messaging. However, there is a difference between using a smartphone for the learning process and daily activities. Joo and Sang (2013) state that there are two types of smartphone usage: ritualized and instrumental. Ritualized media use is more frequent and used more for diversionary reasons. On the other hand, the practical application refers to a more goal-oriented use of media content to gratify "informational needs or motives."

Consequently, some problems arise during the implementation of online learning using WAG. Interaction between teachers and students is not going on well in the execution of mathematics instruction. The teacher asks students to learn the subject matter by referring to the textbooks and

student worksheets to complete the examples and then solve the exercise questions. Learning activities of teachers and students apply the online learning system shown in Figure 5.

Figure 5: Teachers and students activities during online mathematics instruction

Furthermore, although students have been learned from textbooks and student worksheet activities, those who do not understand the subject matter usually ask for both parents' explanations. Unfortunately, not all parents have the competency and opportunity to assist students in comprehending the subject matter. To answer the questions given, students then ask the answers to their friends. There is a tendency for students to answer the questions correctly without understanding the problem.

In an online learning system, the typical interaction occurs in asynchronous, text-based discussion forums. Teachers and students post messages and respond to other people's postings, resulting in a threaded discussion. In these discussions, if a teacher or learner does not display or is delayed in responding to another's post, the absence of communication comes across as silence (Xin & Feenberg, 2007; Duran 2020).

To solve this problem, some teachers asked students to create a video that shows how to resolve a particular issue. But in general, the teachers ask for students to work on the problems and then score without giving feedback to students. The use of video to ensure students' understanding of the subject matter, provided in Figure 6. It shows that students explain the stages to solve a mathematical problem. Students' ability to demonstrate these stages in detail, orderly and correct indicates their mastery of the learning material. The use of the video is an effort to increase interaction between teachers and students in learning. Teachers need to make more innovative approaches to achieve the learning objectives of mathematics instruction.

Figure 6: A student explains a solution of a problem during an online mathematics instruction

The Future of Mathematics Instruction in Online Learning System

Online mathematics instruction is necessary throughout the world, including in Indonesia and West Papua, especially in the COVID-19 Pandemic. The government must address multiple problems in the implementation of online math learning in West Papua. They should quickly provide solutions to overcome the issues.

The first step that needs to be done by the government is to organize the ICT tools for an online learning system. The government has to provide the infrastructure of telecommunication technology to support mobile and internet networks. ICT tools have an essential role in education (Ariyanti & Santoso, 2020). Furthermore, Zhang and Cristol (2019) stated that ICT has been used in higher education for many years. They provide reasonable solutions for Instruction and make Learning available anywhere and anytime.

ICT devices should be accessible to all stakeholders, teachers, lecturers, and students. They should be able to access the internet anywhere and anytime, especially at home. Furthermore, Whelan (2008) shows that government support is one of the essential development factors to improve access to ICT in The South Pacific. The South Pacific is a region with some similarities with the characteristics of West Papua's province in Indonesia.

Farley and Song (2019) explain that Indonesia has high mobile penetration levels but relatively low broadband internet and computer penetration levels. Broadband internet penetration is restricted due to poor infrastructure. On the other hand, on May 16, 2011, the United Nations stated that access to the internet was a human right. That statement has implications for governments in providing internet infrastructure (La Rue, 2011).

The second factor of access to the internet in West Papua relates to affordability. The cost of buying a phone, a sim card, and any upfront fees associated with holding a mobile phone can account for a large proportion of a person's income (Jeroschewski et al., 2013). This corresponded to the students' statements not to access the internet in West Papua. Therefore, the Indonesian government should provide subsidies to overcome this problem. The government can give open textbooks on this issue. It can be done by delivering free books to support online learning (Pitt et al., 2020).

Therefore, the Indonesian government should conduct a study before acting to resolve these problems. The review should involve all stakeholders, including teachers and parents. The study also needs to be done in all aspects, including economic issues. So (2012) states that the Indonesian government must study accessibility, connectivity, and affordability of mobile devices, especially in West Papua. Furthermore, the Indonesian government also needs to establish the National Standards for Distance Education (or online learning system). The standard is a regulation in implementing an online learning system. In the national standard, the online learning system is supposed to produce knowledgeable, skillful, and characterized students as the goal of Indonesia's national learning system.

In the current online learning system, social interaction does not occur between students. On the other hand, student character development can be well-formed if there is social interaction between students. Therefore, the government needs to prepare for online learning standards that can develop the character of students.

Besides lacking character development, the current online learning system cannot develop student skills to the fullest. The result of student knowledge needs to be accompanied by the development of student skills. Therefore, the national standard for online education is necessary to emphasize the development of student's abilities. Some studies showed that online learning systems are still difficult to apply for elementary and middle school students. Online Learning should be equipped with face-to-face Learning. Livingstone's research (2012) shows a real advantage for online over face-to-face learning system, even though the effect was more massive for the blended learning system. The blended learning system is a mode of Instruction that combines an online learning system and a face-to-face learning system.

Blended Learning is a learning system suitable for implementation in West Papua during this Pandemic. This Learning is frequently displayed on a continuum, with face-to-face Learning at one extreme and distance learning system at the other extreme (Fresen, 2018). The combination of some aspects of the two extremes generates the blended learning system, located somewhere along the continuum, as presented in Figure 7.

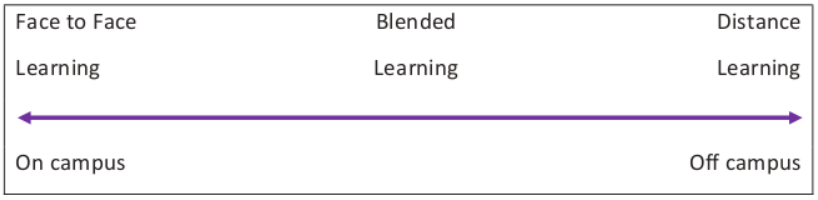

Figure 7: Illustration of Blended Learning, adapted from Fresen (2018)

Finally, an online learning system (whole or blended) is successful when carried out by a creative teacher. The teacher is the leading player when learning is implemented using the online learning

system (Goh et al. 2020). ICT alone cannot guarantee positive educational outcomes, but what the technology can achieve in the hands of skilled and imaginative teachers is equality in access to the kinds of teaching and learning resources and constructive interactions (Latchem & Jung, 2010). Furthermore, ICT for human development is not about technology but people using technology (Nawaz & Kundi, 2011). Therefore, the teachers must also be equipped with knowledge and skills to develop e-learning materials creatively and independently. Teachers should be able to act as a center for online learning success.

The efforts to increase teachers' motivation in West Papua to learn and use ICTs for mathematics learning need to be done continuously. It's because teacher motivation plays an essential role in conventional education and e-learning, especially web-based learning (Kao, Wu, & Tsai, 2011; Khanal et al., 2020). Teachers may take some innovative steps in online learning, including developing interactive learning videos and the use of contextual problems in the teaching materials. These creative efforts are expected to improve the productivity of the online learning system.

CONCLUSIONS

There are two main problems in implementing online mathematics learning systems in West Papua, namely accessibility and the ability to use ICT equipment. On the other hand, online mathematics learning is necessary in times of Pandemic COVID-19 and the future. The government and other stakeholders have an essential role in the online mathematics learning system. The government needs to establish a National Standard for Online Education (Distance Education), including improving teachers' abilities and learning tools. However, Blended Learning is a learning system that is suitable to be applied in West Papua during this pandemic.

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