



Prospective teachers' perceptions of didactic obstacles in the online mathematics learning

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Abstract

The spread of the coronavirus has caused learning that was previously carried out offline to be online. It causes didactic obstacles in learning when implementing online learning. Research related to didactic obstacles has been widely studied from the perceptions of teachers and students but has not been widely studied from the point of view of prospective teachers. The purpose of this study is to investigate the didactic obstacles that arise in terms of the perceptions of prospective teachers in online mathematics learning. The method used in this research is descriptive qualitative. The research subjects were 18 prospective teachers divided into six groups, each consisting of three prospective teachers. The research locations were taken in two locations: East Java and Nusa Tenggara Timur (NTT). The instruments used include assignment sheets, field notes, field observations, and sheets for interviews with mathematics teachers in junior high schools. The triangulation technique compares the data from observations, interview recordings, and descriptions of answers. The research findings show that the biggest didactic obstacle occurs in the giving of too many assignments by the teacher to students. Giving too many assignments makes the quality of student work low. This result implies that teachers think giving students many assignments is natural so that all material is conveyed during the pandemic. It contradicts the perception of prospective teachers.

Keywords: didactic obstacles; mathematics learning; online; prospective teachers

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Introduction

The spread of COVID-19 led to face-to-face online. Learning that was previously done offline becomes online from home (Purwadi et al., 2021). It causes learning systems to be disrupted in all countries (Ferretti et al., 2021). The online learning system must be faced by all components of education: schools, teachers, students, and parents.

Implementing online learning causes didactic obstacles in learning (Van & Thi, 2021). Didactic obstacles are part of cognitive obstacles (Brousseau, 1997; Murniasih et al., 2020). Didactic obstacles are caused by school teacher teaching (Nurjanah & Juliana, 2020; Mustika et al., 2018). Didactic obstacles are not only experienced by low-ability students but also by high-ability students due to the difficulty of teachers transmitting knowledge online (Alves et al., 2021).

The results showed that teachers experienced fewer didactic obstacles in online learning than students (Alolaywi, 2021). However, in developing countries, teachers experience the same didactic obstacles as students (Poroçani & Zaçellari, 2022). It shows that the availability of digital devices is indispensable in overcoming didactic obstacles in online learning.

Several researchers have studied didactic obstacles in terms of teacher and student perceptions. The results of research by Novainda and Turmudi (2021) show that the teacher's mistakes in teaching concepts, lack of prerequisite material, the material are not associated with several different contexts, and the teaching material is not arranged properly, causing didactic obstacles. Furthermore, according to Nurjanah and Juliana (2020), didactic obstacles are caused, among others, by the lack of emphasis on concepts, inappropriate material sequences, and the lack of use of learning media. Didactic obstacles are caused by teachers who are not able to manage time, do not provide student worksheets, lack of variety of problems, and do not implement all the steps in the lesson plan (Fuadiah et al., 2019; Mustika et al., 2018; Sukirno & Ramadhani, 2016).

Research in several countries also examines didactic obstacles to online learning based on student and teacher perceptions. The results of research in Indonesia show obstacles to online learning, including network limitations, internet quotas, technology, and the use of online applications (El Khuluqo et al., 2021; Tauhidah et al., 2021; Susanto et al., 2021). The results of research in the United States of America show that the lack of parental support in online learning causes didactic obstacles (Borup et al., 2019). Research in Saudi Arabia shows that the lack of face-to-face contact causes didactic obstacles (Alshumaimeri & Alhumud, 2021). The low ability to use technology and internet facilities is a didactic obstacle for developing countries in South Africa (Queiros & de Villiers, 2016).

Online learning is not easy without adequate preparation (Kibici & Sarıkaya, 2021). Even though technology has been designed as well as possible, it turns out that there are still didactic obstacles that arise in online learning (Buda, 2020). The results of previous studies have revealed didactic obstacles in online learning based on teacher and student perceptions. There has not been much research on didactic obstacles to prospective teachers (Akkaya et al., 2021; Murniasih et al., 2020). This study aims to describe the didactic obstacles in terms of

prospective teachers' perceptions regarding online learning. This research is essential so that similar obstacles can be minimized and know strategies to overcome them.

Methods

The method used in this research is descriptive qualitative. Through descriptive qualitative research, researchers want to comprehensively describe didactic obstacles (Apsari et al., 2020). The research subjects were 18 prospective teachers, six men, and 12 women. Prospective teachers in this study had the criteria to have taken internship courses at school. Furthermore, 18 prospective teachers were divided into six groups, each consisting of three people (2 women and one man). Each group is tasked to identify didactic obstacles that occur during online mathematics learning in junior high school. The locations for prospective teachers to get data are junior high schools in East Java and Nusa Tenggara Timur (NTT). The reason for choosing this area is because the prospective teachers who attend lectures are in East Java and NTT. The number of prospective teachers who attended lectures was 18, with details nine people from East Java and nine from NTT. The research flow can be seen in Figure 1.

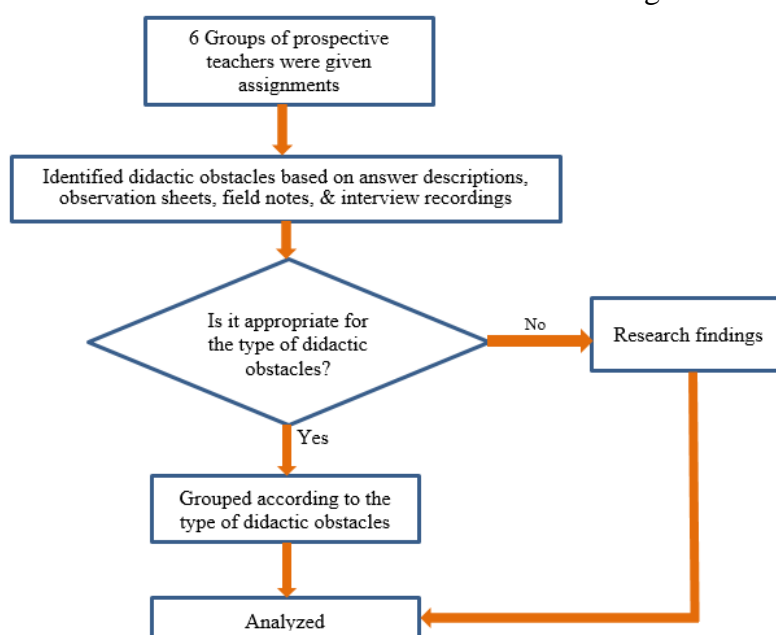


Figure 1. Research flow

The instruments used in the study were: assignment sheets, observation sheets, field notes, and interview sheets with junior high school mathematics teachers. The instrument was first validated by learning and mathematics experts before being used for research. After the instrument is declared valid, it is continued with trials until reliable results are obtained. Researchers adapted the tasks given to prospective teachers from the results of previous research on didactic obstacles in online learning (Alshumaimeri & Alhumud, 2021; Nurjanah & Juliana, 2020; El Khuluqo et al., 2021; Novainda & Turmudi, 2021; Borup et al., 2019; Fuadiah et al., 2019; Queiros & de Villiers, 2016). The questions given to prospective teachers consist of 6 items related to online learning: 1) How is the implementation of mathematics learning plans in junior high schools?; 2) How are a teacher and students mastery of

mathematical concepts?; 3) How is the use of mathematics learning media?; 4) How is the ability of teachers and students to use technology?; 5) How is the quality of the internet network owned by teachers and students?; and 6) How is parental support during online learning? Researchers assign tasks to prospective teachers to identify didactic obstacles experienced in online mathematics learning in junior high schools.

Three groups of prospective teachers are located in East Java, and three groups of prospective teachers are located in NTT because student lectures are conducted online. Data collection involved six junior high school mathematics classes in East Java and NTT. Prospective teachers then make plans and activities for doing assignments. Prospective teachers begin to build communication with teachers at schools both directly and online through videocall or Google Meet. Prospective teachers, according to groups, make observations of students and interview mathematics teachers in junior high schools when implementing online learning. There are nine prospective teachers from East Java (three groups) and nine prospective teachers from NTT (three groups). Six mathematics class teachers were involved in the research activities (three from different schools in East Java and three from different schools in NTT). Observation sheets are used to record exciting things when encountered during online learning. Observations were made according to the online teaching hours of school mathematics teachers. Interviews were recorded and conducted online via telephone, WhatsApp, or Zoom. Field notes are used to record interesting things during the study (Murniasih et al., 2020). Furthermore, to obtain data accurately, triangulation techniques were carried out by comparing data on observation sheets, descriptions of answers, and interview recordings (Alfansyur & Maryani, 2020).

Indicators of didactic obstacles are determined based on the results of previous studies, as shown in Table 1. (Adaptation from El Khuluqo et al. (2021), Novainda and Turmudi (2021), Nurjanah and Juliana (2020), Fuadiah et al. (2019), Borup et al. (2019), Alshumaimeri and Alhumud (2021), Queiros and de Villiers (2016)).

Table 1. Types of didactic obstacles

Types of Didactic Obstacles	Description
DO1	Not using the lesson plan as a reference (unable to manage time, not providing worksheets, not carrying out all the steps in the lesson plan)
DO2	The lack of prerequisite material, the material is not related to several different contexts, the lack of variety of problems and the order of the material is not right
DO3	Teacher mistakes teaching concepts
DO4	Lack of use of learning media
DO5	Network limitations, and internet quota
DO6	Lack of mastery of the use of technology
DO7	Lack of parental support
DO8	Lack of face to face

Note: DO = Didactical Obstacles

Didactic obstacles were analyzed and identified based on the results of completing the tasks of prospective teachers. Furthermore, the results of the completion of the task of prospective teachers are grouped based on indicators of didactic obstacles and research findings.

Results

Researchers analyzed the results of completing the task of 6 groups of prospective teachers. Prospective teachers collect assignments in answer descriptions equipped with observation sheets and recorded interviews with junior high school mathematics teachers. Furthermore, the researchers grouped the obstacles that occurred based on the indicators of previous studies and analyzed them. Meanwhile, didactic obstacles that are not included in the indicators specified are included in the category of findings and analyzed. The researcher also performed technical triangulation by matching answers based on answer descriptions, observation sheets, and interview recordings.

The researchers analyzed the results of the answers of prospective teachers in Group 1 (G1), G2, G3, G4, G5, and G6 when completing the task. G1 wrote an answer that the lack of mathematics learning media and giving too many assignments by the teacher became obstacles during online learning. This result is reinforced by observation sheets and recorded interviews with mathematics teachers in one junior high school in East Java. Group 1 interview activities conducted online with Teacher 1 (T1) is as follows.

G1 : Since when has online learning been implemented in schools?

T1 : Since the pandemic

G1 : We took a Google Meet class on learning fractions. When studying the concept of fractions, you asked the students to open the textbook to page 126. Then, you asked the students to read and understand it. Is the media used during online learning to explain the concept of fractions, for example using PPT by using animation to cut objects into several parts?

T1 : I have never used innovative learning media that I made myself

G1 : What are your obstacles in making innovative media?

T1 : Yes.... I am a teacher who has been teaching for a long time and so far I have had difficulty determining ideas when making mathematics media. Moreover, I am also not familiar with programming languages on computers.

G1 : Okay sir. We also observed that after the lesson ended, Mr. gave assignments in the form of story questions on pages 130 and worksheets on pages 41-43. Why did you give so many assignments?

T1 : There are several reasons because during the pandemic meetings can only be held online for 30 minutes. Half an hour is not enough time to convey all the material. With a lot of assignments, students are also accustomed to working so that they understand the material. Almost all subjects we give a lot of assignments in the form of story questions, projects, short answers, multiple choice and problem solving

G1 : Thank you sir. Healthy greetings. Good afternoon.

The interview results showed that the teacher had difficulty with initial ideas when making media that could explain mathematical concepts. In addition, the teacher also gives many assignments in the form of story questions; so that all the material is conveyed. The results of G2's work show that the difficulty of teachers teaching concepts online causes students'

obstacles to understanding the material. This result is reinforced by field notes and interviews with teachers in one of the junior high schools in NTT. In addition, the internet network is unstable, and teachers lack technology skills. Not all students have online learning tools, and the lack of face-to-face meetings and too many assignments cause didactic obstacles in learning.

The results of G3's work show that the teacher does not carry out all the lesson plans, there are errors in teaching concepts, limitations of the internet network, and students do not listen to learning diligently during zoom meetings. The interviews and field notes show that teachers have difficulty implementing lesson plans with limited face-to-face meetings. In addition, students do not listen diligently when learning online, and some do not have an internet quota. The results of completing the G4 task indicate a lack of parental support because they are busy working. Not all students have cell phones, and teachers have difficulty developing students' abilities because not knowing the students' characters is an obstacle in online learning. Most of the parents of students in NTT have jobs as farmers and ranchers. This result is reinforced by field notes and online interviews between G4 and a teacher at one of the junior high schools in NTT (T4).

G4 : What is the income of parents in one of these junior high schools in NTT?

T4 : Mostly farmers and ranchers. On average, parents are busy working in the fields and taking care of livestock. So that they do not provide support for their children who go to school.

G4 : Do all students have devices such as mobile phones or computers to study online?

T4 : Out of 30 students only 12 students have online learning tools.

G4 : Thanks for the explanation

The results of field notes, interview recordings, and G5's answers show that the learning plans were only partially realized. The lack of parental support and students being problematic to discipline were obstacles to online learning. The results of G6 show that limited time causes teachers to provide problems that are not varied, and the lack of face-to-face and parental support is also an obstacle to online learning. The results of field notes and interviews with teachers at one junior high school in East Java said that the limited time and lack of face-to-face contact made it difficult for teachers to provide varied material. Besides the teacher, correcting group assignments is difficult because only smart students do the work.

Table 2 below shows the didactic obstacles faced by prospective teachers during online mathematics learning in junior high schools.

Table 2. Didactic obstacles based on the results of prospective teacher assignments on online mathematics learning

Group	Research Location	Types of Didactic Obstacles	Research Findings
G1	East Java	DO4	The teacher gives a lot of assignments to students
G2	NTT	DO3, DO5, DO6, DO8	Not all students have cellphones and computers The teacher gives too many assignments
G3	NTT	DO1, DO3, DO5.	Not all students listen to the lesson diligently

Group	Research Location	Types of Didactic Obstacles	Research Findings
G4	NTT	DO7	Not all students have cellphone facilities. Teachers have difficulty developing student competencies
G5	East Java	DO1, DO7	Difficult to condition students for discipline
G6	East Java	DO2, DO7, DO8	Difficulty correcting group assignments. Too many assignments.

Note: G = Group

Based on Table 2, it can be seen the division of groups, research locations, types of didactic obstacles, and research findings. G1, G5, and G6 conducted research in East Java. Meanwhile, research in NTT was carried out by G2, G3, and G4.

Discussion

The first group (G1) describes the didactic obstacles obtained during the observation, including the lack of use of learning media (DO4). This result follows the research of Nurjanah & Juliana (2020), which said that teachers should use various learning media so that students can imagine the material being taught. In addition, G1 also found another didactic obstacle: giving teachers many assignments during online learning. The assignment is widely considered adequate for online learning (Hosseini & Mehraein, 2022). However, in reality, most junior high school students do not understand the assignments given online, so they cannot complete the tasks given by the teacher properly (Sousa, 2021). Students are less responsive when asked to do assignments. The tasks given by the teacher are only partially done by students independently; the rest is the result of parents' work (Retanal et al., 2021).

The didactic obstacles found by Group 2 (G2) are DO3, DO5, DO6, and DO8 types. Teachers have difficulty teaching concepts only through WhatsApp, Google Meet, and learning videos, especially for math lessons. This result is in line with Novainda and Turmudi's (2021) research, who said that teachers have difficulty teaching concepts using online teaching media. In addition, network limitations and internet quotas are obstacles for students in remote areas. This result is supported by previous research in Indonesia, which said network and quota limitations caused didactic obstacles (El Khuluqo et al., 2021; Tauhidah et al., 2021; Susanto et al., 2021). Some junior high school students also do not master the technology, so it takes a long time to be able to join in the learning. These results are the following research in South Africa (Queiros & de Villiers, 2016). During the pandemic, face-to-face meetings are only held twice a week for 3 hours. This limited-time causes students to have difficulty understanding mathematical material in a short time. These results are reinforced by research in Saudi Arabia (Alshumaimeri & Alhumud, 2021). The research findings show that some students do not have mobile phones and computers. The government has provided internet quota assistance, but the absence of computers and mobile phones has caused student obstacles. The teacher must think of a solution to this problem, among others, by studying in groups with students who live close by and have computers and mobile phones. In addition, the teacher prefers to give many

assignments, which causes students to be overwhelmed in completing and not understanding the material given briefly.

The didactic obstacles that occur based on the results of Group 3 (G3) assignments include DO1, DO3, and DO5 types. The learning steps taken by the teacher are not following the lesson plan, so students have difficulty understanding the material in a short time. Teachers who cannot manage time according to lesson plans cause didactic obstacles (Fuadiah et al., 2019; Mustika et al., 2018; Sukirno & Ramadhani, 2016). Online learning of mathematics material causes students to be less able to understand concepts. It is reinforced according to the results of research by Novainda and Turmudi (2021) and Nurjanah and Juliana (2020). In addition, internet limitations and quotas also cause online learning obstacles (Tauhidah et al., 2021). The research findings obtained by G3 are that students do not listen diligently because students feel bored with online learning. Teachers must be creative in making learning media to overcome student boredom (Murniasih, 2018). Even though learning has been done through Google Classroom, Zoom Meeting, or Google Meeting, students do not fully understand math material.

Group 4 (G4) results show that the lack of parental support in caring for their children when school causes didactic obstacles in learning (DO7). Parents have been busy working to earn a living, so they pay less attention to their children when learning online from home. These results follow research in the United States of America which says the lack of parental support causes obstacles during online learning (Borup et al., 2019). In addition, some parents in Indonesia bring cell phones to work, so children have to wait for their parents to come home to do the assignments given by the teacher (Khairat & Junaidi, 2022). The research findings show that teachers have difficulty developing student competencies because teachers are less able to measure students' abilities during online learning. Some students cannot understand the material if they are not facing to face. In addition, teachers also cannot recognize the character of students directly during online learning. Teachers need much time to get to know students' characters, while online learning only takes a little time.

Group 5 (G5) results show didactic obstacles of DO1 and DO7 types. Lesson plans are only partially realized through online learning. The material delivered depends on students' ability so that not all material is taught. The new curriculum during the pandemic allowed some materials to be omitted. This result is supported by the opinion of Novainda and Turmudi (2021) and Nurjanah and Juliana (2020). In addition, the lack of parental support due to busy work is also a separate obstacle (Wafiroh & Harun, 2022; Borup et al., 2019). Group 5 found another result in the study, namely that teachers had difficulty in conditioning students to be disciplined and severe during online learning. Teachers need to make exciting and fun media, so students are disciplined and serious about learning (Murniasih et al., 2021). Attractive animated videos can visualize mathematical concepts, so students better understand the material being taught.

The results of the analysis of Group 6 (G6) work found that the didactic obstacles encountered during online learning were DO2, DO7, and DO8 types. The lack of variety of problems is due to shorter online learning times or lack of face-to-face contact (Mustika et al., 2018; Alshumaimeri & Alhumud, 2021). In addition, parental support is lacking because many

parents work (Wafiroh & Harun, 2022; Borup et al., 2019). The results of G6 include that when the teacher applies group assignments, it is challenging to measure students' understanding. Only diligent students work on group assignments, and the others only answer questions.

Meanwhile, students do not want to work in groups because students feel bored and do not understand the material online. Too many assignments also become a didactic obstacle when students have to complete them without a teacher beside them. Especially if the task is difficult and at home, there are no parents who can assist in the process. Many tasks make children stressed and lazy to do. Student assignments should not be measured only by quantity but also by the quality of their work (Hobbs et al., 2013).

The results showed that the biggest didactic obstacle based on the perception of prospective teachers lies in giving students too many assignments. Meanwhile, based on the results of interviews, the teacher said that many assignments had to be done because, during online learning, there was not much time for face-to-face, so students were expected to be able to learn independently by doing the assigned tasks. It shows that prospective teachers have more mastery of theory and less teaching practice in schools (Sholeh et al., 2018). On the other hand, the teacher teaches more and does not update the theory in learning (Hoesny & Darmayanti, 2021). In addition, working parents' lack of support is a didactic barrier to learning. Many students in NTT who do not have learning tools also cause obstacles to learning.

Conclusion

They are three biggest didactic obstacles: a) the teacher gave too many assignments to students, b) the lack of parental support during online learning, and c) not all students have cellphones and computers. Further research is suggested to provide follow-up in the form of appropriate learning designs for students. Students can be given group assignments where each group member does a task according to their expertise; including those who are good at designing pictures are given the task of making pictures, and those who are good at making videos are given the task of making videos. With a learning design like this, all group members are expected to be active and learn from each other together. The limitation of the research is that the research was conducted online. Researchers do not attend directly in the field but only analyze assignments based on prospective teachers' perceptions. Further research is suggested to compare from the point of view of prospective teachers and teachers.

Conflicts of Interest

Researchers declare there is no conflict of interest in the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

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