

How are Mathematics Teachers Utilizing Technology in Mathematics Learning During the New Normal?

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Abstract – The use of technology in Mathematics learning is crucial because it can provide convenience for the learning process. This research is a qualitative study that aims to describe how Mathematics teachers use existing technology or applications in Mathematics learning during the new normal. The participants were three high school Mathematics teachers who utilized technology in their learning. The analysis technique used refers to a three-stage analysis technique which includes data condensation, data display, and conclusion. The results showed that the use of applications available in Mathematics learning varied. Some utilized and maximized various kinds of application features, but some only took advantage of a few main features. There were teachers whose learning activities did not involve too much technology integration and there were also those that involved the use of various applications, even those specifically designed to learn mathematical concepts. The purposes of using applications that can help the teaching and learning process were very diverse. The use almost involves all activities in all teaching and learning processes such as creating, providing, and teaching the teaching materials, assessment, discussion, assignment, and announcements and reminders.

Keywords: technology, Mathematics learning, Mathematics teacher

I. INTRODUCTION

The COVID-19 pandemic that occurred in the past few years had a huge impact on various sectors of the world, including the world of Education. One of them is teachers who must adapt to learning and mastering the use of technologies or applications that can help distance learning.

Technology is one of the elements that play an important role in education. It helps teachers during the pandemic. In Mathematics learning, the effective use of technology can facilitate the teaching and learning process [1]. The utilization of technology can improve the ability of students to comprehend basic mathematical concepts and their problem-solving abilities [2].

Mathematics learning can be carried out remotely using the help of various applications such as *Google Meet*, *Microsoft Teams*, *WhatsApp (WA)*, *Instagram*, and *Google Classroom*. Through applications like this, teachers can send materials (Documents, Audio, or Video) and deliver learning in real time or via chat. The use of these applications not only makes it easier but also provides equal opportunities for all students to access the Mathematics learning provided.

The topic of using technology in learning, including Mathematics learning is a topic that has been researched by many experts in Indonesia. Several studies had shown that applications such as *Google Classroom* are effective in improving students' Mathematics learning outcomes [3–7]. Several studies such as [8] and [9] even reported positive responses to the use of *Google Classroom* in Mathematics Learning.

There are also applications such as WhatsApp which is one of the applications that are often used by teachers. Some studies even showed the effectiveness of using these applications and how the use of these applications helped students in learning Mathematics [10,11]. Several studies

[12,13] even reported that students responded positively to the use of WA in Mathematics learning. Recent research [14] shows that the combination of WA and *Google Classroom* has proven effective in improving students' Mathematics learning outcomes.

On the topic of the use of technology in Mathematics learning in Indonesia, Most studies discussed the effectiveness or general reasons behind the successful application of technology in Mathematics learning. Research that explains and investigates in detail how applications are used in Mathematics learning by teachers is still very lacking.

In addition to the lack of topics that discuss in detail how Mathematics teachers use technology in learning, [2, 15] described that teachers have a good perception of the function and purpose of learning media, but the use and competence of teachers are still lacking. There are some assumptions that not all material can be taught with the help of electronic media such as computer software.

Based on the description of the importance of using technology and applications in Mathematics learning and the lack of research that discusses in detail how various applications are used, researchers consider it important to conduct research that discusses how Mathematics teachers use technology in Mathematics learning during the new normal.

II. METHODS

This research is qualitative descriptive research involving three Mathematics teachers as participants in the study. The participating Mathematics teachers were high school Mathematics teachers and the high school where they taught was located in South Sulawesi. The teachers chosen to be participants were teachers who used technology in Mathematics learning during the new normal.

Researchers used interview techniques as data collection techniques to obtain more in-depth and more detailed results. The interview used was a semi-structured interview where there is still the possibility of new questions appearing outside the questions contained in the interview guidelines.

The main instrument in this study was the researcher himself. The supporting instrument was an interview guideline that contains two core questions, namely: (1) What applications do you use in teaching Mathematics during the new normal?; and (2) How do you use the application in Mathematics learning?

The qualitative data analysis employed refers to data analysis by [16] which consists of three stages, namely data condensation, data display, and verification and conclusion making. In data condensation, the data obtained is filtered and sorted to determine which one will be the focus of attention. However, the data obtained is certainly not discarded or not used. The data is stored and taken into consideration because there is still the possibility of the data being the focus of discussion if it turns out that the results of the next stages are still not enough. In the data display, the researcher presents data to compare the results obtained. Researchers in this case make comparisons to see existing trends or patterns. The last stage is verification and conclusion making where the results may not be sufficient so that there is a possibility to retrieve data for verification or see data that is not the focus of the previous discussion.

III. RESULTS AND DISCUSSION

Our interviews showed that all three teachers used a variety of applications in teaching Mathematics. The applications used can be seen in Table 1 below.

Table 1 Technology or Application used
Mathematics Teachers during the New Normal

Teacher	Technology or Application Used
Teacher A	1. WhatsApp 2. Google Classroom 3. Google Form 4. Google Meet 5. Microsoft Office
Teacher B	1. WhatsApp 2. Quizziz 3. Microsoft Office
Teacher C	1. WhatsApp 2. Google Classroom 3. Quizziz 4. Microsoft Office 5. GeoGebra

The results of interviews with the three teachers revealed how they used various applications to carry out Mathematics learning. The following three interview excerpts show how they utilized existing technologies or applications in Mathematics learning.

Interviewer : You are saying here that you use about seven applications in math

learning. Can you explain how you use the app to teach? You might be able to explain starting from WhatsApp.

Teacher A : First, I use WA to give announcements or remind students, whether it's related to assignments, exam materials, or learning materials. When the exam was held online, I shared the exam link through WA. For those who do not have time to attend because they are unavailable, experience problems related to connection or internet quota, or for those who want to ask or confirm related to the material, I facilitate them by suggesting to conduct discussions and questions and answers through WA, either through private chat or in group chat. Sometimes, I also send photos or voice notes related to the explanation of the material in addition to if someone needs it. So learning does not only occur and is pegged to the hours set at school but can also be outside of it, either as an addition or substitute. Then, discussions related to contracts and rules during learning are also carried out on WhatsApp as confirmation and continuation of what was discussed in class.

Interviewer : What about the Google Meet app?
Teacher A : I use this application when I want to teach in real-time, face-to-face, both during school hours and outside school hours (in addition or substitute). If learning is carried out online and students have no difficulties related to internet quota, then I advise them to take part in the Google Meet session in providing material because, of course, it will be easier to understand.

Interviewer : What about Google Forms?
Teacher A : I use Gform in assessments or surveys. The assessment in question includes quizzes, PTS, or PAS. I conducted a survey here to find out how students respond to the learning I give, both after all meetings are over and in the middle of the semester. This form is very good because it doesn't use a lot of quota. Using GForm is very easy because there is a feature that can summarize the

answers given by students. In addition, there is also a feature that shows many students who answer incorrectly and correctly for each question item.

Interviewer : What about Google Classroom?

Teacher A : This application helps me in providing learning materials for students. At GC, I post questions or discussion spaces that students can use. In addition, the material stored in GC will not be deleted, unlike WhatsApp where it could be that the files we will read again cannot be downloaded. In addition, there is also a task assignment feature, be it a task in the form of a project or the form of a short question. We are also given a feature to directly assess and assign an appraiser rubric. In addition, we can easily see who is late or did not submit assignments at all. Finally, another feature that is no less important is the reminder of tasks that have not been completed it helps with time management owned by students.

Interviewer : What about Microsoft Office?

Teacher A : I create presentation materials using PowerPoint by utilizing features such as Animation to make presentations more interactive. For Word, I use it to create reading materials for students and design and design learning outcomes assessments. Finally, for the Excel application, I use it to recap and analyze student learning outcomes and then report to the school regarding what follow-up will be given.

Excerpts of the interview show that Teacher A uses various applications in teaching even though most of the learning has returned to offline. The teacher considers students who want supplement lessons or who were unable to attend (due to logical reasons) but still want to experience real-time learning or direct guidance from the teacher.

Furthermore, the following interview excerpts show how Teacher B was utilizing technology during the new normal.

Interviewer : How do you use the WA application you mentioned to teach?

Teacher B : I use WA to announce things related to learning or remind me about assignments. In addition, sometimes, I also have discussions

with some students who need additional explanations related to what has been explained in class offline.

Interviewer : What about Quizziz?

Teacher B : Its interactive features and appearance are the reasons I use this app. In this application, quiz work is more exciting because of its appearance and makes it easier to make math problems because of the help of the symbol feature.

Interviewer : What about Microsoft Office?

Teacher B : PowerPoint for presentations in Classroom, Word for creating reading materials, and Excel for grade recaps.

Interviewer : What about other apps? Is there still?

Teacher B : Nothing, Most of it is already offline so I focus on face-to-face learning in class rather than online because students are easier to understand. Of course, restrictions during the new normal remain in place.

Excerpts of the interview show that Teacher B still uses several applications to facilitate Mathematics learning. However, the application used was not as much as teacher A. Its use was limited because Teacher B focused more on offline sessions in class.

Next, Teacher C said similar things to some things conveyed by Teachers A and B. However, there were differences, especially in the GeoGebra application. Here's an excerpt of an interview we've done.

Interviewer : I see that here you are using GeoGebra in Mathematics learning.

Teacher C : Yes, because of the support of resources from the school and students, I decided to use this application because it is very useful as a tool and makes it easier for students to explore and visualize materials and concepts such as geometry, algebra, and calculus.

Excerpts from an interview with Teacher C reveal how Master C used applications that are designed and made specifically to learn mathematical concepts, specifically such as Geometry, Algebra, and Calculus.

From the interview excerpts that have been shown, we can see that there are some similarities or differences in the use of technology or learning applications. Some teachers utilize various applications (Teacher A) in carrying out learning to facilitate and provide convenience for all students without exception. The use of these applications was intended so that all students can get the same opportunity to learn mathematical concepts, whether they have limited

resources or who are unable to attend for obvious reasons. On the other hand, there was also a teacher (Teacher B) who does not use many applications because they focused more on offline learning. Finally, a teacher used applications specifically designed to learn Mathematics concepts.

Regarding the similarities, all of the teachers interviewed used social media such as *WhatsApp* to teach Mathematics, especially to make announcements or reminders. In addition, they also utilized *Microsoft Office* to prepare the learning materials or to recap and analyze the assessment results.

The results obtained are in line with some research results and opinions expressed by researchers or other experts. Results reported by [17] and [18] reported that many teachers focused on using social media to teach Mathematics. In this case, the dominant social media used is *WhatsApp*. What was stated by Teacher A is very in line with the results stated by [18] that the use of technology in Mathematics learning leads to time flexibility, access, and convenience. This means that all students have the same opportunity to access Mathematics learning materials and experience discussions with teachers. In this case, students who are unable to attend for logical reasons, of course, can still learn by discussing with the teacher or participating in synchronous learning sessions in the virtual conference application.

IV. CONCLUSION AND SUGGESTION

The results showed that teachers use a variety of applications in learning Mathematics. The applications used vary, ranging from social media such as *WhatsApp*, special learning applications such as *Google Classroom*, and special applications for quizzes such as *Quizziz*, to applications specifically designed to learn mathematical concepts such as *GeoGebra*.

The use of applications available in Mathematics learning varies. Some utilize and maximize various kinds of existing features, but some only take advantage of a few main features. Regarding the use of applications that help Mathematics learning, there are teachers whose learning activities do not involve too much technology integration and there are also those that involve the use of various applications, even those specifically designed to learn mathematical concepts.

The purpose of using applications that can help the teaching and learning process is very diverse. The use almost involves all activities in all teaching and learning processes such as creating materials (*Microsoft PowerPoint* and *Microsoft Word*), giving and providing materials (*Google Classroom*, *WA*, *Google Meet*, *GeoGebra*), assessment (*Microsoft Excel*, *Google Form* or *Quizziz*), discussion (*WhatsApp*, *Google Classroom*, or *Google Meet*), additional teaching sessions (*WA* or *Google Meet*), assignment (*Google Classroom*), making announcements and reminders (*WhatsApp* and *Google Classroom*).

This study only discusses how Mathematics teachers use technology or applications in Mathematics learning during the new normal period. There is still a need for

investigation or research that discusses the comparison of learning that uses various applications and those that only use a few applications. In addition, researchers who are interested in this topic can also examine how students or students respond to the use of many and also small applications. Finally, both teachers and lecturers can use the results of this research as a reference in designing Mathematics learning because it provides an overview of how some teachers use technology in Mathematics learning.

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