

# DIGITALIZATION OF MATHEMATICS LEARNING BASED ON PROBLEM SOLVING

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## ABSTRACT

The Covid-19 post-pandemic era requires learning activities to be carried out remotely or hybrid so that it requires teachers to be skilled in presenting interesting learning to support a good learning environment. The use of digital technology can be an alternative to learning mathematics, not only as a medium for presenting material but also to improve students' ability to solve problems. This study aims to explain the use of digital technology, including its advantages and disadvantages, especially when viewed from the perspective of solving mathematical problems. The research method used is the method of literature review or literature study (library research). The literature taken is articles published in various journals indexed by Scopus or Sinta. The analysis technique in this research is the content analysis technique. Based on the literature that has been analyzed, it can be concluded that using digital technology in learning mathematics can improve students' problem-solving skills. Digital technology can assist students in illustrating, understanding, and solving problems. For this reason, teachers need to train students' skills in operating various digital applications because they affect their ability to solve problems. The variety of technologies that can be used in learning allows teachers to choose suitable technology and can combine several applications to produce more optimal media.

**Keywords:** Digital technology; mathematics learning; problem-solving

## 1. INTRODUCTION

The development of Covid-19 post-pandemic era caused the level of PPKM (Imposition of Restrictions on Community Activities) in all regions of Indonesia, so learning methods continued to change. After distance learning (on the network) has been implemented, recently a new method has emerged, namely hybrid learning. Mixed learning is mixed learning between face-to-face and virtual face-to-face. Both daring learning and mixed learning in essence, still require teachers and students

to meet face-to-face or distance learning. Distance learning has many drawbacks and risks in its application, one of which is the lack of teacher supervision in ensuring students learn actively. For example, suppose those who are asked to access learning videos may not be able to see the students to the end, in this case the teacher is often unable to bring them together. This incident is possible because the teacher is less skilled in applying the selected digital technology. This is reinforced by the findings of Setyorini (2020) which stated that at the beginning of the pandemic, some teachers still had difficulties operating and implementing digital technology in distance learning (Setyorini, 2020).

Even though some teachers initially had difficulties designing learning using digital technology, for about three years, some teachers have continued to create and perfect the previous digital technology. Several teachers have implemented and combined various digital technologies in learning mathematics, for example: google classroom, geogebra, wolframalpha, desmos, edmodo, moodle, AR, and so on. In essence, digital technology cannot be separated from the learning process. Learning is not only content and pedagogical aspects, but also technological aspects. These three aspects are interrelated with each other, all three support each other so that they must be fully mastered. Content mastery will be stronger if it is presented attractively using digital technology. Then, the teacher's pedagogical ability will also affect his skills in using digital technology in the teaching and learning process. The interrelationship of these three aspects is illustrated in Figure 1.

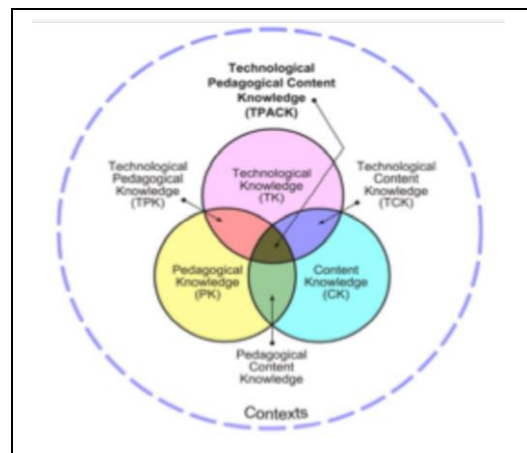


Figure 1. The connection among Content, Pedagogy, and Technology  
(Adapted from Mishra dan Koehler on Walters et al., 2018)

The use of digital technology, especially in learning mathematics, is not only seen as a learning medium but also a way to improve students' ability to solve problems. Mathematical problem-

solving ability is the ability of students to solve non-routine math problems whose completion requires organizing between several concepts. Problem-solving comprises four sequential stages: understanding the problem, planning problem-solving, implementing the plan, and checking again (Chirinda & Barmby, 2018; Polya, 1973, Polya, 1957). In more detail, the stages and indicators of problem-solving are presented in table 1.

Table 1. Indicator of Polya's problem-solving process

No	Problem-Solving Process	Indicator
1.	Understanding the problem	Student can identify the essential and non-essential information
2.	Devise a plan	Student can devise a plan to solve the problem
3.	Carry out the plan	Student carry out the plan by revising as needed to solve the problem
4.	Look back at the solution	Student look back and check the solution, and decide whether or not the solution makes sense

Source: (Chirinda & Barmby, 2018; Polya, 1973)

Much research has been carried out on the use of technology in distance learning, for example Khairunnisa and Aziz (2021) conducted research on using augmented reality (AR) in learning mathematics. Based on a literature study, it was found that the use of AR has the potential to increase interest, motivation, and results from a mathematics learning process (Khairunnisa & Aziz, 2021). In general, digital technology can be a tool for completing mathematical calculations, developing concepts, and training students' procedural skills (Jupri, 2018). The use of digital technology, such as learning videos, has also proven effective in increasing activity and ability to understand concepts (Agusta, 2020). More specifically, research on the use of digital technology based on problem-solving skills has also been carried out, for example: "Improving student's mathematical problem-solving skills" (Setiyani, Fitriyani, & Sagita, 2020); "Analysis of Mathematical Problem-Solving Ability with Distance Learning Methods on Quadrilateral Subjects" (Kanida, 2020); and "Mathematical Problem-solving ability Through Google Classroom Learning Media" (Yulian & Budianingsih, 2021). The results of these three studies will also be reviewed in this article. Therefore, researchers are interested in analyzing the use of digital technology and its potential in problem-solving-based mathematics learning. In addition, researchers also want to know the advantages and disadvantages of each digital technology used so that it can be used as a suggestion for the future.

## 2. METHODS

This is a literature review study utilizing a five-stage framework by Cronin, Ryan, & Coughlan, M. (2008). The five-stage framework were: selecting a review topic; searching the literature; gathering, reading, and analyzing the literature; writing the review; and references. The researcher conducted a literature review using direct sources as Mestika Zed did on Khairunnisa & Aziz (2021). This research source comes from articles published in Scopus and Sinta using the keywords “digital technology in problem-solving.”

## 3. RESULTS & DISCUSSION

The articles that have been selected are then briefly displayed, including the author, year, subject, method, instrument, dependent variable, and results. The summary information of the article is presented in table 2.

Table 2. Summary of selected article information

No	Researcher	Year	Title	Method	Results
1.	Arifin, Sholeh, Hafiz, Agustin, & Wardana	2021	Developing Interactive Mobile Mathematics Inquiry to Enhance Students' Mathematics Problem-solving Skill	Agile method	The use of Interactive Mobile Mathematics Inquiry (IMMI) affects indicators of students' problem-solving abilities, namely the ability to understand problems, the ability to plan solutions, re-check solutions
2.	Yulian & Budianingsih	2021	Mathematical problem-solving ability through google classroom learning media	Quasi experiment	After being taught with google classroom media, problem-solving ability is 54% in the good category. The test answer sheet shows that the majority of students still have difficulty doing a Back Examination (Looking Back)
3.	Setiyani, Fitriyani, & Sagita	2020	Improving student's mathematical problem-solving skills through Quizizz.	Quasi-experiment	The use of quizizz has a positive effect on students' mathematical problem-solving abilities of 52.6%
4.	Murni, V., Sariyasa, S., & Ardana, I. M.	2017	GeoGebra Assist Discovery Learning Model for Problem-solving ability and Attitude toward Mathematics.	Quasi-experiment	The difference in the learning process causes the GeoGebra-assisted discovery learning model to be better than the conventional learning model
5.	Mulhayatiah, Purwanti, Setya,	2019	The Impact of Digital Learning Module in	Quasi-experiment	Students' problem-solving skills using digital modules are

	Suhendi, Kariadinata, & Hartini		Improving Students' Problem-Solving Skills		better than PowerPoint
6.	Abramovich	2014	Revisiting mathematical problem-solving and posing in the digital era: toward pedagogically sound uses of modern technology	Kualitatif deskriptif	Even though applications can solve problems, teachers should design problems that cannot be directly worked on directly, but students need strategies to construct their solutions with digital applications.
7.	Avci, Vasu, Oliver, Keene, Fusarelli, & Avci	2014	Utilization of online technologies in mathematical problem-solving at high school level: student and teacher perceptions.	Kualitatif, studi kasus	Online communication and collaboration in groups as well as various perspectives or ways of solving problems, are factors that are considered important in the contribution of technology to improving students' abilities
8.	Kanida	2020	Analysis of Mathematical Problem-solving ability with Distance Learning Methods on Quadrilateral Subjects	Kualitatif deskriptif	From the four stages of solving math problems, students can carry out three stages well, while in the final stage, namely checking the results again, students have not achieved them

## Problem-Solving and Digital Technology

Problem-solving is a fundamental ability and foundation in mathematics education (Kilpatrick, 1969). Problem-solving is also included in the main 21<sup>st</sup>-century skills: communication, creative thinking, collaboration, critical thinking, and problem-solving (Kemendikbud, 2014). Problem-solving requires a question called a problem, meaning that not all questions are problems. A problem is categorized as a problem if students cannot solve it immediately, but need to organize several concepts to solve it. When solving problems, students need to: understand the problem, including writing down what is asked and what is known; creating a plan involves associating the problem with the information in the schematic; carrying out the plan includes solving the problem according to the previous plan; and re-checking includes writing answers according to questions in total and checking for errors in workmanship.

Students still encounter various problem-solving problems, especially in the distance learning period. In research conducted by Kanida (2020), the results obtained were that students tended not to meet the indicators of understanding the problem and did not check again so they did not answer

the problem correctly. A similar finding was found by Astutiani et al. (2019), in their research involving 44 class XI students, only one student solved the problem correctly and completely according to Polya's steps. This condition implies that problem-solving still needs to be optimized, one involving digital technology.

The use of digital technology in the distance learning period is indispensable. Even though this condition is relatively sudden, in the past two years, teachers have continued to work on improving their skills in creating digital-based learning media. The use of digital technology can be viewed from ready-made products such as video conferencing to those that require complicated processes, such as Moodle. Digital technology facilitates teachers to build a place filled with materials, questions, assignments, and quizzes. The use of digital technology is not only a substitute for conventional media but has its own role in influencing aspects of students' cognitive skills. The use of digital technology is effective in changing students' attitudes towards mathematics; digital technology is effective in supporting students' higher-order thinking skills, these skills are aligned with the needs of mathematics, namely the ability to solve problems creatively (Al-Hilli, 2018). Furthermore, students' skills in using digital technology are related to their ability to solve problems (Jacinto & Carreira, 2016).

The use of digital technology in problem-solving is numerous and varied, for example, using digital devices to replace conventional pencil and paper-based models. Jacinto & Carreira (2021) found that using digital devices makes it easier for students to express and solve mathematical problems. In fact, digital technology has been implemented to shift the negative impact of student smartphone use. The tendency of students to use smartphones gave birth to ideas from education experts to construct smartphone-based learning known as Mobile Learning (M-Learning). M-Learning is a part of digital-based learning or digital learning (Basak et al., 2018). The use of M-Learning has been around for a long time and has also been frequently researched, one of which is by Al-Khateeb (2018). Research found that students taught using M-Learning had better problem-solving skills than conventional methods (Al-Khateeb, 2018). The use of M-Learning in mathematics learning has been widely made, Arifin et al. (2021) creating IMMI (Interactive Mobile Mathematics Inquiry), namely M-Learning which is devoted to improving students' problem-solving skills through discovery-based learning. IMMI is proven to improve students' problem-solving skills (Arifin et al., 2021). The IMMI M-Learning dashboard display can be seen in Figure 2.

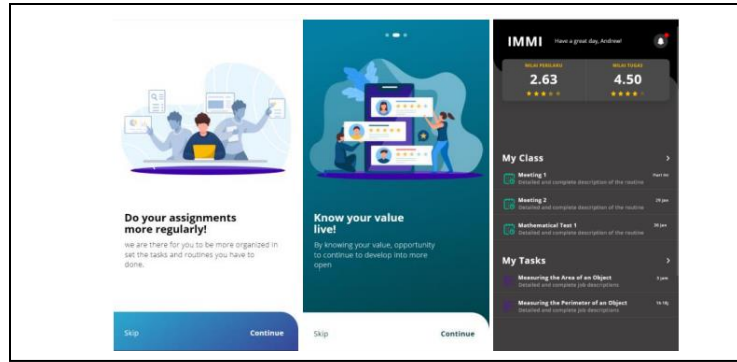


Figure 2. Dashboard IMMI (Arifin, Sholeh, Hafiz, Agustin, & Wardana, 2021)

### Digital Technology Efforts to Improve Problem-Solving ability

The use of digital technology is not only seen as a medium for providing learning material, but a system used to improve abilities, one of which is the ability to solve mathematical problems. The use of digital technology has found many positive impacts in supporting problem-solving abilities. Yulian (2021) found that students can solve problems well through the use of the Google Classroom application, furthermore, the most optimal stage to take is the stage of carrying out the plan. Graphically the research results can be seen in Figure 3.

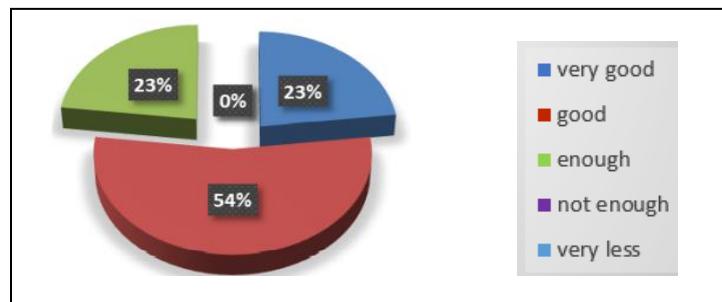


Figure 3. Percentage of Achievement of Mathematical Problem-Solving Ability (Yulian & Budianingsih, 2021)

Meanwhile, although digital technology can improve problem-solving abilities, Rahmawati (2021) found that many learning videos are still limited to discussing material concepts and have not yet touched on problem-solving. In this case, teachers must learn to apply digital technology and

design the material to be delivered, especially based on problem-solving. Learning resources that achieve problem-solving will support students in solving mathematical problems in different contexts. The problem that students in solving math problems often encounter is the problem of drawing graphs. Often students have difficulty representing questions in graphical form. Meanwhile, currently many applications can be used to assist students in making graphs. Interestingly, it turns out there is a special relationship between skills in operating a graphing calculator and problem-solving abilities. Parrot & Leong (2018) researched to investigate the effect of using a graphing calculator in solving mathematical problems. The results showed that students who were skilled in operating a graphing calculator had a better attitude in solving mathematical problems (Parrot & Leong, 2018).

Learning mathematics is closely related to solving mathematical problems, the more routine students practice solving problems, the more their abilities will increase. Presentation of problems in learning is usually in the form of exercises and quizzes. If exercises are used as a way of strengthening understanding, quizzes are used to check student understanding. Giving quizzes in the era of remote learning should not be presented casually because it tends to make students not interested. One of the media that can be used to present quizzes is the quizizz application which can be accessed via the address [quizizz.com](https://quizizz.com). Quizizz offers an interactive and interesting presentation of quizzes, even Setiyani (2020) investigates the role of quizizz in solving mathematical problems. The results show that using quizizz effectively improves students' problem-solving skills. The use of the quizizz application can be a means of presenting quizzes interestingly while increasing students' problem-solving abilities. Examples of problems presented in quizizz can be seen in Figure 4.

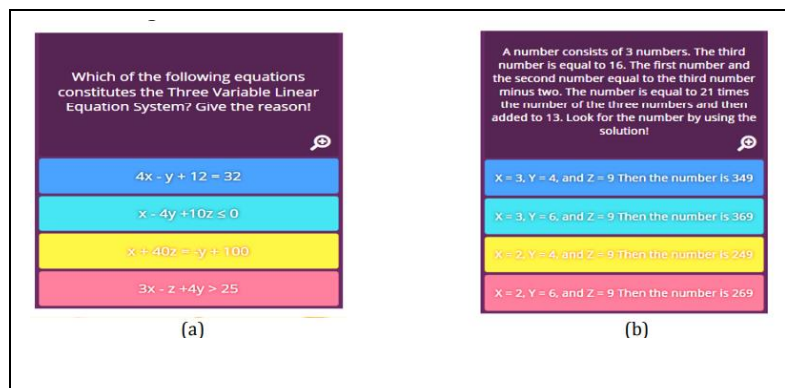


Figure 4. Math Problems Presented in Quizizz (Setiyani, Fitriyani, & Sagita, 2020)



One of the student’s difficulties in solving problems is usually because students fail to understand and illustrate the problem. Here digital technology should be used to assist students in representing problems in graphical representations that are easier to understand. Murni et al. (2017) investigated using a math graphics application called GeoGebra. The results showed that using GeoGebra can help students identify and solve problems and increase student interest (Murni et al., 2017). GeoGebra can be used in learning mathematics, especially discovery-based learning. Murni et al. (2017) gave students problems finding the area formula for a circle with the help of GeoGebra. First, the problem is presented in GeoGebra so that students can shift and adjust the radius as they wish (See figure 5a). Next, students are asked to partition the circle into a shape similar to a triangle so students can associate the area of the circle with the area of the triangle (See Figure 5b).

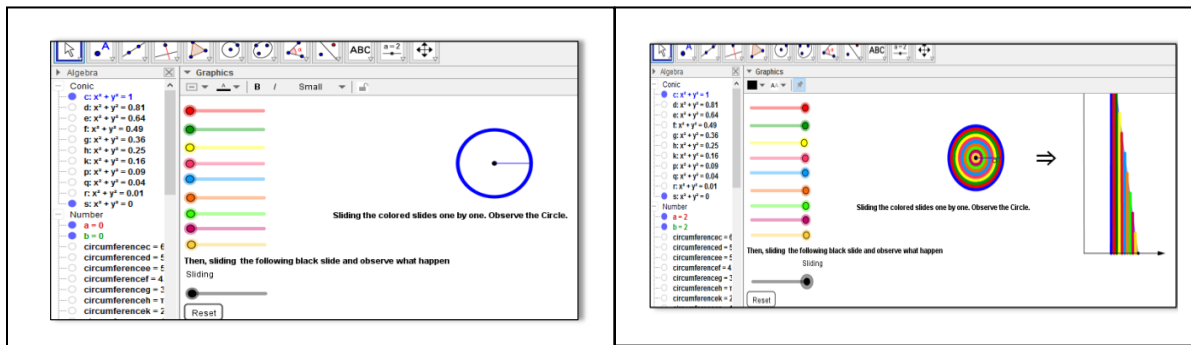


Figure 5. (a) Presentation of Problems Through GeoGebra, (b) Plan and Execute Plans Through GeoGebra (Murni, Sariyasa, & Ardana, 2017)

Finally, students are expected to be able to find the formula for the area of a circle, namely  $L = \pi r^2$ . Based on these problems, it can be concluded that using GeoGebra helped students understand and solve problems. Problems in learning mathematics are generally related to context-free problems, but currently, contextual problems are problems that are the center of attention, one of which was proclaimed by PISA. PISA questions are usually presented in the form of stories or everyday problems so that there is an axiological aspect to the problem. Based on these conditions, Walters et al. (2018) conducted exciting research on prospective mathematics teachers. This research was conducted to investigate the role of digital media-assisted storytelling on problem-solving strategies. Based on Polya's problem-solving steps, prospective teachers are asked to solve problems in narrative form. Then the prospective teacher tells it in video form by adding illustrations to clarify. The video is processed through the Window Video Maker 2.6 or iMovie application, a

method like this is called Math-eo. The study results show that teachers can use Math-eo to increase student engagement, motivation, and content acquisition.

Distance learning and video conferencing are two things that cannot be separated. Students and teachers no longer meet face-to-face but face in virtual meetings. There are many different things when meeting in a virtual one, one of which is that the teacher cannot monitor each student, whether he pays attention or not. The use of video conferencing has been criticized by many, one of which is through the question, "does video conferencing keep students' abilities the same compared to face-to-face?" Starting from this condition, Marhami et al. (2020) conducted research on the effect of online learning assisted by video conferencing on students' mathematical problem-solving abilities. The research was conducted on mathematics education students at a university in Indonesia. The study results show that online learning assisted by video conferencing has a positive effect on problem-solving abilities, meaning that learning using video conferencing does not eliminate the essence of learning mathematics (Marhami et al., 2020). Furthermore, learning mathematics assisted by video conferencing is the same as face-to-face because students and teachers can actively interact with each other by asking questions, giving suggestions, and discussing.

The use of digital technology continues to grow from time to time, currently the newest digital technology is AR technology. AR (Augmented Reality) technology is a technology that can project the virtual world into the real world. In simple terms, AR is being able to bring digital illustrations into the real world. Regarding the relationship between AR and the real world, it can be seen in Figure 6.

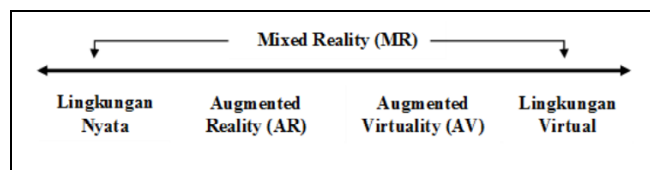


Figure 6. The Connection between the Real World and the Virtual World (Bower, Howe, McCredie, Robinson, & Grover, 2014)

AR technology has been widely used in the learning process. Khairunnisa & Aziz (2021) conducted a literature study on the role of AR technology in learning mathematics. The result is that AR technology increases students' interest, motivation, and learning outcomes. AR can allegedly bring students into the world of abstract mathematics, especially in the field of geometry, which is

full of graphic illustrations. Teachers can quickly introduce three-dimensional objects such as balls, cones, and tubes through virtual objects projected into the real world.

Mathematics learning cannot be separated from the main learning source, namely books. Books are one of the learning resources that are always used in learning, but books have drawbacks, namely being passive so there is no interaction. The development of the era has shifted the use of conventional books to be replaced them with digital learning modules. Digital learning modules don't just project books into a virtual world but add advanced features that conventional books don't have. Digital learning modules offer displays that attract students' attention, the presence of digital videos, there are even games. An example of a digital learning module can be seen in Figure 7.



Figure 7. Digital Learning Module (Mulhayatiah et al., 2019)

Furthermore, Mulhayatiah et al. (2019) conducted research to investigate the effect of using digital learning modules on students' problem-solving abilities. The results show that learning using digital learning modules positively affects students' problem-solving abilities. Problem-solving skills of students using digital learning modules are better when compared to students who are taught using PowerPoint media (Mulhayatiah et al., 2019).

More sophisticated digital technology facilitates computational thinking, simply the computer will work to solve complex mathematical problems. Examples of applications that can be used are Wolfram Alpha and Mapple. Both of this software can solve most math problems ranging from calculus, algebra, geometry, combinatorics, and others. The software works like a thinking student, interestingly, the software is tireless so that even very long processes can be completed in a short

time. Abramovich (2014) conducted research on the use of Wolfram Alpha, Mapple, and electronic spreadsheet applications to solve combinatorics problems. The problems and solutions using the Mapple application can be seen in Figure 8.

The screenshot shows the following mathematical steps in Mapple:

$$P(n) := \frac{n^2 \cdot (n+1)^2 \cdot (n^2 + n - 1) \cdot (2n^4 + 4n^3 - n^2 - 3n + 3)}{20}$$

$$n \rightarrow \frac{1}{20} n^2 (n+1)^2 (n^2 + n - 1) (2n^4 + 4n^3 - n^2 - 3n + 3)$$

$$P(n+1)$$

$$\frac{1}{20} (n+1)^2 (n+2)^2 ((n+1)^2 + n) (2(n+1)^4 + 4(n+1)^3 - (n+1)^2 - 3n)$$

$$P(n+1) - P(n)$$

$$\frac{1}{20} (n+1)^2 (n+2)^2 ((n+1)^2 + n) (2(n+1)^4 + 4(n+1)^3 - (n+1)^2 - 3n) - \frac{1}{20} n^2 (n+1)^2 (n^2 + n - 1) (2n^4 + 4n^3 - n^2 - 3n + 3)$$

simplify (%)

$$n^9 + 9n^8 + 36n^7 + 84n^6 + 126n^5 + 126n^4 + 84n^3 + 36n^2 + 9n + 1$$

Figure 8. Mapple Assisted Combinatorics Problem-Solving (Abramovich, 2014)

Based on figure 8, it can be seen that Mapple can solve this problem well. Even though these applications can solve problems, teachers should design problems that cannot be directly worked on but need students' strategies to construct solutions with the help of digital applications. This condition allows interaction between students and digital technology and supports digital technology as a student assistant in solving problems (Abramovich, 2014).

Using digital technology in learning mathematics is not always easy to implement, some teachers complain when teaching mathematics through distance learning. One of the things that most complain about is the loss of the role of the blackboard as a teacher's media in writing mathematical formulas. In contrast to Indonesian, the language of mathematics contains formal notations that are not on the keyboard. In this case, math teachers should use an additional device called a pen tablet. Pen tablet is a digital pen that functions the same as a marker on a whiteboard. Teachers don't have to worry about writing difficulties using the touchpad, pen tablets offer high precision and accuracy. Digital pens (pen tablets) are very effective for application in learning, especially for developing online and combined learning materials in offline learning (Mehlhorn et al., 2011).

Despite the many benefits and advantages of using digital technology in learning, it turns out that it also has a negative side. In a study, Avci et al. (2014) found several criticisms of using digital

technology, namely Google Documents, in problem-solving-based mathematics learning. This criticism is seen in 4 main themes: dislike of computers, not needed, the weight of computers, and responses that are not immediate. In detail, the data can be observed in Figure 9.

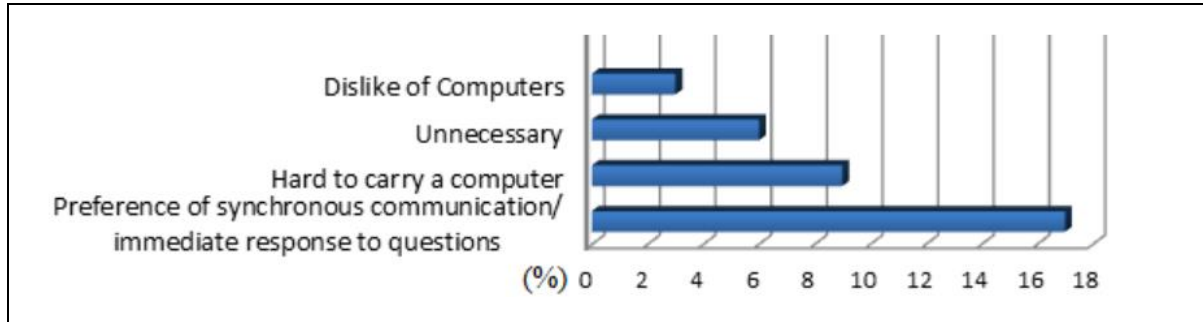


Figure 9. Four Main Themes Criticized by Students in the Use of Digital Technology (Avci et al., 2014)

Based on Figure 9, it appears that students' criticism of the use of digital technology is mostly an indirect response. Here students feel that using Google Documents does not facilitate students to get responses directly as in face-to-face learning. This criticism shows that digital technology should not rely on just one application but several applications that support each other. The use of digital technology continues to grow and its benefits are also increasingly widespread. Collaborative learning utilizes the use of digital platforms both synchronously and asynchronously, especially to improve mathematical problem-solving skills, which is a small but essential thing to prepare students for the 4.0 era (Symons & Pierce, 2019). In the end, although the development of learning materials does not directly guarantee student learning outcomes, this must continue to be done to help student success, of course along with student efforts as well (Mehlhorn et al., 2011).

### Disadvantage and Advantages

Among the various digital technology applications that can be used in mathematics learning based on problem-solving, we are presented it along with its advantages and disadvantages in table 2.

Table 3. Digital technology applications and their advantages and disadvantages

No.	Application	Advantages	Disadvantages
1.	Quizizz	Easy to use, simple, attractive appearance, points according to the speed of answering, rating system.	Cannot use video yet

2.	Graph Calculator	It is easy to just enter the formula, lots of color and presentation options.	allows students to rely only on a graphing calculator without being able to paint graphs manually
3.	Google Classroom	Can be used as a place to provide material, quizzes, exercises, conduct assessments in the form of photos and videos (links).	Only serves as a place only, need a file that has been made.
4.	GeoGebra	Can be used as media to construct graphics, graphics can be manipulated easily, complete applications and can also be formed in animation	Requires a powerful laptop as GeoGebra is quite heavy.
5.	Math-eo	Become a story teller	Designing stories in mathematics is not easy
6.	Video Conferencing	Can interact actively	Difficult to supervise
7.	Digital Learning Module	Attractive appearance, can be presented in the form of pictures, videos, and games.	Making it takes a long time, especially when using games
8.	Mapple	Able to solve mathematical problems such as calculus, geometry, algebra, combinatorics, et al.	Requires teacher skills to design problems that Mapple can't work on right away, heavy application.
9.	Wolfram Alpha	Like Mapple, it is just that it can be accessed via the website directly	Requires the teacher's skills to design problems that Wolfram Alpha cannot directly work on, requires a strong network connection.
10.	Google Document	Can be used as a place to put material, quizzes, assignments, and there is a comment feature as student feedback to the teacher	Does not facilitate an immediate response

Teachers need to train students to be skilled in operating digital technology because students' skills in operating digital calculators affect their ability to solve problems. Even though digital technology has proven to positively affect problem-solving abilities, each application has different functions, advantages, disadvantages, and designations, so teachers need to choose the one that suits their needs. The use of digital technology can assist students in illustrating problems, for example, using the GeoGebra application. Geogebra can be used as a medium in learning mathematics, for example, with the Geogebra-assisted discovery model which is proven to be better than conventional models (Murni, V., Sariyasa, S., & Ardana, I. M., 2017). Digital learning modules can be used as an alternative in presenting and guiding students to solve problems. As found by Setiyani, Fitriyani, & Sagita (2020), Quizziz has a positive effect on improving students' problem-solving abilities. Quizziz can be used to add to the beauty of the problems presented so that students' interest is higher. Discovery-based Mobile Learning has a positive effect on indicators of students' ability to solve problems (Arifin, Sholeh, Hafiz, Agustin, & Wardana, 2021), so that Mobile Learning can be used as an option in teaching problem-solving-based mathematics. Mapple and Wolfram Alpha software facilitates students to do complex calculations and help solve various math problems. The Google Classroom application can also be an option in teaching math problem

solving, because the use of Google Classroom can improve students' problem-solving skills (Yulian & Budianingsih, 2021). Augmented Reality (AR) contributes to developing students' higher-order thinking skills, on the other hand higher-order thinking skills affect students' problem-solving abilities, so that AR has the potential to indirectly improve students' problem-solving skills (Bower, Howe, McCredie, Robinson, & Grover, 2014). The teacher should explore the intricacies of the application to be selected and then try to combine it with several other applications to obtain more optimal learning media.

The research results from the articles state that digital technology positively affects problem-solving skills in mathematics. Based on the analysis, it can be concluded that digital technology can improve students' ability to solve mathematical problems. Some studies recommend using digital technology in learning because it can improve higher-order thinking skills. Even though digital technology can help students, teachers must design questions that fall into math problems. The use of technology such as Wolfram Alpha can actually have a harmful impact if students only copy the answers. Distance learning or hybrid learning allows students to use cellphones and laptops, if the questions are not appropriately designed, students don't solve problems, maybe students just copy answers.

The research results from the selected articles show that although digital technology has a positive effect on students' problem-solving abilities, each technology has different drawbacks. The better and more complete the digital media is, the more complicated and time-consuming it is to manufacture. This might be a criticism for teachers and policymakers, teachers' time will be more consumed if they have to design complex digital learning media. There should be a collaboration between creators of digital learning media and teachers as instructors. In addition, there are not a few teachers who are not digitally competent, this condition is contrary to the government's expectations to implement digital technology in learning. It is better if schools and related parties continue to launch training programs for making digital learning media, especially for math teachers. In this study, researchers would like to recommend further research regarding the skills of mathematics teachers in constructing digital learning media, especially in improving students' problem-solving abilities in the post-pandemic era.

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