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## Mathematics Teachers' Difficulties in Implementing Online Learning during the COVID-19 Pandemic

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**Abstract:** The COVID-19 Pandemic, which hit various countries, has caused changes in the education sector, such as school closure and the transition from face-to-face learning methods to online learning. The application of online learning is considered a sudden decision, causing teachers as executors of education to take responsibility for the difficulties during online learning implementation. This study discussed the difficulties faced by mathematics teachers in implementing online learning during the COVID-19 pandemic. The method used in this study was exploratory. The data collection process was carried out through an online questionnaire delivered to twenty high school mathematics teachers in Pekanbaru, Riau, Indonesia. Based on the data analysis, it was found that teachers' difficulties during the implementation of online learning were caused by several factors such as students, teachers, the school, curriculum, and parents. Students and teachers caused significant difficulty. Therefore, it was essential to consider some suggestions and efforts to overcome teachers' difficulties implementing online learning. Good coordination and collaboration between government, schools, teachers, students, and parents played a significant role in supporting online learning success. The findings of this study provided some information to improve online learning quality during the COVID-19 Pandemic in Indonesia.

**Keywords:** teachers' difficulties, online learning, COVID-19 pandemic.

### 新冠肺炎大流行期間數學老師在實施在線學習中遇到的困難

#### 摘要

席捲各個國家的新冠肺炎大流行病已導致教育部門發生變化，例如學校停課以及從面對面學習方法向在線學習的過渡。在線學習的應用被認為是一個突然的決定，導致作為教育執行者的教師對在線學習實施過程中的困難承擔責任。這項研究討論了在新冠肺炎大流行期間數學老師在實施在線學習方面面臨的困難。本研究中使用的方法是探索性的。數據收集過程是通過在線問捲進行的，該問卷已分發給印度尼西亞廖內佩坎巴魯的20位中學數學老師。根據數據分析，發現教師在實施在線學習過程中遇到的困難是由學生，教師，學校，課程和父母等多種因素引起的。學生和老師造成了很大的困難。因此，必須考慮一些建議和努力，以克服教師實施在線學習的困難。政府，學校，教師，學生和家長之間的良好協調與協作在支持在線學習成功中發揮了重要作用。這項研究的發現為印度尼西亞在新冠肺炎大流行期間提高在線學習質量提供了一些信息。

**关键词：**教師的困難，在線學習，新冠肺炎大流行。

## 1. Introduction

The spread of coronavirus becomes a big polemic for many countries in the world. It is a challenge for the governments in every state, including in Indonesia, to

anticipate the increase of victims. It is believed that the spread of the coronavirus was originated from a virus found in the animal market in Wuhan, the capital of Hubei Province, China, in December 2019 [1]. This

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virus was straightforward to spread among people, and in a short time, it became a pandemic in many countries [2]. Moreover, this virus was categorized as a dangerous virus because it attacked the respiratory system [3] and could cause death, especially in patients with concomitant diseases [4].

Coronavirus was announced as a global pandemic on March 11, 2020 [4]. They provided social distancing protocols that were then updated to physical distancing in anticipation of a wider spread of the virus. Besides, since it had been revealed as a global pandemic, many affected countries have undertaken emergency response measures by legitimizing a lockdown system, both wholly and partially [5]. The aim was to reduce the increase of casualties due to this virus. In Indonesia, the coronavirus spread since March 2020 also made the government respond by implementing PSBB (Large-Scale Social Restrictions) or a semi-lockdown system. As a country with the fourth highest population globally, this action was expected to prevent the transmission of the virus to many regions in Indonesia.

COVID-19 Pandemic caused many changes in normal life order, such as social and physical distancing policy. It limits people's daily activities. Public places involving many people such as schools, offices, shopping centers, entertainment centers, public transportation, worship places, and other places for social activities were closed to prevent transmission [6, 7]. The education sector was one of the worst affected areas due to the COVID-19 pandemic [8, 9, 10]. It happened because school is a center of education that involves many people such as teachers, students, and staff to have a high risk of massive and rapid transmission. Therefore, to restrict the spread of coronavirus contagion in schools, the Indonesian government, through the Ministry of Education and Culture, issued a policy to close schools and provide lessons to students from home since March 14, 2020 [11].

A study from the home policy issued by the government caused a sudden change in education patterns. Face-to-face learning done in schools was instantaneously replaced by remote learning [12]. Remote learning included learning activities that use various means of synchronous or asynchronous communication technology [13]. Remote learning was developed and became known as online learning. Online learning is a form of integrated learning activities through online communication both directly and indirectly by using various devices connected to the internet, such as smartphones, laptops, etc. [14]. Online learning can be applied through three methods:

1. Synchronous learning - learning with virtual and interactive classroom settings;
2. Asynchronous learning, which uses media exploited in the forum so that it is not interactive;
3. Open learning, which aims to help students build their learning processes [15].

Online learning can allow students to interact directly with learning material in videos, documents, audio, etc. This interaction can also occur through direct and indirect internet-based online communication such as video conferences, chats, audio, or various forms of virtual interaction [16].

Online learning is considered the best alternative to replace face-to-face learning due to school closure during the COVID-19 Pandemic [17, 18] since it is done virtually from students' houses [10]. Online learning in the implementation of education began to emerge in the mid-1990s and the discovery of the internet [19] and developed briskly from North America and Europe to Asia [20]. Online learning was a concept of online teaching and learning, accompanied by technology tools and platforms [6]. Online learning, or distance education, was a form of material dissemination that was fast and efficient through information technology and the internet [20]. Thus, it can be inferred that online learning integrates information and communication technology and the internet to present a learning process that unlimited by time and space.

Online learning became popular because of its potential to provide learning flexibility that enables access and instruction without place and time restrictions [21]. Online learning had many advantages, including a high level of motivation, a broader approach to education, the availability of quality learning opportunities, students' learning skills and outcomes enhancement, educational choices, and efficiency in educational administration. Online learning also had flexible characteristics, facilitated students to access reputable learning resources, and fostered students' independent learning skills [10]. Besides, an online learning environment could develop personal relationships, social skills, and collaboration among participants [16]. Although online learning was a solution to the school closure, online learning could not replace the importance of face-to-face interaction between students and teachers [6].

Besides its advantages, online learning also had quite severe challenges, especially for teachers, because of its immediate implementation due to the COVID-19 Pandemic. Insufficient time to convert from face-to-face learning to online learning becomes a significant obstacle for the education sector [10]. Concrete learning activities are now shifting to digital learning activities. This transition of the learning process made teachers need to adjust and quickly adapt to online learning. But in fact, teachers were more accustomed to face-to-face learning rather than using technology in the form of online learning media [8]. The current era demanded the unification of technology in education because the technology was essential to increase innovation and creativity [22]. As a result, various obstacles arose in online learning implemented by teachers.

As one of the subjects taught through online learning, mathematics required a lot of preparation so that the material presented can be easily understood by students. Especially in high school, mathematics, which contains abstract topics, requires an excellent presentation strategy so that online mathematics learning becomes effective and meaningful. As prominent in online learning, mathematics teachers need to compile and present exciting and intelligible online mathematics learning. However, high school mathematics teachers still experienced various difficulties in conducting this online learning in the implementation. These difficulties were from teachers' internal and external factors, such as low ability to use technology for online learning, the absence of distance learning culture, teachers' boredom and social life lost, and increasing costs for the internet [8]. A study conducted by [7] found that four factors caused difficulties for teachers in implementing online learning. Those were obstacles from teachers, students, curriculum, and school, which student factor was the biggest obstacle in implementing online learning.

Referring to the background of this study, it is essential to explore the difficulties faced by high school mathematics teachers in implementing online learning. The difficulties faced by teachers during online learning will certainly differ with the conditions of each region and various other factors. However, the novelty in this study reveals specific difficulties experienced by mathematics teachers, which may be different from the difficulties experienced by teachers in other areas. This study will also strengthen and update the relevant previous research results regarding difficulties, challenges, and solutions to overcome them in online learning practices. This study also suggested overcoming the difficulties in achieving successful education during the COVID-19 pandemic based on theory and based on the reality on the ground. Thus, the results of this study can be used as a reference by all education stakeholders to improve and increase online learning outcomes.

## 2. Research Methodology

This study employed exploratory methods to reveals the difficulties experienced by high school mathematics teachers in implementing online learning during the COVID-19 Pandemic and overcoming the difficulties. The approach taken by researchers in this study is quite specific because it is only aimed at mathematics teachers in senior high school. This option is done because the substance of the abstract mathematics material in high school students is quite tricky so that it will cause difficulties for the teacher. The exploration method used to collect data was also carried out on groups of teachers who are members of the Pekanbaru Mathematics Teachers Association. The data received is more open, focused, and in accordance with the perceived conditions. Participants in this study

were 20 high school mathematics teachers teaching in various schools in Pekanbaru, Riau Province, Indonesia. The data were collected through online questionnaires, with the questions adapted from research by [7]. The questionnaire was gathered by following a physical distancing protocol from the government. The questionnaire items were open-ended to express their experiences according to their point of view. The questionnaire consisted of a section to obtain participants' demographic data, assess online learning media or platforms' availability, and collect teachers' perceptions about online learning. Also, there is a section to determine the difficulties teachers face during online learning and a section for teachers' suggestions or recommendations to improve online learning quality. This questionnaire was validated by a lecturer and a deputy headmaster of the curriculum. The data obtained through this questionnaire were then analyzed using the frequency tabulation procedure and the percentage of responses. The analysis results were then presented in diagrams to display the relationship between data, interpreted narratively, and compared with relevant previous studies. The research hypothesis in this study is that the difficulties experienced by mathematics teachers in implementing online learning are caused by several factors such as student, teacher, school, parents, and school factors. This difficulty can be overcome with theoretical and practical solutions adapted to the conditions of online learning.

## 3. Results

### 3.1. Demographic Information of the Respondents

According to Table 1, the majority of teachers were between 21-30 years old (55%), while the rest were between 31-40 years old (40%) and more than 41 years old (5%). This result indicated that teachers of productive age dominated mathematics teachers in Pekanbaru. Moreover, all teachers had a bachelor's degree, of which 75% of them already had a professional teacher's certificate. Furthermore, teachers had various teaching periods, but most of them have taught for 1-10 years. The teaching experience was important because teachers could improve the skills needed to present effective teaching using their experience [7].

Table 1 Demographic information of the respondents

Demographic Background		Number of Participants	Percentage
Age	21 – 30 years	11	55%
	31 – 40 years	8	40%
	> 41 years	1	5%
Level of Education	Undergraduate Degree	20	100%
	Postgraduate Degree	0	0%
Teaching Experience	1 – 5 years	9	45%
	6 – 10 years	7	35%
	11 – 15 years	3	15%

	> 15 years	1	5%
Professional	Yes	15	75%
Teachers'	No	5	25%
Certification			

Based on teacher demographics, it can be seen that most of the teachers were in the productive age range, have a bachelor's degree, have educator certificates, and have sufficient teaching experience. This condition can be a factor facilitating them to adapt the online learning. The questionnaire findings were promoted, which declared that 65% of the teachers were already familiar with online learning while the rest, or 35%, were not too familiar.

### 3.2. Type of Online Learning Media/Platform Used

Referring to Fig. 1, the three media/platforms used to teach mathematics were Google Classroom, WhatsApp, and Youtube. Google Classroom and Youtube platforms were included in asynchronous communication technology because the communication did not occur directly (occurring over time), while WhatsApp was the synchronous communication technology in the form of written text. In addition, for using another synchronous communication technology, 25% of teachers used the Zoom platform, 15% of teachers who used the Line platform, and 5% of the teacher who used Google Hangout. Zoom and Google Hangout platforms enabled direct and two-way interaction video (occurring in real-time). At the same time, Line uses the written text, and the other platforms such as Quipper and Google Drive were asynchronous communication technology because they delivered indirect interaction.

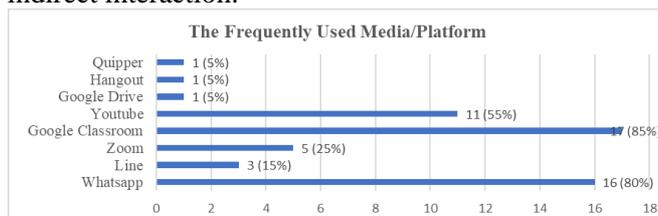


Fig. 1 Online learning media/platforms frequently used

Table 2 Reasons for using media/online learning platforms

Reasons for Using Media/Platform	Percentage
Direction and agreement from the school	15%
Intelligibility	65%
Familiarity and students' access	20%

The frequency of media selection in online learning was based on various reasons/backgrounds. The main reason being considered was the practicality of the platform. It was user-friendly and easy to access, free, easy and fast media to transfer, unlimited by time, and efficient in organizing material and questions for practice. These advantages supported the functions of online educational technology, which were enhancing the teaching and learning experience, composing content, sharing lessons, assessment, and feedback [6]. Another consideration of using the platform to support

online learning was that students were familiar with and already owned the platform. Finally, direction and agreement from school management was the reason with the smallest percentage in choosing an online learning platform.

### 3.3. Benefits of Online Learning

Online learning is part of distance learning which the primary characteristic was the separation of teachers and students [23]. Online learning is also interpreted as a learning activity where the instructions and material given to students were presented through technology and internet media [24]. The current COVID-19 Pandemic made online learning a much-needed learning method that rapidly developed to become a part of education in schools [20]. Because of its nature that neglected distance, time, and place limitations, online learning could be implemented successfully. The benefits of online learning perceived by the teachers are presented in Table 3.

Table 3 Benefits of using online learning

Aspects	Percentage
Learning is not limited by time	85%
Have enough free time	35%
Efficient because it did not require fees to go to school	30%
No need to pay for other supporting costs	15%
Easy to make visualization	5%
Various available online resources to support online learning	5%

The majority of teachers revealed that the benefit of online learning was no time limitation. The use of internet access and virtual media unlimited to time caused learning can be done anytime quickly. The implementation of online learning outperformed face-to-face learning in time, place, and learning resources. This finding was consistent with the previous studies that explained online learning provided unlimited access to time and place [20, 25] and reduced inequality in education [26]. Besides, the existence of a work from home system caused the teacher to learn only at certain times to have enough free time. The teacher's free time could be spent creating online learning media and improving teachers' quality by attending online training, widely practiced. Another benefit was that online learning reduced teacher costs since they did not go to school, and there was no need to spend other supporting expenses. However, the price was used for internet access.

### 3.4. Difficulties of Online Learning

The application of online learning as a substitute for face-to-face learning during the COVID-19 pandemic period was the best choice to maintain students' safety during learning [18]. In the previous section, online learning had many advantages. However, it also created some difficulties for teachers. The findings in this study revealed that 70% of teachers agreed that they face

difficulties in implementing online learning. In comparison, the remaining 30% stated few significant difficulties they experienced when the topics were

difficult to teach through online learning. The topics are presented in Fig. 2.

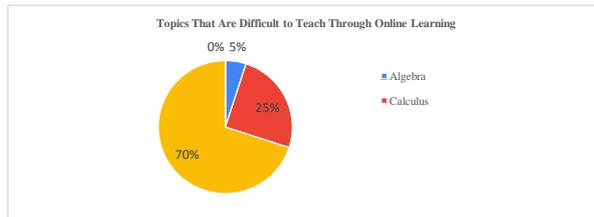


Fig. 2 Mathematical topics difficult to teach through online learning

During mathematics teaching in online learning, the lesson topic became one of the problems that teachers face. Based on Permendikbud No. 21 the Year 2016, four main parts of high school mathematics material: algebra, calculus, geometry and trigonometry, and statistics. According to the result, it was found that 70% of the teachers claimed that the geometry and trigonometry topic was the most challenging topic taught and understood by students through online learning. The reasons underlying the difficulty were high geometrical visualization characteristics that were hard for students, time-consuming to prepare geometry learning media, and many algebraic manipulations and trigonometric charts that required many examples. Furthermore, 25% of teachers stated that calculus was complicated, and only 5% indicated that the algebra topic was complex. The main constraints experienced by teachers in teaching the calculus and algebra topics were elaborate material preparation, time-consuming to make the equations, and difficulty to understand since students lacked understanding of the prerequisite material. Finally, statistics material did not give any obstacles to teachers during online learning.

## 4. Discussion

### 4.1. Difficulties/Constraints Faced by the Teacher

The COVID-19 Pandemic resulted in teachers and students no longer being able to meet in the classroom. The face-to-face learning activities were now turned into distance learning. Online learning was the leading choice to continue learning today since it had various benefits and was most likely implemented during the COVID-19 Pandemic. However, behind the convenience, teachers must quickly adapt to different online learning methods. Therefore, it is expected that teachers faced difficulties during the implementation. Several factors can cause challenges faced by teachers during the execution of online learning. Student, teacher, school, curriculum, and parent factors can cause difficulties faced by teachers [7, 27, 28]. Based

on the findings in this study, teachers faced some difficulties during the implementation of online learning caused by four factors presented in Table 4.

*The main difficulties faced by teachers due to student factors:* students' difficulty to understand the material, students' complain about electricity and internet costs rising, students lacked media to learn online, students' perception to think that online learning did not provide optimal results, and students' lack of motivation in online learning [46]. Mathematics as a subject with abstract material and high-level thinking logic made it difficult for students to understand the material presented through online learning. This difficulty caused students to be less enthusiastic and perceived that the learning they receive is not optimal. The high expenditure due to routine internet access made students also complain about attending online learning. These findings were supported by a study conducted by [27]. They found out that students' ability and learning experience during online learning, financial problems, motivation problem, and isolation from peers became the obstacles in implementing online learning.

Table 4 Difficulties faced by teachers during online learning

Factor	Difficulties That Arise and Are Faced by the Teacher	Percentage	
Students	Students found it difficult to understand the subject matter	95%	
	Students complained about rising electricity and internet costs	75%	
	Some students did not have the technology media to learn online	60%	
	Students felt online learning did not provide optimal results	55%	
	Students felt less enthusiastic in learning online	50%	
	Students felt less interested in online learning	30%	
	Some students could not use technology media	30%	
	Inadequate internet network	5%	
	Teachers	Difficulty to interact with students	100%
		Difficulty to provide feedback	55%
Teachers felt that the benefits of		45%	

	online learning were not optimal	
	Teachers complained about electricity and internet costs raising	40%
	Difficulty to interact with other teachers	30%
	Difficulty to have a consultation with students' parents	25%
	Difficulty and uncomfortable using online media/platforms	25%
	Difficulty in preparing online learning material	25%
	Too much demand from school	15%
	Teachers felt less enthusiastic in providing subject matter	10%
Schools	Schools lacked clear guidelines on online learning technical implementation	55%
	Schools did not provide adequate internet facilities	45%
	School policies did not support the realization of optimal online learning	25%
	Schools did not have an online learning program	5%
Curriculum	Student performance assessment in the curriculum was not included during online learning	75%
	The subject matter is difficult to understand by students through online learning	70%
	The subject was difficult to teach through online learning	55%
	Learning material could not be provided through online learning	5%
Parents	Parents did not supervise their children during online learning	90%
	Parents were busy working and paid less attention to their children	55%
	Parents did not facilitate internet access for their children	25%
	Parents were difficult to contact to make correspondence regarding the development of their children	25%

On the other hand, if the issue was seen from internal factors such as the teacher, the main difficulties were interacting with students and providing feedback. These obstacles appeared because most media or platforms used in online learning were only one-way so that interactions between teachers and students did not occur directly. Moreover, teachers were still accustomed to paper-oriented grading systems, so that teachers found it difficult and took a long time to provide feedback on student performance in soft files. This condition is in line with the result of a study carried out by [27], who found that the main problem faced by teachers in online learning was the assessment and evaluation. Moreover, implementing meaningful reviews and feedback were the challenges of online learning [29, 30].

Meanwhile, the main difficulty of teachers caused by the school factor was that schools did not provide clear guidance on the technical implementation of online learning. This condition caused many teachers to feel still confused about the technical implementation of online learning. As a result, teachers implemented

online learning using their respective perceptions so that there was the various technical implementation of online learning, leading to other obstacles. Besides, some schools did not provide adequate internet facilities, so teachers felt burdened with online learning, which used internet connection [47]. This finding is supported by a study conducted by [10]. They revealed that many teachers experienced technical difficulties organizing online learning and complained about internet facilities.

Besides the school's regulation and condition, the curriculum was also a factor affecting teachers' difficulties implementing online learning. The factors from the curriculum were student performance assessment in the curriculum was not appropriate for the evaluation in online learning. The subject was difficult to understand by students in online learning, and the significant difficulty was that mathematics was challenging to teach during online learning. Furthermore, the changes in the school administration related to students' assessment were a substantial obstacle for teachers because the mandated evaluation in the curriculum was not appropriate to be used during online learning. In addition, the abstract and complicated mathematical material put teachers in a problematic situation to explain to students. This difficulty ultimately led to students' challenges in understanding the topics. Besides, making teaching modules and typing mathematics equations was time-consuming so that it became another obstacle for the teacher. The time constraints of preparing technology-based learning were a big challenge for teachers [31].

The last factor contributing to teachers' difficulty was the parents' factor; namely, the parents were not supervising and paying attention to their children during online learning because they were busy working. This condition caused students to be less severe in participating in online learning. The state of students learning from home made it difficult for teachers to control students' learning activities. Supervision and control of student development during online learning were also very dependent on the role of parents [32].

The difficulties faced by the teachers in this study were primarily due to students and teachers. These findings were in line with [7], who found that students' factors caused the most significant obstacles in implementing online learning. The reason is that students were not accustomed to online learning, and they found it difficult to understand the material using online learning. The obstacles, as mentioned earlier, were also in line with [33], which found that many school teachers had difficulty implementing online learning because of the limitation and lack of experience to implement online learning. Moreover, many teachers still did not understand how to use software and technology in online learning [28]. Lastly, high expenditure and the unavailability of digital

devices become obstacles in online learning [10]. These findings are in line with [34, 35] study that revealed the use of the online platform, study material, ICT tools, internet access still lack during the implementation of online learning.

#### **4.2. Suggestions for Overcoming Difficulties and Improving the Quality of Online Learning**

The implementation of online learning during the COVID-19 Pandemic in Indonesia provided many challenges to education practitioners, including high school mathematics teachers. Based on the findings of this study, it was found that 75% of teachers stated that the application of online mathematics learning had low effectiveness. In comparison, the remaining 25% of teachers noted that online learning was not effective. Moreover, the findings of the questionnaire indicated that 40% of teachers felt that learning goals were not achieved through online learning. In comparison, 10% of teachers perceived the learning objectives were performed, and 50% of teachers felt that some of the learning objectives were achieved, and some others were not. The findings were supported by a study conducted by [10]. They found that online learning was effectively used during a pandemic even though teachers still stated that learning in the classroom was more effective than online learning. There are some suggestions to overcome teachers' obstacles and optimize online learning, as listed below.

1. Building good coordination and communication among teachers, homeroom teachers, students, and parents so students can be well controlled to participate in online learning.

2. Providing training to teachers about the procedures or technical preparation of learning media and practical assessment procedures during online learning. The training can be initiated by the school, government, or in collaboration with certain institutions.

3. Providing adequate facilities for teachers, especially the Internet, is very important in supporting online learning.

4. Promoting the use of online learning media/platforms that support direct communication or two-way interaction so that learning can be more communicative and meaningful.

5. Improving the quality of teachers through self-taught learning or attending seminars/workshops that provide knowledge to maximize online learning.

6. Providing alternative methods and learning media that are varied and interactive to attract students' interest in online learning.

7. The government and schools conduct periodic evaluations of the merits and obstacles in online learning so that the problems can be directly addressed.

Online learning was still the best choice during the current COVID-19 pandemic, so support from various parties was needed [7]. Since all learning activities

were carried out online, the teacher must understand and find an online instruction model suitable for the students' condition and the taught topics [36]. Furthermore, teachers need to understand appropriate learning scenarios for individual, group, and community learning [16, 37]. Some instructional methods selected to implement online learning included lecturing, case studies, debates, discussions, student-led discovery, experiential learning, educational games or competition, brainstorming, and drill and practice [38]. Furthermore, teachers should explore new effective learning methods for online learning [18, 39]. A solution that can be done is to consider online learning media based on two-way interaction. Based on the study by [17], the application of online learning with live broadcasting media provided better learning outcomes than video recording media. Besides, two-way communication technology (synchronous) in online learning can increase students' involvement in learning [40].

The teacher plays a vital role in implementing online learning because he must overcome the difficulties encountered and improve the learning model under the current conditions. Teachers must be given reinforcement and technical guidance to implement online learning [41]. Further, training is needed to improve teachers' ability to use technology and online teaching skills [42]. The training provided could be in the model of workshops for online-based learning software skills, learning management systems skills, and designing attractive, practical, and meaningful learning activities skills [16]. The use of software in learning mathematics is also a matter that teachers must consider because the software positively impacts students' understanding and engagement [43, 44]. Besides, providing internet cost support was also an important thing that can be done to maximize the benefit of online learning because it is an essential thing for online learning. Furthermore, teachers' communication with parents as domestic support about how online learning should be done must also be considered to know their role in helping their children's education [42, 45].

The government must also support online learning success through guidelines for implementing online learning policies. The policies issued by the government determined the success of online learning [20]. The existence of curriculum adjustments to the current conditions of online learning needed attention from related parties. Curriculum implementation conditions that previously emphasized the transfer of knowledge must now lead to the education that encourages students to explore actively and persevere in their performance, train students to collect and process information independently (autonomous learning) with the assistance of technology [32]. Besides, the government must also build good coordination between institutions, schools, research

institutions, families, and communities to create a suitable communication platform, determine adequate learning resources under current conditions, and encourage flexible learning methods for various situations experienced by students [16]. The quality of online learning is very dependent on the support and collaboration among the government, schools, related institutions, and families [16, 41].

The findings in this study provided information and suggestions to the government and various related parties to improve and develop online learning. The conclusions of this study were revealed based on the factual conditions experienced by mathematics teachers. The difficulties felt by the teachers were explored in more detail so that they could enrich the information and knowledge that had also been obtained previously. These difficulties can be caused by the five factors that have been described, so for future improvement, it is necessary to pay attention to these factors. Besides, the difficulties can be minimized by paying attention to suggestions and conditions to achieve optimal results of online learning. The end of the COVID-19 Pandemic, which has not been predicted, makes online learning the primary choice to continue education. Therefore, the implementation of online learning needs attention because this method is not only applied due to the COVID-19 Pandemic, but it also has excellent potential for future learning models such as blended learning or hybrid learning.

### 4.3. Limitations

Regardless of the findings obtained in this study, some limitations may provide the background for further research. This study was conducted during online learning, so the distribution of questionnaires and interviews was shown online. This condition may lead to self-reporting bias. However, researchers have attempted to collect data and validate data well through various communication to participants. Besides, this study is only limited to the perspective of mathematics teachers teaching in Pekanbaru City. This city is the capital city of Riau province, which has adequate access to facilities and infrastructure. Some findings may be different compared to other regional conditions. Therefore, it is possible to carry out further studies from different perspectives or methods so that it is hoped that it can increase the diversity of information to improve education implementation.

## 5. Conclusion

The COVID-19 Pandemic has forced the education sector to close schools and shifted face-to-face learning into online learning. Apart from the advantages of online learning, the transition and application of online learning often created significant difficulties. The teacher, as the primary executor of learning, experienced various obstacles in applying online learning. Difficulties experienced by teachers can be

caused by students, teachers, schools, curriculum, and parents factors. Based on the student factors, teachers' constraints are students' difficulty understanding the material; students' complaints about electricity and internet costs; students' lack of technology media for online learning; and students' low motivation who felt that online learning did not give them optimal results. On the other hand, the obstacles were difficulty interacting with students and difficulty doing and providing feedback from the teachers' factors.

Based on school factors, the obstacles faced by teachers were that schools did not provide clear guidance on the technical aspects of online learning, and there were still schools with inadequate internet facilities. From the curriculum factor, the difficulties experienced by the teachers were inappropriate students' performance assessment in the curriculum for online learning assessment, difficulty to understand material using online learning, and difficulty to teach the subject using online learning. Nevertheless, from the parents' factor, the problem experienced by the teacher was that parents did not give sufficient supervision and attention to their children during online learning because they were busy with their work.

The difficulties faced by teachers can be overcome through some efforts such as: providing adequate internet facility to teachers, enhancing the use of media/platforms that support two-way interaction, providing training to teachers on the technical preparation of learning media, implementation, and adequate assessment according for online learning, increasing coordination and cooperation between the government, schools, teachers, students, and parents to support the effective implementation of online learning. If these efforts have been conducted well, then the performance of online learning will improve success.

Finally, the findings of this study can be used by education policymakers to respond to the impact of the current online learning implementation. Also, this study could be the basis for future formal education to implement blended learning or the combination of face-to-face learning and online learning. However, further studies are suggested to examine the difficulties caused by online learning from students' perspectives and discover the online learning models appropriate and effective for high school mathematics learning.

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