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Journal of Research and Advances in Mathematics Education Volume x, Issue x, xxxxx 2020, pp. xx – xx DOI: p-ISSN: 2503-3697, e-ISSN: 2541-2590 Indonesian Mathematics Teachers' Views on Distance Learning Barriers during the Early Covid-19 Pandemic Hongki Julie1*, Veronika Fitri Rianasari2, Maria Suci Apriani3 1,2,3 Department of Mathematics Education, Sanata Dharma University, Indonesia *Corresponding author: hongkijulie@yahoo.co.id ARTICLE INFO ABSTRACT Article history: The aim of this paper is to describe the views of mathematics teachers in Received: Indonesia on the distance learning barriers during the early Covid-19 Revised: pandemic. Specifically, this paper investigates the barriers that teachers Accepted: view as significant in distance learning and efforts taken to overcome the Published online: Published regularly: barriers during the early Covid-19 pandemic. This study employed a descriptive research design involving 415 mathematics teachers to fill out an online questionnaire. This study shows that barriers related to Keywords: pedagogical dimensions were perceived as significant in distance learning Teachers' views, Distance during the early Covid-19 pandemic. Moreover, this study reveals that Learning, Covid-19 Pandemic most of the teachers did some efforts that can be done by the teachers themselves to overcome the barriers. Based on the findings, we argue that it is important to support teachers' pedagogical competencies to conduct distance learning in order to face this current pandemic or any future crises that may potentially disrupt face-to-face learning. ©2020 Universitas Muhammadiyah Surakarta Introduction The Covid-19 pandemic has brought significant changes to the education system. In early March 2020, Indonesian schools began closing and affecting at least 68 million students (UNESCO, 2020). Addressing this issue, the Indonesian government released distance learning policies during the Covid-19 pandemic. The policies state that distance learning may vary between students, according to their interests and conditions, by considering the gaps in terms of learning access or facilities at home (Surat Edaran Nomor 2 Tentang Pencegahan Dan Penanganan Corona Virus Disease (Covid-19), 2020). This policy has undoubtedly brought significant changes in learning practices, one of which is the change from face-to- face learning to online learning. This rapid transition is certainly a new experience for Indonesian teachers, especially to implement distance learning in a relatively long time. Responding to this, Huang, Liu, Tlili, Yang, & Wang (2020) proposed the idea of flexible learning to accommodate learning during the Covid-19 pandemic. Flexible learning is a learner-centered educational strategy that provides various alternative dimensions of learning, such as location and time of learning, teaching and learning resources, approaches, activities, and assistance for both teachers and students (Huang et al., 2020). In line with this idea, the Indonesian Ministry of Education and Culture (2020) and the World Bank (2020) explained that distance learning should provide meaningful and productive learning experiences for students. Such learning principles are To cite this article: Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Ssttoyples: D0e.f3i8n"i,tiLoenft: section: Indent: First line: 0.38", Tab Journal of Research and Advances in Mathematics Education, x(x), x-x, xxxxxx 2020 important to serve as guidelines for educators in carrying out distance learning in the current pandemic since the rapid adoption of technology during distance learning can be at risk to drive learning to return to old pedagogical practices such as knowledge transfer or discovery without guidance (Bakker & Wagner, 2020). In distance learning, both teachers and students need training on how to make effective use of the learning resources (Perreault et al., 2002). For teachers, the use of technology during this pandemic to maintain education continuity of education is expected to have a significant impact on the quality of learning. However, Aldunate &Nussbaum (2013) found that teachers who are less exposed to technology or who rarely integrate educational technology are less likely to adopt new technology into their classroom instruction. There has been ample research investigating potential barriers that might contribute to teachers' reluctance to adopt new technology. Wachira & Keengwe (2011) found that unavailability and unreliability of technology, lack of proper technology leadership and support, anxiety and low confidence in using technology, as well as poor knowledge on how to take advantage of technology became the major barriers for teachers to integrate technology into their classroom. Another barrier is related to teachers' beliefs. Teachers who have positive beliefs about technology are more likely to integrate technology into

their teaching (Kim et al., 2013; Ottenbreit-Leftwich et al., 2010). In the context of online learning, there were several studies investigating this issue, such as those studies conducted by Assareh & Hosseini Bidokht (2011), Gamdi & Samarji (2016), Safford & Stinton (2016), and Wachira & Keengwe (2011). However, previous research has left several gaps. First, most of the prior research was conducted in normal situations before the Covid-19 pandemic (e.g., Assareh & Hosseini Bidokht, 2011; Gamdi & Samarji, 2016; Safford & Stinton, 2016; Wachira & Keengwe, 2011). Second, most of the studies did not focus on mathematics learning (e.g., Assareh & Hosseini Bidokht, 2011; Gamdi & Samarji, 2016; Safford & Stinton, 2016). In Indonesia, there were only a limited number of studies investigating distance learning barriers during the Covid-19 pandemic (e.g., Mailizar, Almanthari, Maulina, & Bruce, 2020; Rasmitadila et al., 2020) that also left some gaps. The study of Rasmitadila et al. (2020) did not focus on mathematics and only involved primary school teachers as participants. Furthermore, Mailizar et al. (2020) only investigated distance learning barriers during the Covid-19 pandemic from the perspective of secondary school mathematics teachers. Therefore, those studies did not address the views of mathematics teachers in Indonesia at all levels on distance learning barriers during the Covid-19 pandemic. The study was conducted in Indonesia, where both students' and teachers' competency and digital infrastructure remain to be major challenges. The results of the Program for International Student Assessment (PISA), announced in late 2019 by The Organization for Economic Cooperation and Development (OECD), revealed that the ability of Indonesian students in reading, mathematics, and science is still below the OECD average (OECD, 2019). Regarding the teachers' competency, the latest study found that mathematics teachers in Indonesia lacked in ICT knowledge and proficiency, as well as ICT-related pedagogical content knowledge (Mailizar & Fan, 2020). In digital infrastructure, Indonesia's quality of connections is low (Hootsuite and We Are Social, 2020). Moreover, the number of internet users in urban and rural areas is significantly different in 2018, with only 31.25% in rural areas and 68.75% in urban areas (Sub Directorate of Communications and Information Technology, 2020). Therefore, it is important to investigate distance learning barriers of Indonesian mathematics teachers in implementing distance learning during the Covid-19 pandemic. http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), xxxx 2020, x-x 3 This present study is aimed to describe the views of mathematics teachers in Indonesia on the distance learning barriers during the early pandemic. This study provides valuable insights into the implementation of distance learning during the pandemic. This study will investigate two questions as follows: (1) What are the barriers that Indonesian mathematics teachers perceive as significant in distance learning during the early Covid-19 pandemic?; (2) What are the efforts taken by Indonesian mathematics teachers to overcome distance learning barriers during the early Covid-19 pandemic? Research Method Research Design This study employed descriptive research design. Within a descriptive research design, the researchers are able to describe a phenomenon and its features (Nassaji, 2015). Participants In order to obtain a large number of responses in the online survey, this study employed snowball sampling and involved 415 participants (142 males and 272 females). The demography of the participants is illustrated in the diagrams below. The number of teachers per region Teachers' school level 6.51% 4.10% 11.33% 10.60% 4.82% Sumatera Elementary school Jawa Kalimantan Middle school Bali dan Nusa Tenggara 73.25% Sulawesi, Maluku, and Papua 53.73% 35.66% High school Age of the teachers Teachers' academic qualifications 13.25% 0.24% 16.63% 14.22% 39.76% Under 30 years Diplomas 30 - 40 years Undergraduate degrees 41 - 50 years 32.77% Over 50 years 83.13% Graduate degrees Only 63.9% of the 415 participants in this study had experience with distance or online learning prior to the Covid-19 pandemic. Additionally, 9.9% of the participants did not facilitate distance learning. However, it does not imply that the teachers discontinue students' learning activities. They might use learning strategies that did not involve the use of technology, for example, by visiting the students' house, sharing modules with their students, or combining both. This could be due to the lack of ICT skills in Indonesian teachers and uneven internet access in the country. Data Collection http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), x-x, xxxxxx 2020 In collecting the data, an online questionnaire was employed because it can be readily distributed to a large number of people via a variety of online platforms (Fraenkel, Wallen, & Hyun, 2012). The researchers' social media were used to distribute the online questionnaire. The authors open the questionnaire from April 16 to April 30, 2020. To address the research questions, the data sources for this paper focused on the second part of the questionnaire that used partially open-ended questions and also closed-ended questions using the Likert scale. Partially open-ended questions were used because this type of question offers several possible answers and provides room for additional responses (Gliner et al., 2016). In designing the questionnaire, the items were reviewed by some colleagues. The questions are as follow: (1) What are the barriers that Indonesian mathematics teachers view as significant to distance learning during the early Covid-19 pandemic?; (2) What are the efforts taken by Indonesian mathematics teachers to overcome distance learning barriers during the early Covid-19 pandemic?; (3) Do the solutions help overcome the barriers?; (4) Do you feel that the distance learning that you are currently doing is more challenging than face-to-face learning at school?. The first two questions are partially open-ended and the rest are Likert scale questions. Data Analysis The responses to the first two questions above resulted in a list of answers. These responses were analyzed using Miles, Huberman, & Saldana's (2014) qualitative data analysis framework, which included data condensation, data display, as well as conclusion drawing and verification. Descriptive statistics were also used to analyze the responses, particularly those from Likert scale questions. Results Distance learning barriers during Covid-19 pandemic The participants were asked to mention the learning barriers that they encountered during the Covid-19 pandemic (Table 1). Since the item is a partially open-ended question, they can choose the answers from the given choices or write their answers in the given space. Some examples of respondents' answer to the question "What are the barriers that Indonesian mathematics teachers view as significant to distance learning during the early Covid-19 pandemic?" are as follows: "Menyusun materi pelajaran agar dapat disampaikan melalui pengajaran jarak jauh; Mendesain pembelajaran matematika yang berpusat pada siswa; Memilih sarana pembelajaran jarak jauh yang efektif; Memilih sarana pembelajaran jarak jauh yang efisien; Mengoperasikan sarana pembelajaran jarak jauh yang berbasis teknologi; Melakukan kegiatan pembelajaran jarak jauh yang membuat siswa terlibat

aktif; Melakukan kegiatan pembelajaran jarak jauh yang membuat siswa berpikir kritis; Melakukan kegiatan pembelajaran jarak jauh yang membuat siswa berpikir kreatif; Memotivasi siswa agar mampu belajar mandiri; Melakukan evaluasi pembelajaran yang autentik; Pembelajaran tidak berjalan lancar karena jaringan internet yang lemah (Developing subject matter so that it can be delivered through distance teaching; Designing student-centered mathematics learning; Choosing effective distance learning tools; Choosing efficient distance learning tools; Operating technology-based distance learning facilities; Conducting distance learning activities that make students actively involved; Conducting distance learning activities that make students think critically; Conducting distance learning activities that make students think creatively; Motivating students to be able to learn independently; Conducting an authentic http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), xxxx 2020, x-x 5 learning evaluation; Learning does not run smoothly because of the weak internet network)". Table 1 shows that more than 50% of the teachers perceived that designing lessons in distance learning, motivating students to learn independently, choosing an effective distance learning platform, encouraging students to engage in distance learning, and having weak internet connection are the barriers during the Covid-19 pandemic. Around 40% to 46% of the participants mentioned that promoting students' critical thinking, choosing an efficient learning platform, encouraging students to think critically, conducting authentic-learning evaluations, and operating technology-based learning tools are barriers in conducting distance learning during the Covid-19 pandemic. Table 1 Distance learning barriers during Covid-19 pandemic (n = 374) Distance learning barriers Number of participants % Designing lessons so that they can be delivered through 254 67.91 distance learning Motivating students to be able to learn independently 242 64.71 Choosing an effective distance learning platform 227 60.70 Encouraging students to be actively engaged in distance 211 56.42 learning Having weak internet connection 209 55.88 Designing student-centered learning 202 54.01 Promoting students' critical thinking during distance learning 171 45.72 Choosing an efficient distance learning platform 171 45.72 Encouraging students to think critically in distance learning 157 41.98 Conducting authentic-learning evaluations 153 40.91 Operating technology-based distance learning tools 151 40.37 Lack of online learning facilities owned by students 6 1.60 Time spent in preparing distance learning 1 0.27 Maintaining students' concentration during distance learning 1 0.27 Maintaining the physical health of teachers 1 0.27 Students' indiscipline during distance learning 1 0.27 Moreover, to further analyze the sixteen barriers in Table 1, the barriers are classified into two classifications, namely the pedagogical dimensions and non-pedagogical dimensions. This classification was made based on the consideration that distance or online learning does require not only infrastructural or logistic support (e.g., internet connection and technological devices) but also pedagogical support so that teachers can effectively integrate technology into learning design (Gamdi & Samarji, 2016). Table 2 shows that around 98% of the teachers perceived barriers related to pedagogical dimensions and around 70% of the teachers perceived non-pedagogical barriers during distance learning. Table 2 Classification of distance learning barriers during Covid-19 pandemic (n = 374) Barriers classification Description of barriers Number of participants % Pedagogical dimensions Designing lessons so that they can be 366 97.86 delivered through distance learning; Motivating students to be able to learn independently; Encouraging students to be actively engaged in distance learning; Designing student-centered learning; Promoting students' critical thinking during distance learning; Encouraging students to think critically in distance http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), x-x, xxxxxx 2020 learning; Conducting authentic-learning evaluations; Maintaining students concentration during distance learning; Non-pedagogical Choosing an effective distance learning 260 69.52 dimensions platform; Choosing an efficient distance learning platform; Weak internet connection; Lack of online learning facilities owned by students; Students' indiscipline during distance learning; Operating technology-based distance learning tools; Time spent in preparing distance learning Efforts that teachers took to overcome distance learning barriers during the Covid-19 pandemic After investigating barriers perceived by teachers during distance learning, the participants were asked to mention the efforts that they did to overcome the barriers (Table 3). Table 3 shows that approximately 75% to 78% of the teachers overcome the barriers by learning independently from available sources and using available resources. Accounted around 50% to 52% of the teachers collaborate with mathematics teachers from the same school and learn from teachers from the same school. Moreover, teachers overcome the barriers by learning from mathematics teachers from other schools (approximately 39%) and collaborating with mathematics teachers from other schools (approximately 32%). For less than 20% of the participants, the efforts are taking online courses on managing distance learning and collaborating with students and parents. Table 3 Efforts taken to overcome distance learning barriers during Covid-19 pandemic (n = 374) Efforts Number of participants % Using available resources 290 77.54 Learning independently from available sources 282 75.40 Collaborating with mathematics teachers from the same school 193 51.60 Learning from teachers from the same school 168 44.92 Learning from mathematics teachers from other schools 146 39.04 Collaborating with mathematics teachers from other schools 119 31.82 Taking online courses on managing distance learning 72 19.25 Collaborating with students 2 0.53 Collaborating with parents 1 0.27 Furthermore, the teachers were asked whether the efforts done helped them to overcome the barriers. Figure 1 shows that around 80% of the teachers perceived that their efforts helped them overcome the barriers during distance learning. Moreover, to provide better insights towards their experience in doing the transition from face-to-face learning to distance learning, they were asked whether distance learning during the pandemic was more challenging than face-to-face learning. Figure 2 shows that more than 60% of the teachers agree that distance learning is more challenging. http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), xxxx 2020, x-x 7 60.00% 50.00% 40.00% 30.00% 20.00% 10.00% 0.00% Not at all Slightly Somewhat Very helpful Extremely helpful helpful helpful helpful Figure 1. Teachers' view toward the efforts taken 40.00% 35.00% 30.00% 25.00% 20.00% 15.00% 10.00% 5.00% 0.00% Strongly Disagree Neutral Agree Strongly Disagree Agree Figure 2. Teachers' view toward the complexity of distance learning Discussion The analysis of the teachers' responses reveals two points of discussion. First, the study revealed that most of the barriers perceived by at least 40% of the participants are related to the pedagogical dimensions of distance learning. Those barriers are designing

lessons in distance learning, motivating students to learn independently, encouraging students to be active, designing student-centered learning, promoting students' critical and creative thinking, and conducting authentic evaluations. This finding confirms the results of previous studies regarding the need to support the teachers' pedagogical dimension in implementing online learning (Simuth & Sarmany-Schuller, 2012) and also in distance learning (Ascough, 2002). Specifically, Ascough (2002) argued that the use of technology in online or distance learning should be based on sound pedagogical principles. However, this finding did not imply that overcoming barriers related to technology is not an important factor to be considered. Moreover, these barriers also confirm the previous study, which reveals that the social challenges related to the lack of human interaction between teachers and students and http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), x-x, xxxxxx 2020 among the students were perceived as one of the challenges during the emergency remote learning (Ferri et al., 2020). The other barriers perceived by at least 40% of the participants are related to poor internet access, choosing an effective and efficient distance learning platform and operating technology-based distance learning tools. Overcoming these barriers is mandatory in order to enable teachers to focus more on the pedagogical dimensions of learning (Gamdi & Samarji, 2016) so that teachers can facilitate meaningful learning interaction in distance learning. To facilitate meaningful learning interaction, teachers need to emphasize social presence (a feeling of connectedness), cognitive presence (promote students' knowledge construction), and teaching presence (facilitation of student learning) (Jia et al., 2020). Moreover, Apriani et al. (2021) revealed that communication between teacher and student's parent through home visit become teachers' solution to facilitate meaningful learning interaction in distance learning. Combining the findings of this study with the earlier findings (Rianasari et al., 2021), the researchers found that their struggles related to pedagogical aspects of distance learning might become a reasonable reason for them to choose teacher- centered learning as their main learning approach. Second, in Table 3, it is found that there are nine efforts that have been made by the teachers to overcome the barriers that they encountered, and the most effort done by the teachers is using available resources. The researchers divided the efforts made by the teachers into two parts, namely the efforts that can be done by the teachers themselves and the efforts that require assistance or collaboration with other parties. There are three out of nine efforts that can be done by the teacher themselves, namely using available resources, learning independently from available sources, and taking online courses on managing distance learning. Only around 20% of the teachers took online courses on managing distance learning because this effort needs financial support from schools or the government. The two most efforts carried out by teachers are efforts that can be done by the teachers themselves. When teachers conducted independent learning from sources that the teachers can access, they can adjust the learning resources to their needs in managing online learning. This results in the high success rate of teachers in understanding these sources. To carry out the other six efforts, teachers cannot work alone because they need help and collaboration with their colleagues from their own school or other schools, students, and parents. In this study, the teachers were also asked whether the efforts helped the teachers to overcome the barriers. The answer to this question is presented in the form of a bar chart and can be seen in Figure 1. Approximately 80% of the participants said that their efforts helped them overcome the barriers. When these results are connected to those obtained in Table 3, then it can be explained why the efforts made by the teachers are helpful in overcoming the barriers, since, from the nine efforts made by the teachers, the two most efforts are efforts made by the teachers themselves. Because this effort was carried out by the teachers themselves, they can find out what their problems are, and they can look for learning resources that can help them to overcome the barriers. As a result, the efforts they made are indeed helpful to overcome the barriers they encounter. The findings are in line with the findings which revealed that one of the efforts that must be made by teachers in managing online learning is that teachers need to learn independently about how to design online learning and teach online (Perreault et al., 2002). Through the independent learning process, teachers can look for learning resources that match their needs in managing online learning. http://journals.ums.ac.id/index.php/jramathedu Journal of Research and Advances in Mathematics Education, x(x), xxxx 2020, x-x 9 Conclusion This study reveals that barriers related to pedagogical dimensions were perceived as the significant factors hindering the implementation of distance learning during the Covid-19 pandemic. Specifically, the teachers were struggling to design mathematics lessons that motivate students to learn independently and promote students' active participation, creative and critical thinking. Moreover, this study also reveals that to overcome the barriers, most of the teachers did some efforts that can be done by the teachers themselves, namely using available resources and learning independently from available sources. This means that in the early pandemic, teachers worked with what they knew and with the available resources they had in order to ensure the continuity of learning while upgrading their knowledge and skills to conduct distance learning. The findings of this study suggest that more training is needed to support teachers' pedagogical competencies to conduct distance learning in order to deal with the current pandemic or any future crises that may potentially disrupt face-to-face learning. 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Indonesian Mathematics Teachers' Views on Distance Learning Barriers during the Early Covid-19 Pandemic

Hongki Julie[1*], Veronika Fitri Rianasari[2], Maria Suci Apriani[3]

[1,2,3] *Department of Mathematics Education, Sanata Dharma University, Indonesia*

*Corresponding author: hongkijulie@yahoo.co.id

ABSTRACT

The aim of this paper is to describe the views of mathematics teachers in Indonesia on the distance learning barriers during the early Covid-19 pandemic. Specifically, this paper investigates the barriers that teachers view as significant in distant learning and efforts taken to overcome the barriers during the early Covid-19 pandemic. This study employed a descriptive research design involving 415 mathematics teachers to fill out an online questionnaire. This study shows that barriers related to pedagogical dimensions were perceived as significant in distance learning during the early Covid-19 pandemic. Moreover, this study reveals that most of the teachers did some effort that can be done by the teachers themselves to overcome the barriers. Based on the findings, we argue that it is important to support teachers' pedagogical competencies to conduct distance learning in order to face this current pandemic or any future crises that may potentially disrupt face-to-face learning.

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Introduction

The Covid-19 pandemic has brought significant changes to the education system. In early March 2020, Indonesian schools began closing and affecting at least 68 million students (UNESCO, 2020). Addressing this issue, the Indonesian government released distance learning policies during the Covid-19 pandemic. The policies state that distance learning may vary between students, according to their interest and conditions, by considering the gaps in terms of learning access or facilities at home (Surat Edaran Nomor 2 Tentang Pencegahan Dan Penanganan Corona Virus Disease (Covid-19), 2020). This policy has undoubtedly brought significant changes in learning practices, one of which is the change from face-to-face learning to online learning.

This rapid transition is certainly a new experience for Indonesian teachers, especially to implement distance learning in a relatively long time. Responding to this, Huang, Liu, Tlili, Yang, & Wang (2020) proposed the idea of flexible learning to accommodate learning during the Covid-19 pandemic. Flexible learning is a learner-centered educational strategy that provides various alternative dimensions of learning, such as location and time of learning, teaching and learning resources, approaches, activities and assistance for both teachers and students (Huang et al., 2020). In line with this idea, the Indonesian Ministry of Education and Culture (2020) and the World Bank (2020) explained that distance learning should provide meaningful and productive learning experiences for students. Such learning principles are

important to serve as guidelines for educators in carrying out distance learning in the current pandemic since the rapid adoption of technology during distance learning can be at risk to drive learning to return to old pedagogical practices such as knowledge transfer or discovery without guidance (Bakker & Wagner, 2020).

In distance learning, both teachers and students need training on how to make effective use of the learning resources (Perreault et al., 2002). For teachers, the use of technology during this pandemic to maintain education continuity of education is expected to have a significant impact on the quality of learning. However, Aldunate & Nussbaum (2013) found that teachers who are less exposed to technology or who rarely integrate educational technology are less likely to adopt new technology into their classroom instruction. There has been ample research investigating potential barriers that might contribute to teachers' reluctance to adopt new technology. Wachira & Keengwe (2011) found that unavailability and unreliability of technology, lack of proper technology leadership and support, anxiety and low confidence in using technology, as well as poor knowledge on how to take advantage of technology became the major barriers for teachers to integrate technology into their classroom. Another barrier is related to teachers' beliefs. Teachers who have positive beliefs about technology are more likely to integrate technology into their teaching (Kim et al., 2013; Ottenbreit-Leftwich et al., 2010).

In the context of online learning, there were several studies investigating this issue, such as those studies conducted by Assareh & Hosseini Bidokht (2011), Gamdi & Samarji (2016), Safford & Stinton (2016), and Wachira & Keengwe (2011). However, previous research has left several gaps. First, most of the prior research was conducted in normal situations before the Covid-19 pandemic (e.g., Assareh & Hosseini Bidokht, 2011; Gamdi & Samarji, 2016; Safford & Stinton, 2016; Wachira & Keengwe, 2011). Second, most of the studies did not focus on mathematics learning (e.g., Assareh & Hosseini Bidokht, 2011; Gamdi & Samarji, 2016; Safford & Stinton, 2016).

In Indonesia, there are only a limited number of studies investigating distance learning barriers during the Covid-19 pandemic (e.g., Mailizar, Almanthari, Maulina, & Bruce, 2020; Rasmitadila et al., 2020) that also left some gaps. The study of Rasmitadila et al. (2020) did not focus on mathematics and only involved primary school teachers as participants. Furthermore, Mailizar et al. (2020) only investigated distance learning barriers during the Covid-19 pandemic from the perspective of secondary school mathematics teachers. Therefore, those studies did not address the views of mathematics teachers in Indonesia at all levels on distance learning barriers during the Covid-19 pandemic.

The study was conducted in Indonesia, where both students' and teachers' competency and digital infrastructure remain to be major challenges. The results of the Program for International Student Assessment (PISA), announced in late 2019 by The Organization for Economic Cooperation and Development (OECD), revealed that the ability of Indonesian students in reading, mathematics, and science is still below the OECD average (OECD, 2019). Regarding the teachers' competency, the latest study found that mathematics teachers in Indonesia lacked in ICT knowledge and proficiency, as well as ICT-related pedagogical content knowledge (Mailizar & Fan, 2020). In digital infrastructure, Indonesia's quality of connections is low (Hootsuite and We Are Social, 2020). Moreover, the number of internet users in urban and rural areas is significantly different in 2018, with only 31.25% in rural areas and 68.75% in urban areas (Sub Directorate of Communications and Information Technology, 2020). Therefore, it is important to investigate distance learning barriers of Indonesian mathematics teachers in implementing distance learning during the Covid-19 pandemic.

This present study is aimed to describe the views of mathematics teachers in Indonesia on the distance learning barriers during the early pandemic. This study provides valuable insights into the implementation of distance learning during the pandemic. This study will investigate two questions as follows: (1) What are the barriers that Indonesian mathematics teachers perceive as significant in distance learning during the early Covid-19 pandemic?; (2) What are the efforts taken by Indonesian mathematics teachers to overcome distance learning barriers during the early Covid-19 pandemic?
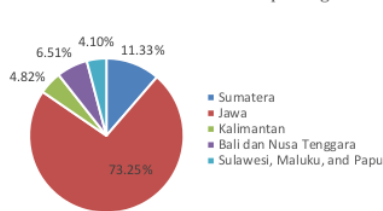
Research Method

Research Design

This study employed descriptive research design. Within a descriptive research design, the researchers are able to describe a phenomenon and its features (Nassaji, 2015).
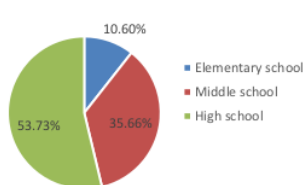
Participants

In order to obtain a large number of responses in the online survey, this study employed snowball sampling and involved 415 participants (142 males and 272 females). The demography of the participants is illustrated in the diagrams below.
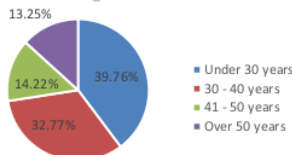
The number of teachers per region

- Sumatera
- Jawa
- Kalimantan
- Bali dan Nusa Tenggara
- Sulawesi, Maluku, and Papu

11.33%
4.10%
6.51%
4.82%
73.25%

Teachers' school level

- Elementary school
- Middle school
- High school

10.60%
35.66%
53.73%

Age of the teachers

- Under 30 years
- 30 - 40 years
- 41 - 50 years
- Over 50 years

13.25%
39.76%
14.22%
32.77%

Teachers' academic qualifications

- Diplomas
- Undergraduate degrees
- Graduate degrees

0.24%
16.63%
83.13%

Only 63.9% of the 415 participants in this study had experience with distance or online learning prior to the Covid-19 pandemic. Additionally, 9.9% of the participants did not facilitate distance learning. However, it does not imply that the teachers discontinue students' learning activities. They might use learning strategies that did not involve the use of technology, for example, by visiting the students' house, sharing modules with their students, or combining both. This could be due to the lack of ICT skills in Indonesian teachers and uneven internet access in the country.

Data Collection

In collecting the data, an online questionnaire was employed because it can be readily distributed to a large number of people via a variety of online platforms (Fraenkel, Wallen, & Hyun, 2012). The researchers' social media were used to distribute the online questionnaire. The authors open the questionnaire from April 16 to April 30, 2020. To address the research questions, the data sources for this paper focused on the second part of the questionnaire that used partially open-ended questions and also closed-ended questions using the Likert scale. Partially open-ended questions were used because this type of question offers several possible answers and provides room for additional responses (Gliner et al., 2016). In designing the questionnaire, the items were reviewed by some colleagues. The questions are as follow: (1) What are the barriers that Indonesian mathematics teachers view as significant to distance learning during the early Covid-19 pandemic?; (2) What are the efforts taken by Indonesian mathematics teachers to overcome distance learning barriers during the early Covid-19 pandemic?; (3) Do the solutions help overcome the barriers?; (4) Do you feel that the distance learning that you are currently doing is more challenging than face-to-face learning at school?. The first two questions are partially open-ended and the rest are Likert scale questions.

Data Analysis

The responses to the first two questions above resulted in a list of answers. These responses were analyzed using Miles, Huberman, & Saldana's (2014) qualitative data analysis framework, which included data condensation, data display, as well as conclusion drawing and verification. Descriptive statistics were also used to analyze the responses, particularly those from Likert scale questions.

Results

Distance learning barriers during Covid-19 pandemic

The participants were asked to mention the learning barriers that they encountered during the Covid-19 pandemic (Table 1). Since the item is a partially open-ended question, they can choose the answers from the given choices or write their answers in the given space. Some examples of respondents' answer to the question "What are the barriers that Indonesian mathematics teachers view as significant to distance learning during the early Covid-19 pandemic?" are as follows:

"*Menyusun materi pelajaran agar dapat disampaikan melalui pengajaran jarak jauh; Mendesain pembelajaran matematika yang berpusat pada siswa; Memilih sarana pembelajaran jarak jauh yang efektif; Memilih sarana pembelajaran jarak jauh yang efisien; Mengoperasikan sarana pembelajaran jarak jauh yang berbasis teknologi; Melakukan kegiatan pembelajaran jarak jauh yang membuat siswa terlibat aktif; Melakukan kegiatan pembelajaran jarak jauh yang membuat siswa berpikir kritis; Melakukan kegiatan pembelajaran jarak jauh yang membuat siswa berpikir kreatif; Memotivasi siswa agar mampu belajar mandiri; Melakukan evaluasi pembelajaran yang autentik; Pembelajaran tidak berjalan lancar karena jaringan internet yang lemah* (Developing subject matter so that it can be delivered through distance teaching; Designing student-centered mathematics learning; Choosing effective distance learning tools; Choosing efficient distance learning tools; Operating technology-based distance learning facilities; Conducting distance learning activities that make students actively involved; Conducting distance learning activities that make students think critically; Conducting distance learning activities that make students think creatively; Motivating students to be able to learn independently; Conducting an authentic

learning evaluation; Learning does not run smoothly because of the weak internet network)".

Table 1 shows that more than 50% of the teachers perceived that designing lessons in distance learning, motivating students to learn independently, choosing an effective distance learning platform, encouraging students to engage in distance learning, and having weak internet connection are the barriers during the Covid-19 pandemic. Around 40% to 46% of the participants mentioned that promoting students' critical thinking, choosing an efficient learning platform, encouraging students to think critically, conducting authentic-learning evaluations, and operating technology-based learning tools are barriers in conducting distance learning during the Covid-19 pandemic.

Table 1

Distance learning barriers during Covid-19 pandemic (n = 374)

Distance learning barriers	Number of participants	%
Designing lessons so that they can be delivered through distance learning	254	67.91
Motivating students to be able to learn independently	242	64.71
Choosing an effective distance learning platform	227	60.70
Encouraging students to be actively engaged in distance learning	211	56.42
Having weak internet connection	209	55.88
Designing student-centered learning	202	54.01
Promoting students' critical thinking during distance learning	171	45.72
Choosing an efficient distance learning platform	171	45.72
Encouraging students to think critically in distance learning	157	41.98
Conducting authentic-learning evaluations	153	40.91
Operating technology-based distance learning tools	151	40.37
Lack of online learning facilities owned by students	6	1.60
Time spent in preparing distance learning	1	0.27
Maintaining students' concentration during distance learning	1	0.27
Maintaining the physical health of teachers	1	0.27
Students' indiscipline during distance learning	1	0.27

Moreover, to further analyze the sixteen barriers in Table 1, the barriers are classified into two classifications, namely the pedagogical dimensions and non-pedagogical dimensions. This classification was made based on the consideration that distance or online learning does require not only infrastructural or logistic support (e.g., internet connection and technological devices) but also pedagogical support so that teachers can effectively integrate technology into learning design (Gamdi & Samarji, 2016). Table 2 shows that around 98% of the teachers perceived barriers related to pedagogical dimensions and around 70% of the teachers perceived non-pedagogical barriers during distance learning.

Table 2

Classification of distance learning barriers during Covid-19 pandemic (n = 374)

Barriers classification	Description of barriers	Number of participants	%
Pedagogical dimensions	Designing lessons so that they can be delivered through distance learning; Motivating students to be able to learn independently; Encouraging students to be actively engaged in distance learning; Designing student-centered learning; Promoting students' critical thinking during distance learning; Encouraging students to think critically in distance	366	97.86

	learning; Conducting authentic-learning evaluations; Maintaining students concentration during distance learning; Choosing an effective distance learning platform; Choosing an efficient distance learning platform; Weak internet connection; Lack of online learning facilities owned by students; Students' indiscipline during distance learning; Operating technology-based distance learning tools; Time spent in preparing distance learning		
Non-pedagogical dimensions		260	69.52

Efforts that teachers took to overcome distance learning barriers during the Covid-19 pandemic

After investigating barriers perceived by teachers during distance learning, the participants were asked to mention the efforts that they did to overcome the barriers (Table 3). Table 3 shows that approximately 75% to 78% of the teachers overcome the barriers by learning independently from available sources and using available resources. Accounted around 50% to 52% of the teachers collaborate with mathematics teachers from the same school and learn from teachers from the same school. Moreover, teachers overcome the barriers by learning from mathematics teachers from other schools (approximately 39%) and collaborating with mathematics teachers from other schools (approximately 32%). For less than 20% of the participants, the efforts are taking online courses on managing distance learning and collaborating with students and parents.

Table 3
Efforts taken to overcome distance learning barriers during Covid-19 pandemic (n = 374)

Efforts	Number of participants	%
Using available resources	290	77.54
Learning independently from available sources	282	75.40
Collaborating with mathematics teachers from the same school	193	51.60
Learning from teachers from the same school	168	44.92
Learning from mathematics teachers from other schools	146	39.04
Collaborating with mathematics teachers from other schools	119	31.82
Taking online courses on managing distance learning	72	19.25
Collaborating with students	2	0.53
Collaborating with parents	1	0.27

Furthermore, the teachers were asked whether the efforts done helped them to overcome the barriers. Figure 1 shows that around 80% of the teachers perceived that their efforts helped them overcome the barriers during distance learning. Moreover, to provide better insights towards their experience in doing the transition from face-to-face learning to distance learning, they were asked whether distance learning during the pandemic was more challenging than face-to-face learning. Figure 2 shows that more than 60% of the teachers agree that distance learning is more challenging.
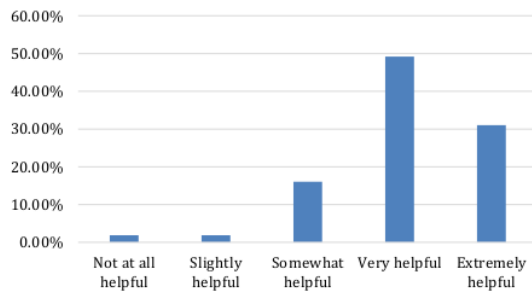
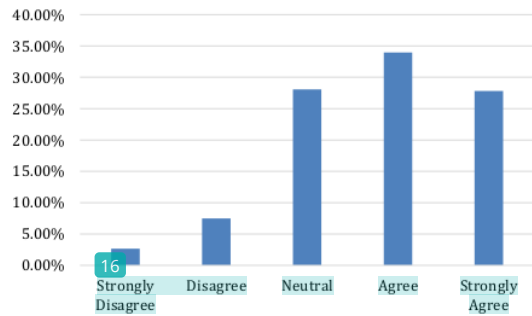**Figure 1.** Teachers' view toward the efforts taken

Figure 2. Teachers' view toward the complexity of distance learning

Discussion

The analysis of the teachers' responses reveals two points of discussion. First, the study revealed that most of the barriers perceived by at least 40% of the participants are related to the pedagogical dimensions of distance learning. Those barriers are designing lessons in distance learning, motivating students to learn independently, encouraging students to be active, designing student-centered learning, promoting students' critical and creative thinking, and conducting authentic evaluations. This finding confirms the results of previous studies regarding the need to support the teachers' pedagogical dimension in implementing online learning (Simuth & Sarmany-Schuller, 2012) and also in distance learning (Ascough, 2002). Specifically, Ascough (2002) argued that the use of technology in online or distance learning should be based on sound pedagogical principles. However, this finding did not imply that overcoming barriers related to technology is not an important factor to be considered. Moreover, these barriers also confirm the previous study, which reveals that the social challenges related to the lack of human interaction between teachers and students and

among the students were perceived as one of the challenges during the emergency remote learning (Ferri et al., 2020).

The other barriers perceived by at least 40% of the participants are related to poor internet access, choosing an effective and efficient distance learning platform and operating technology-based distance learning tools. Overcoming these barriers is mandatory in order to enable teachers to focus more on the pedagogical dimensions of learning (Gamdi & Samarji, 2016) so that teachers can facilitate meaningful learning interaction in distance learning. To facilitate meaningful learning interaction, teachers need to emphasize social presence (a feeling of connectedness), cognitive presence (promote students' knowledge construction), and teaching presence (facilitation of student learning) (Jia et al., 2020). Moreover, Apriani et al. (2021) revealed that communication between teacher and student's parent through home visit become teachers' solution to facilitate meaningful learning interaction in distance learning. Combining the findings of this study with the earlier findings (Rianasari et al., 2021), the researchers found that their struggles related to pedagogical aspects of distance learning might become a reasonable reason for them to choose teacher-centered learning as their main learning approach.

Second, in Table 3, it is found that there are nine efforts that have been made by the teachers to overcome the barriers that they encountered, and the most effort done by the teachers is using available resources. The researchers divided the efforts made by the teachers into two parts, namely the efforts that can be done by the teachers themselves and the efforts that require assistance or collaboration with other parties. There are three out of nine efforts that can be done by the teacher themselves, namely using available resources, learning independently from available sources, and taking online courses on managing distance learning. Only around 20% of the teachers took online courses on managing distance learning because this effort needs financial support from schools or the government. The two most efforts carried out by teachers are efforts that can be done by the teachers themselves. When teachers conducted independent learning from sources that the teachers can access, they can adjust the learning resources to their needs in managing online learning. This results in the high success rate of teachers in understanding these sources. To carry out the other six efforts, teachers cannot work alone because they need help and collaboration with their colleagues from their own school or other schools, students, and parents.

In this study, the teachers were also asked whether the efforts helped the teachers to overcome the barriers. The answer to this question is presented in the form of a bar chart and can be seen in Figure 1. Approximately 80% of the participants said that their efforts helped them overcome the barriers. When these results are connected to those obtained in Table 3, then it can be explained why the efforts made by the teachers are helpful in overcoming the barriers, since, from the nine efforts made by the teachers, the two most efforts are efforts made by the teachers themselves. Because this effort was carried out by the teachers themselves, they can find out what their problems are, and they can look for learning resources that can help them to overcome the barriers. As a result, the efforts they made are indeed helpful to overcome the barriers they encounter.

The findings are in line with the findings which revealed that one of the efforts that must be made by teachers in managing online learning is that teachers need to learn independently about how to design online learning and teach online (Perreault et al., 2002). Through the independent learning process, teachers can look for learning resources that match their needs in managing online learning.

Conclusion

This study reveals that barriers related to pedagogical dimensions were perceived as the significant factors hindering the implementation of distance learning during the Covid-19 pandemic. Specifically, the teachers were struggling to design mathematics lessons that motivate students to learn independently and promote students' active participation, creative and critical thinking. Moreover, this study also reveals that to overcome the barriers, most of the teachers did some efforts that can be done by the teachers themselves, namely using available resources and learning independently from available sources. This means that in the early pandemic, teachers worked with what they knew and with the available resources they had in order to ensure the continuity learning while upgrading their knowledge and skills to conduct distance learning. The findings of this study suggest that more training is needed to support teachers' pedagogical competencies to conduct distance learning in order to deal with the current pandemic or any future crises that may potentially disrupt face-to-face learning.

Acknowledgement

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