Prospective elementary teachers’ perspectives on online mathematics learning during coronavirus outbreak

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Abstract. Coronavirus disease (COVID-19) outbreaks have changed learning models from face-to-face to online learning. This change has an impact on students’ readiness in participating in learning. To deal with this situation, this study aims to investigate prospective elementary teachers’ perspective on online mathematics learning. Thirty-eight prospective elementary teachers from a public teacher institution in Pekanbaru, Riau, Indonesia, participated in this study. The informants were asked to answer an open question at the end of the course related to their views on online mathematics learning during COVID-19 pandemic. The findings showed that the online course was less effective due to poor internet connection and limited internet quota. Those problems affected their performance on understanding the mathematics contents, interacting with the teacher and other students, and doing assignments. However, few prospective teachers provided positive attitude toward online mathematics learning. An implication for this study was the government must intervene and provide support for online learning success.

1. Introduction

The education system has changed due to Coronavirus disease (COVID-19) outbreaks. Traditional or on-site learning has become an online learning model. The change occurs in all educational levels, from kindergarten to university. The Indonesian Ministry of Education and Culture has made a policy to let students study from home [1]. Consequently, teachers and teacher educators have to develop several online learning models to support their students to learn from home.

Many previous studies have paid attention to the use of digital technology in education [2] and especially in mathematics education [3]–[9]. Loong and Herbert [4] found that the method of using digital technology in the classroom is a complex one. The developmental stage of teachers’ technological, pedagogical, and content knowledge (TPACK) determines how competence and knowledgeable the teachers are in selecting digital technology for substituting, augmenting, modifying and redesigning mathematical tasks for deep learning and higher-order thinking [4]. Meanwhile, a recent study conducted by Mailizar et al., [10] found that Indonesian secondary mathematics teachers faced a major challenge using digital technology as an instructional resource during the COVID-19 pandemic. Teachers’ most critical obstacles came at the student stage, including student lack of knowledge and e-learning abilities, and their lack of exposure to computers and internet connectivity. This situation could lead students’ difficulties to learn in this challenging period and even further [10].

Concerning the use of digital technology in teacher education in the time of COVID-19 pandemic, this study is interested in evaluating prospective elementary teachers’ perspectives on online mathematics learning. We focus the analysis of teachers’ perspectives on technology, didactical and pedagogical aspects, and mathematics knowledge. Therefore, the main research question for this study is to examine what teachers’ view about online mathematics learning during coronavirus outbreak.
2. Methods
This study was based on qualitative internet-based research method [11]. We use an online learning management system to ask prospective elementary teachers’ perspective about online mathematics learning. The participants for this study were second-year prospective elementary teachers (2 men and 36 women) from a public teacher institution, Riau province, Indonesia. The participants took a mathematics education course in which four first meetings were delivered on-site learning, and then due to COVID-19, the course was fully online. The mathematics contents for the course cover both mathematics and didactics domains. The mathematics domains focus on fractions and measurements, and the didactical ones focus on tools and media for teaching and learning mathematics, designing tasks, lesson plans, and developing learning scenario. Meanwhile, the online learning model combines between synchronous and asynchronous mode. It means that some meetings required prospective elementary teachers to participate in video conferences, and sometimes they worked individually or discussed online in small groups.

To collect the data, we designed five open questions, but in this study we only focused on the first question (Figure 1) because it asks respondents to give their general perspectives on the implementation of online learning on the mathematics education course. The question was given at the end of the course using an online learning management system, called Schoology. Approximately, the participants had 12 minutes to answer a question.

**Question:** What do you think about the implementation of online lectures during the COVID-19 Pandemic, especially in the mathematics education course?

**Figure 1.** Questions Given to Prospective Elementary Teachers

The data analyses were focusing on what prospective elementary teachers’ concern on the implementation of online mathematical learning. First, we pay attention to their arguments on the use of digital technology and its infrastructures, such as an internet connection. Second, we concerned about their difficulties to understand the mathematics contents and aspects related to pedagogic and didactics during their participants in the online mathematics course.

3. Results
The findings of this study are based on prospective elementary teachers’ written answers to the given question (Figure 1). The general findings indicated that 65.79\% of prospective elementary teachers clearly stated that online mathematics learning was less effective. This answer was followed by some reasons and consequences for the learning mathematics. We describe barriers and challenges for learning mathematics using online courses.

3.1. Barriers and challenges related to ICT
Internet connectivity was the most common barrier for prospective elementary teachers to participate in the course. This problem was expressed by 73.68\% of prospective elementary teachers. For example, one participant, PET1, wrote as follows:

"In my opinion, the online course, specifically in mathematics education, is less effective, because several things cause it, one of which is inadequate internet network in some student residences, so they are left behind or do not understand the course contents”.

PET1 justified that the internet connection was the capital problem for participating in the online course. She reflected the situation where some of her friends could not participate in the course due to poor internet connection. This situation led them to get difficulties to understand the mathematics contents.

Another example comes from PET11. She also thought online mathematics course was less effective. She answered the question as follows:
“In my opinion, online learning is less effective, because there are many obstacles, such as networks. So when lecturing using Skype, sometimes I cannot join because my internet connection does not support. So that I sometimes do not understand mathematics taught”.

Poor internet connection made PET11 unable to participate in a video conference course where the teacher educator gave some explanation on mathematics to be learned by the prospective elementary teachers. She could not know and understand what was being learned.

Besides internet connection, 23.68% of prospective elementary teachers considered limited internet quota becoming another barrier for participating in the online mathematics course. This is expressed by PET10 as follows:

“For the implementation of online learning activities during this pandemic, it may be somewhat ineffective because to conduct an online course, students must have an internet package and adequate internet network. Also sometimes poor internet network makes lectures so constrained.”

PET10 claimed that besides good internet connection, the internet quota became another important aspect to supports their learning in the online course. While, some prospective elementary teachers reacted that they had to pay extra cost for buying the internet quota, especially when the online course required them to participate in a video conference.

Few prospective elementary teachers also mentioned that a power outage and unsupported programs on their smartphone or computers were other challenges for them to participate and study in the mathematics online course. To deal with this situation, PET13 says that:

“…Maybe there are some of my friends, including me, also have difficulties regarding the network, especially during a power outage. Sometimes we go near the main road to get the cellphone network back, and we can continue studying online.”

PET13 reflected what she did to deal with the power outage. They had to find a spot closed to the main road to get an internet connection. This situation was often found especially for those who live in small villages.

Although many prospective elementary teachers considered the online mathematics course was not effective due to the internet connection and other barriers, a few of them still had positive opinions about the online course. One example comes from PET16 that she stated as follows:

“The implementation of online lectures during the Covid-19 pandemic requires us to be able to make the best use of technology for teaching and learning needs. While the online learning occurs, there are several difficulties, such as the lack of online support facilities and a poor internet connection, but online learning brings many benefits, such as during the mathematics education course, where we do not only learn about mathematics but also learn how to use technology, completing assignments also demands students’ ideas and creativity in using technology.”

PET16 emphasized some positive effects of the implementation of online courses. She realized that during the course, she did not only learn mathematics but also how to use technology itself. This experience will be much useful for them especially when they become elementary school teachers in the future. The use of technology is something that cannot be avoided in education anymore during the industrial revolution of 5.0.

3.2. Barriers and challenges related to mathematics, pedagogic, and didactics

Difficulty in understanding contents became the main barrier for many prospective elementary teachers during the online mathematics course. Up to 36.84% of prospective elementary teachers wrote that they got difficulties to understand the contents of the course. It is illustrated by PET24 as follows:

“In my opinion, the implementation of online lectures during the pandemic is highly support students’ learning process including in mathematics courses. However, it is more effective to have face-to-face learning, but what we are used carrying out [online course] is quite helpful, it is just little more difficult to learn [mathematics contents] caused by some problems such as networks and so on.”
PET24 agreed with the online course during the pandemic. When she compares between online courses and face-to-face learning, she composed that understanding the contents became more difficult using the online course.

Limited interaction between the lecturer and students became another obstacle in understanding the mathematics contents. This was revealed by PET37.

“In my opinion, the online lecture is ineffective and inefficient, because of the limited interaction between the lecturer and the students, as well as networks that are sometimes not good because many people are participating in online courses. In mathematics education, in my opinion, time and space are limited, so students are less able to understand what is explained by the lecturer. For example, when we are online using Skype, there are just some annoying disturbances, such as bad network and noisy friends, which disturbs learning.”

PET37 considered that it is crucial for her to have interaction between the lecturer and the students. Beside internet connection, she felt annoyed by the noisy sound from her friends during the lecture living on a video conference. In addition, time used for explaining the contents to the students was limited, and it is also another obstacle for them to understand what has been explained by the lecturer.

Lack of communication in group assignments is another obstacle during the online mathematics course. This was revealed by PET30.

“…when a group assignment, for example, it depends on the network when discussing the completion of the assignment. Then due to group assignments in the online form sometimes people only hitchhike their names when completing the assignment”.

Related to the assignments given to prospective elementary teachers, when they tested some mathematics tasks online to elementary school students, they had difficulty to communicate with the teachers and the students. This was stated by PET7 as follows:

“…especially for mathematics education courses during this pandemic, online learning is not too difficult. It is only a little difficult when asking elementary school students to answer questions created by our group because they have no more learning at school. So it is a little difficult to ask the homeroom teacher to give questions to their students.”

Although many prospective elementary teachers have difficulty learning mathematics in this pandemic, some of them considered online learning as a positive impression. PET9 exposed that she motivated to search for other learning resources if the contents presented in the online course was not understood.

“Online courses have several obstacles such as [unsupported] signals in their respective areas, and also maybe some online applications that are less supportive, but those can be overcome by our creativity to look for other learning resources if the contents presented are less understood.”

Meanwhile, courses that were still carried out according to the schedule became a positive thing for prospective elementary teachers because they can still attend the courses as usual. Another interesting finding was that prospective elementary teachers could take the course casually. This was revealed by PET19 as follows:

“…online math learning has its advantages and disadvantages. Luckily this online learning is that we can relax in participating in the lectures. Relaxing here means not having to go to campus, not having to dress neatly, even while lying down can participate in the course…”

Although PET19 considered that she could relax in participating in the course, she still needed to have good behaviour in participating in online courses.

4. Discussion and concluding remarks
The study aims to investigate prospective elementary teachers’ perspective on online mathematical learning during COVID-19 pandemic. The study shows that many prospective elementary teachers considered online course is less effective. Poor internet connectivity becomes the main factor for their
difficulties to participate in the online course [8]. This finding supports what has been revealed by Mailizar et al. [10]. They found that Indonesian secondary mathematics teachers faced a major challenge using digital technology as an instructional resource during the COVID-19 pandemic because of student lack of exposure to computers and internet connectivity. Meanwhile, limited internet quota becomes the second barrier for prospective elementary teachers to participate in online courses. The cost to buy an internet package in Indonesia is quite expensive, where for 1 GB the cost is between Rp 5,000 to Rp 10,000. To participate in an online course, such as participating in a video conference, prospective elementary teachers need at least 1 GB for 1 hour [12].

Lack of internet connection leads prospective elementary teachers to have difficulties in understanding the mathematics contents of the online courses. This was expressed by more than 30% of prospective elementary teachers. They could not understand the mathematics contents and also got difficulties to discuss with the lecturer and other students. This finding was also shown by several previous studies where students who learn using an online platform are not much better than face-to-face learning [6]. One of the main factors involved was schools’ experience with ICT [6], and it is also many cases in Indonesia, where students directly moved from face-to-face to online learning due to COVID-19 pandemic outbreaks.

With many challenges faced in conducting online courses during this pandemic, support from government is capital important. The government have to improve learning infrastructure, including an internet network immediately. Besides, the government must intervene in providing internet providers to have lower prices for students. On the other hand, schools or universities need to combine between face-to-face and online learning, but they still need to make sure teachers and students follow the health protocol of COVID-19.

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