Exploring the Impact of Technology-Integrated Mathematics Worksheet in the Teaching and Learning during Covid-19 Pandemic

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Abstract: The Covid-19 pandemic switched the learning activity at school to be home learning. In Indonesia, the practice of uploading paper - based worksheets is the most practice conducted during pandemic. Many students feel disengaged with the activity, leading to a decline in their study results. The use of paper-based worksheets itself also brings limitations to the learning activity. Therefore, this research introduces interactive and technology-integrated mathematics worksheets using Desmos for teaching and learning in high school to solve the issue through a series of workshop to junior high school mathematics teachers in Jakarta. The workshop participants would then use the developed worksheets in their teaching and learning. The questionnaires and reflection forms would be distributed after they had completed the worksheet implementation. The questionnaire adapted from the Triple E framework assessed the impact of the technology implementation. The data would be analyzed using descriptive statistics and described according to the triple E framework component to get insight from both students and teachers into the relevant issues in implementing the worksheet. The research found that most students can increase learning mathematics engagement and enhancement using this kind of worksheet during home learning. However, there were concerns regarding how the teacher was supposed to use this sort of worksheet.

Keywords *worksheet, Mathematics worksheet, triple E framework, Desmos, Covid-19 Pandemic*

INTRODUCTION

Covid 19, which causes a worldwide pandemic, becomes a challenge in everything globally, including education. All schools and campuses are forbidden to have face-to-face meetings in the teaching and learning process. Every teacher requires the adoption of the technology immediately to keep the teaching and learning process continuity. However, as most teachers usually adopt face-to-face meetings in their teaching and learning activities, not much variation of educational technology is being used during the pandemic. The current research reveals that most teachers used the technology only to upload the learning media such as paper-based worksheets, video, or books and asked students to study it in the mode of independent asynchronous (Agarwal & Kaushik, 2020; Allo, 2020; Murtafiah et al., 2020; Senza Arsendy,

George Adam Sukoco, 2020). This continual practice's impact decreases the engagement level and leads to the decline of the study results (Onyema et al., 2020; Orlov et al., 2021).

Worksheet is one of the tools teachers use to help the learning process (Windari et al., 2018). In other words, the worksheet has a role to be the scaffold that provides hints or descriptions of the steps the students should go through when solving the problem (Choo et al., 2011; Kajander & Lovric, 2009; Nasrullah et al., 2018). The worksheet is also used to promote active learning through discussion (Haryani, 2020). The delivery of worksheets can be in the form of computer-based or paper-based. The computer-based worksheet itself is often associated with technology-integrated worksheets as some technology is required to develop this worksheet. Some previous research stated that many teaching practices use paper-based worksheets (Amalia et al., 2018; Haryonik & Bhakti, 2018; Zahro et al., 2017). However, there are some limitations in using the paper-based worksheet, especially in the pandemic era. It is harder to engage students in discussion using paper-based worksheets in online learning settings, as not all students are willing to share their ideas. Students' level of willingness and confidence to speak up their ideas is affected by comprehension (Abdullah et al., 2012). The better performance of students in academics, the more confidence of students to speak up. We also need to notify other external factors that discourage students from sharing their opinions, such as limited internet connection, non-interactive environments of online learning, and concerns about Covid-19 (Baloran, 2020). There is an urgency to motivate students speak up in a discussion, as students learn better when communicating their ideas with others (Hobri et al., 2019).

Giving feedback on paper-based worksheets is also challenging. The time constraint limits the teacher's ability to give immediate feedback (Wyels, 2011). Teachers may also find it challenging to choose interesting students' work that can be discussed as a learning case. Furthermore, it is harder to explore mathematics in the non-animative figure with paper-based worksheets. We take an example in geometry, where it studies all the objects in this world, which cannot be simply explained using two-dimensional Euclidean geometry (Güven & Kosa, 2008). To better understand geometry, NCTM (2000) recommended providing instruction to study three-dimensional geometry and opportunities by using spatial skills to solve the problem that is not supported by paper-based worksheets (Güven & Kosa, 2008). Promoting spatial skill can be done by supporting technology such as virtual reality or other technology, bringing geometry visualization in 2D and 3D (Kwon, 2003).

The National Council of Teachers of Mathematics (NCTM) stated that it is vital to access the technology that supports reasoning, problem-solving, and communication. Many research has suggested that technology has provided a better Mathematics understanding of students as they can explore through interacting with geometry figures and other abstract concepts (Attard & Curry, 2012; Setyawan et al., 2018; Zengin, 2017). This research then suggests Desmos.

Desmos is a web-based application that was made to help students learn math and make math fun (Kristanto, 2019). Desmos itself has a lot of free digital activities that help students learn math in different ways. If you want to learn about math, Desmos has a graphing calculator and a way to make digital activities. This platform is very useful right now, especially in the math classroom, teaching, and learning through online lessons. If you'd like more information about Desmos, you can go to https://www.desmos.com to find out more about it.

Quesada & Cooper (2010) state that the potential benefits of graphing calculators in Desmos can go beyond students' achievement and conceptual understanding because it can integrate technology into material that can increase students' engagement with learning. Graphing calculators on Desmos can empower students to explore mathematical concepts independently, allowing them to take an active role in their learning (Thomas, 2015). There was a study in which the researcher gave a project to 8-grade students to make graphs with Desmos using different ways of function and transformation (King, 2017). The teacher asked students to explore an online calculator during an hour of mathematics lessons and start drawing the required graph. The result was that students develop an understanding of Desmos and how online graphing calculator works. Students completed most of the work required in a class, so they only needed to add the finishing touches to projects at home. They also got instant feedback from their project, making the students interested and excited to explore what is happening on the graph of the function as parameters vary, much less trying to enter an equation that produces an expected or desired curve. So, the time spent on the classroom activities can help the researcher monitor students' progress and solve any problems they may encounter, either with the Desmos calculator or instructions.

Other research conducted by Abdul Rachman Taufik and Sadrack Luden Pagiling (2021) aimed to introduce the Desmos page for learning mathematics and train the teachers to use it in the teaching and learning process. The results obtained were that most of the participants are proficient in operating the Desmos page, and this training has provided new knowledge to visualize abstract Mathematical objects, especially in the material of functions and geometry or graphics (Taufik & Pagiling, 2021).

However, previously mentioned research did not discuss how well the use of technology-integrated worksheets in their lessons to achieve the desired learning goals. Several studies stated that technology could increase students' engagement (Bebell & O'Dwyer, 2010; Kristanto, 2019; Russell et al., 2003). Meanwhile, other research also mentioned that increasing student engagement does not always positively impact student enhancement (Filer, 2010). Knowing that the technology is beneficial for our classroom cannot be done by simply choosing the apps listed as "educational technology." A study found that over 70% of apps listed as educational applications in the Apple store have zero educational research in the development (Wartella, 2015). Moreover, only a few studies explained that such apps positively correlate to the learning goals (Wartella, 2015). Therefore, we must ensure that the technology we choose brings excitement and satisfies students' learning needs.

Triple E-Framework was designed by Dr. Liz Kolb for educators to easily evaluate how to select tools to meet their learning goals and ultimate design learning experience. The framework is not explicitly highlighting technological tools, but it focuses more on learning goals. Using Triple E-Framework by Dr. Liz Kolb will guide and provide teachers with a quick and straightforward way to evaluate technology's use in their lessons. The framework also determines if the technology used for the teaching and learning process is appropriate and positively impacts meeting learning goals (Sripada & Cherukuri, 2019). Thus, Triple E-Framework's use can give teachers information about how well the technology supports them in achieving learning goals. This framework has three components: engage, enhance, and extend, each containing three questions concerning learning goals (Curry & Curry, 2018).

Finally, this research also aims to optimize the capability of teachers in highlighting the features of the technology to support the learning activities that will develop students' understanding, stimulate their interest, and increase their mathematics proficiency. Therefore, this research introduces Desmos in developing and implementing the worksheet to answer issues of students' disengagement, ineffective feedback, and the need to learn spatial skills in the form of a workshop for the junior high school mathematics teachers. Furthermore, this workshop highlighted the feature of Desmos as Dynamic Geometry software (Setyawan et al., 2018) and explained that Desmos could be used to create an interactive technology-integrated worksheet. The researcher then explored the worksheet implementation in the teaching and learning process at the school and investigated the worksheet's impact on the teaching and learning seen from both teachers' and students' perspectives using Triple E framework, especially in solving the issues addressed by the covid-19 pandemic.

METHODOLOGY

In this research, the researcher would conduct a workshop for teachers to introduce the Desmos Activity Builder to create the technology-integrated worksheet. After the workshop, teachers were required to create the worksheet and implementing it in their classroom. The teachers who completed the workshop and were applying it in their classrooms and their students would then be the participants in this study. There were 13 teachers and 315 students who would be the research participants. The researcher then distributed the student's questionnaire and the teacher's reflection form to see the worksheet's impact on the teaching and learning activities. Both data would be analyzed and described descriptively based on the Triple E framework. However, the coding and description of the Teacher reflection result also covered the teaching experience in utilizing digital technology and the problem in utilizing the Desmos worksheet. The details of the methodology will be as follow:

a. Preparation of Community Services

This research was started by preparing the community services. First, the researcher would conduct a workshop to utilize a Desmos teacher to create a technology-integrated worksheet. The preparation included the development of the material, the example of technology integrated mathematics worksheet with the help of the Desmos teacher, trainer (ToT) training for facilitators coming from the Mathematics Education Department, and the co-facilitators who were the students of the Mathematics Education Department.

The material covered in the worksheet was linear equation and function, as this is one of the junior high school level mathematics contents. The researcher developed the worksheet to develop the exploration and analysis skill of students. Therefore, many questions in the worksheet lead the students to use their analytical and exploration skills. The worksheet is available at the following link:
https://teacher.Desmos.com/activitybuilder/custom/5e1f96471efe4826298745b6

Besides the sample of a technology integrated worksheet, the researcher also developed a module consisting of the tutorial, the exercise, and the answer that can be accessed digitally. Participants then accessed the materials in the provided google classroom

Community Services

In the community services, the researcher with Mathematics Education Lecturers and some students had a one-month workshop with four times meeting, covering teaching how to utilize teacher Desmos as the media to create a technology-integrated worksheet. About 60 Mathematics Teachers from all over Jakarta participated in this workshop. This workshop aimed to introduce Desmos and feature as media for creating the worksheet, made teachers get used to working with Desmos, and created worksheets from Desmos that can be discussed directly with other teachers.

After the workshop, teachers must have applied the knowledge in the classroom practice, then filled the teacher's reflection form accordingly. Teachers also required their students who receive the worksheet's implementation to fill the student's questionnaire.

b. Data Collection and analysis

After an online workshop, every teacher must have continued implementing technology-integrated worksheets in their online teaching and learning. Teachers were allowed to contact the researcher if there were some issues during the implementation. Following implementation, the teacher should have submitted an implementation report by filling out several questions and data in the teacher's reflection form. Students from the associated teacher also completed the questionnaire. The questionnaire adapted from Triple E Framework assessed the impact of technology use in the teaching and learning process by looking at three components: Engagement, Enhancement, and Extension. **Table 1** will contain the list of statements in 3 scales answer (Yes, Maybe, No):

NO	STATEMENTS	0 (NO)	1 (MAYBE)	2 (YES)
	ENGAGEMENT			
1	The material is more interesting if it is presented in the form of a Desmos worksheet than in a paper-based worksheet			
2	I become more motivated in learning the material presented in the form of Desmos Worksheet			
3	The Desmos Worksheet makes me focus on the material without trying to open unnecessary websites.			
4	I am becoming more active when working with the Desmos worksheet			
	ENHANCEMENT			
5	I understand better if the content delivered in the form of the Desmos worksheet			
6	The Desmos worksheet makes me understand the material through the given feedback from the teacher.			

7	The Desmos worksheet makes me understand the material not only with the drill and practice but also with the material exploration through the content visualization	
	EXTENSION	
8	The Desmos worksheet creates a bridge between the learned material in the class and everyday lives.	
9	The Desmos worksheet makes me able to learn the material outside of school hours.	

Table 1: Students' questionnaire adapted from Triple E Framework.

How to read the overall result:
13 – 18 : Exceptional connections between the technology tools, instructional choices around the tool, and students' focus and comprehension of the learning goals.

7 -12 : Some connections between the technology tools, instructional choices around the tool, and students' comprehension. A need to reevaluate the missing part in this technology implementation.

6 below : The lesson design requires more attention as the lesson only engages students but is not meaningful.
(Liz Kolb, 2017)

While the teacher would fill the survey of the following questions:

No.	Teacher Reflection Report Questions
1.	Before this workshop, have you used digital technology in your teaching and learning?
2.	If you have used digital technology, please mention the technology you have used in your class!
3.	Have you known about Desmos before this workshop?
4.	Have you used Desmos in teaching and learning Mathematics before the workshop?
5.	After implementing in your class, please describe the positive impact and the advantages using Desmos in your classroom!
6.	After implementing in your class, please describe the negative impact and disadvantages using Desmos in your classroom!
7.	If you feel that Desmos is helpful, please describe why other teachers should know about Desmos?

Table 2: Teacher Reflection Report Questions

All of the students' results and teacher reflective form would be coded based on three elements of the Triple E rubric: Engagement, Enhancement, and Extension. It would be

analyzed percentage - statistically descriptive and supported by the teachers' statement in teachers' reflective report to answer whether the Desmos can solve the issues of paper-based worksheet implementation during the covid-19 pandemic.

FINDINGS AND DISCUSSION

Thirteen teachers submitted their reflective reports about the utilization of the Desmos worksheet in their classroom. The following charts and table summarize the results of the teacher reflective report. Questions 1, 3, 4 are yes/ no questions asking whether teachers have used digital technology in teaching and learning Activities. Moreover, Question 2 lists the digital technology that teachers have used. Please see **Table 2** for the list of questions. The following charts depict the result of Q1 - 4.

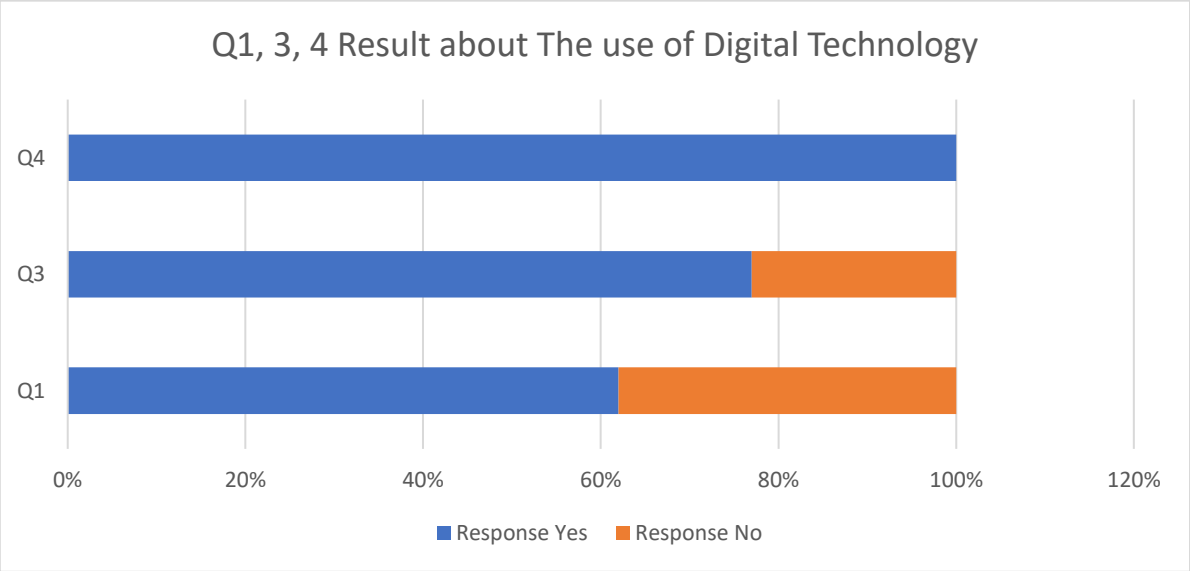

Figure 1: The Result of Question 1, 3, and 4 of the Teacher Reflection Report

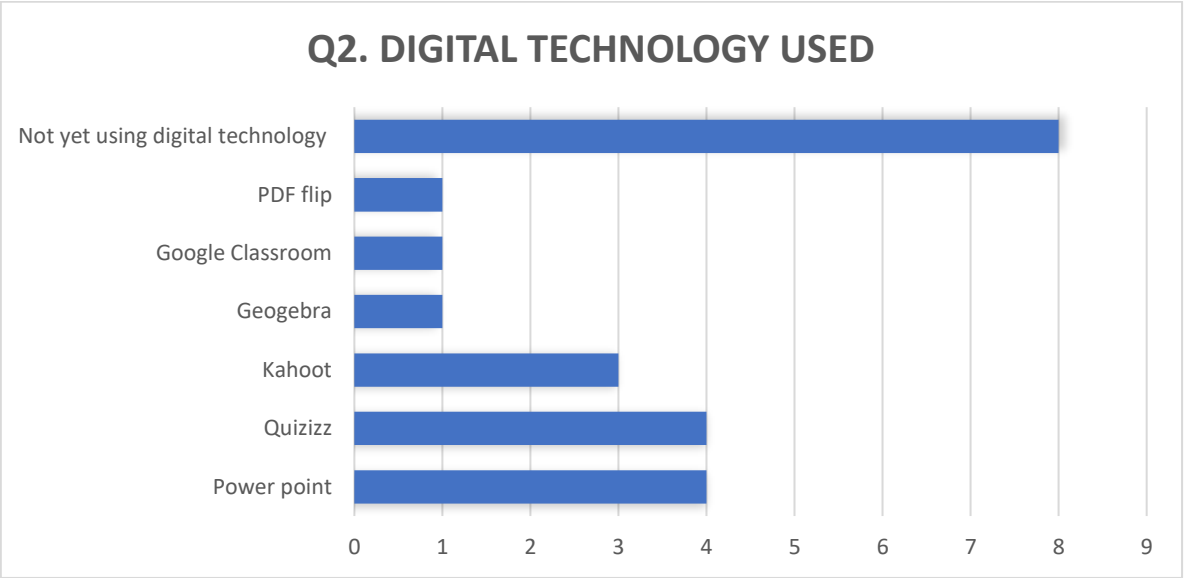

Figure 2: The result of Question 2 of the Teacher Reflection Report

Questions 5 – 7 were coded and themed into teaching experience with digital technology after utilizing the Desmos worksheet in their classroom. The following topics will be the Triple E component: Engagement of Students in working with the worksheet, Students Enhancement of the topics delivered in Desmos worksheet, and the Extension of the worksheet into the daily lives. Finally, the last topic will be the problem in utilizing the Desmos worksheet. The written statements will be coded as $Q_a(Te/E/N)_bT_c$. The Capital Q indicates the Question source. The capital Te/E/N tells the topic among Teaching experience with digital technology (Te), Triple E Component (E), or the problem in utilizing Desmos (N). Furthermore, Capital T represents the teacher.

The small letter a, b, c explains the sequence. The small letter "a" explains the sequence of questions. The small letter "b" explains the sequence of the sub-topics where the first topic has two subtopics, the second topic has three sub-topics, and the last topic has three subtopics. Finally, the small letter "c" tells the sequence of teacher identity from 13 teachers.

For example, the code $Q_5Te_1T_7$ means the statement is the response for Question no.5 about Teaching Experience with digital technology with the first subtopic: Teacher performance in digital technology from teacher 7. T**able 3** represents the result.

TEACHING EXPERIENCE WITH DIGITAL TECHNOLOGY		
Coding	**Statement**	**Sub Topics**
$Q_5Te_1T_5$	I can create two worksheets	Teacher performance in Digital technology
$Q_5Te_1T_7$, $Q_5Te_1T_{11}$	I (teacher) develop my knowledge in using and creating Desmos worksheet	

$Q_5Te_1T_{10}$	I (teacher) learn a lot about the digital technology development	
$Q_5Te_1T_{13}$	I successfully create a worksheet containing the opening, the learning activity, and also reflection session	
$Q_7Te_1T_3$, $Q_7Te_1T_4$, $Q_7Te_1T_{12}$	Desmos is very easy to make. There are many examples of games, opening, closing, and challenges that can be adopted and used immediately	
$Q_5Te_1T_3$	The teacher can see how far the live progress of students' understanding."	Teaching Mathematics in pandemic
$Q_5Te_1T_1$	The learning becomes interactive	
$Q_7Te_2T_1$	help mathematics teacher in teaching mathematics online	
$Q_7Te_2T_3$	Desmos enables interactive distance learning	
$Q_7Te_2T_2$, $Q_7Te_2T_3$, $Q_7Te_2T_5$	teachers can directly monitor student performance via the teacher dashboard	
$Q_7Te_2T_3$	can provide immediate feedback on student performance	
$Q_7Te_2T_3$	Desmos allows for fun learning with various games and challenges.	
$Q_7Te_2T_4$, $Q_5E_1T_8$	interesting and not monotonous	
TRIPLE E COMPONENT		
Coding	**Statement**	**Sub topics**
$Q_5E_1T_1$	students are motivated	Engagement
$Q_5E_1T_2$	feel interested in working with the problem feel challenged to solve the problem	
$Q_5E_1T_3$	students can work independently	
$Q_5E_1T_4$, $Q_7E_1T_5$	Students become more active	
$Q_5E_1T_9$, $Q_5E_1T_{12}$, $Q_7E_1T_9$	Students feel excited, and they are more enthusiastic about discussing the taught material	
$Q_5E_1T_{12}$	Students enjoy activity using Desmos because it is visually exciting, and there are interactive mathematical games also	

$Q_5E_1T_{12}$	Students do not feel bored spending much time in mathematical learning	
$Q_5E_1T_{13}$	Students enjoy having mathematics class, as they can learn while being monitored and guided by the teacher	
$Q_7E_1T_{10}$	Desmos makes students love learning mathematics	
$Q_5E_2T_6$	Students understand material faster using this kind of worksheet	Enhancement
$Q_5E_2T_{10}$	Students feel Desmos helpful in building creativity and geometry visualization	
$Q_7E_2T_6$, $Q_7E_2T_9$	Some material is easier to understand by using Desmos	
$Q_5E_3T_{12}$	The content given in the Desmos is meaningful as it is in the form of daily life stories	Extension
PROBLEMS IN USING THE DESMOS		
Coding	**Statement**	**Sub Topics**
$Q_6N_1T_1$	Explore more about the Desmos menu and feature	Desmos Creation and Utilization
$Q_6N_1T_3$, $Q_6N_1T_7$, $Q_6N_1T_{10}$	Not getting used to utilizing Desmos	
$Q_6N_1T_8$	I cannot find how to type the Mathematics Symbol in Desmos	
$Q_6N_1T_{12}$	Creating Explorative Pages	
$Q_6N_1T_{13}$	Need more time to create the worksheet	
$Q_6N_3T_2$, $Q_6N_3T_9$	The Unstable Signal	Internet Connection
$Q_6N_2T_2$	The computer did not respond when using Desmos with other application	Problem with used Device
$Q_6N_2T_4$, $Q_6N_2T_5$, $Q_6N_2T_{11}$	A small screen on the phone limits the way of students utilize Desmos	

Table 3: Q5 - 7 Results of Teacher Reflection Report

Three hundred fifteen students of the corresponding teachers filled the questionnaire, and the following T**able 4** shows the result. The percentage explains how many students answered the

options (yes/no/maybe). The total score is obtained from the sum of multiplying the percentage with the option's score accordingly**.**

Statement	0 (No)	1 (Maybe)	2 (Yes)	Total Score
ENGAGEMENT				
1	13%	30.80%	56.20%	1.432
2	17.50%	40.60%	41.90%	1.244
3	13.30%	36.80%	49.90%	1.366
4	17.80%	35.60%	46.60%	1.288
Mean	15.40%	35.95%	48.65%	
SD	2.25%	3.50%	5.20%	
ENHANCEMENT				
5	13%	41.90%	45.10%	1.321
6	11.10%	43%	46%	1.35
7	6.70%	54.70%	38.60%	1.319
Mean	10.27%	46.53%	43.23%	
SD	2.64%	5.79%	3.30%	
EXTENSION				
8	9.10%	36.60%	54.40%	1.454
9	13.40%	41.30%	45.30%	1.319
Mean	11.25%	38.95%	49.85%	
SD	2.15%	2.35%	4.55%	
			TOTAL SCORE	12.093

Table 4: Result of students' questionnaire.

According to the Triple E framework (Kolb, 2020), the total score of 12.093 reflects some connections between the technology tools, instructional choices around the tool, and students' comprehension. However, there is a need to reevaluate the missing part in this technology implementation.

The following discussion will be based on the percentage of each component in the students' questionnaire result supported by the result of the teacher's reflective survey in the topics Triple E component to tell more about the Desmos implementation in the classroom. Before that, the researcher would have discussed teachers' performance in utilizing digital technology before and after the workshop using the data presented in **figure 1, figure 2,** and **Table 3**. Finally, the researcher also discussed the issues in utilizing the Desmos worksheet in classroom practice.

a. Teachers Performance in Utilizing Digital Technology

The teachers' reflective report result shown in **figure 1** shows that more than 60% of participating teachers did not use digital technology in the classroom. Ironically, in **figure 2,** we found that less than 40% of teachers who have used digital technology said that their

used digital technology was primarily limited to PowerPoint and gamification platforms such as Quizizz and Kahoot.

According to **Table 3** in topics about teachers' performance in utilizing digital technology, after joining the workshop and implementing it into their class, teachers finally realized that Desmos Worksheet positively impacted students and teachers. Teachers were also motivated to know more and keep studying Desmos to create better worksheets. Teachers also gave positive feedback of the workshop and recommended this kind of activity to be conducted again. They found the workshop about Desmos helped them significantly deliver meaningful material and improve the students' conceptual understanding, especially in this pandemic situation where technology adoption is still a challenge for most teachers in Indonesia (Edtech World Bank, 2020). Using the Desmos worksheet helps teachers monitor every student's progress through a real-time dashboard so that teachers can give immediate feedback. Teachers also found that creating the Desmos worksheet is easy as many templates and activities can be adjusted according to the students' needs.

Teachers' motivation to learn about Desmos leads to better utilization of digital technology in the classroom during the pandemic. They were willing to spend more time studying and experimenting with Desmos features, as seen by the worksheets they have made. Several studies indicated that technology acceptance and the positive attitude of the teacher toward the technology would bring a successful integration of the technology into the classroom (Ertmer et al., 2012; Kluever et al., 1994; Yuen & Ma, 2008). Furthermore, it boosted the teacher's enthusiasm and allowed the teacher to develop a sharing community in which any teacher may look at the developed worksheet and use, amend, and alter other teachers' worksheets based on their needs.

b. Triple E – Component

This part describes how the Desmos worksheet can build better engagement, extension, and enhancement supported by the teacher's reflective report in topics about Triple E component given in **table 3** and students' questionnaire result in **table 4**.

1. Better Engagement

   Students and teachers reported that using Desmos Worksheet, the class engagement level increased regardless of the changing teaching and learning delivery mode. They were more active during distance learning and motivated to learn further. It is supported by statement no. 1-4 in **Table 4** and some teachers' statements in the reflective report as listed in **Table 3** in subtopic Engagement. Furthermore, engagement is not merely an act of involvement, yet a sense of belonging to the activity (Trowler, 2010). There are three dimensions of engagement when we are looking at the teaching and learning activity. They are behavioral, social, and cognitive engagement (Fredricks et al., 2004). **Table 5** exhibits three dimensions of engagement in the teaching and learning activity using Desmos technology-integrated worksheet supported by the teacher's statement in the reflective report taken from **table 3.**

Dimensions	Teachers' Statement	Details
Behavioral Engagement	Students do not feel bored spending much time in mathematics class (Q5E1T12)	Behavioral engagement focuses on behavioral norms such as attendance and involvement. Feeling being monitored is considered positive, as students know that the teacher will always be there for students and willing to give help anytime students needed even though they cannot meet face-to-face. The use of Desmos in building the technology-integrated worksheet can provide both teachers and students in terms of monitoring the progress through the teacher dashboard.
	Students enjoy having mathematics class, as they can learn while being monitored and guided by the teacher (Q5E1T13)	
Emotional Engagement	Students show enthusiasm in learning mathematics using this kind of worksheet (Desmos) (Q5E1T9, Q5E1T12, Q7E1T9)	Emotionally engaged students will show enthusiasm, interest, excitement in joining the class. They feel excited not only because it is interesting visually but also because they express their idea worry-free that their identity will be exposed. Desmos provides a safe environment where the identity will be anonymous or not depend on how the teacher sets it up according to the class needs.
	It encourages them to ask questions about the explained material (Q5E1T9, Q5E1T12, Q7E1T9)	
Cognitive Engagement	Students feel interested in working with the problem and feel challenged to solve the problem. (Q5E1T2)	In cognitive engagement, students will at least meet the requirements of the teacher. Feel that being challenged is one example of cognitive engagement. They will find more than what the teacher requires in the learning activity. The student will build their independence automatically when they are cognitively engaged. They know what to do.

Table 5: Three dimensions of engagement.

Table 5 exhibits evidence that Desmos Interactive worksheet can encourage students to engage behaviorally, emotionally, and cognitively. The previous study mentioned that factors influencing students to engage and speak up their ideas in the classroom discussion were affected mainly by students' comprehension (Abdullah et al., 2012). Meanwhile, this research showed that this kind of technology supported students to be cognitively engaged with the activity. Students were active in speaking up about their

idea regardless of their comprehension of Mathematics. Students were provided with space where they can speak up their ideas, and through the teacher dashboard, the teacher also can monitor which students were not engaged in the discussion yet and motivated them to speak and give the support as needed.

2. Better enhancement yet needs attention in some parts

Table 3 in subtopics Enhancement found that the Desmos worksheet makes students feel easier and faster in understanding the material. Teachers also mentioned that the Desmos worksheet helps in better geometry visualization and builds students' creativity. This is also justified by students' questionnaire result no.5 in **Table 4,** which states that most students (45.1%) believe that they understand the concept through the Desmos worksheet. Desmos worksheet provides a way where the teacher can build a conducive classroom. A conducive classroom is where students and teachers actively interact through discussion (Abdullah et al., 2012). Various features of Desmos can help students to get more understanding of the mathematical concept. For example, students could see the table to analyze the data presented. Students may also work with sliders in the graph feature to see the transformation of the graph toward change in a particular variable. Students who like the challenge can work with sets of questions set in marble slides or matching cards. Students are also provided with the flexibility to answer the teacher's prompt by choosing a correct answer, writing an essay, writing the mathematical equation, uploading a picture, or describing the thinking through a graph using a graphing calculator or drawing through sketching feature (Orr, 2017).

Students can also enhance their understanding through feedback given by the teacher/ by the system. This is in line with statement no. 6 in **Table 4**. Desmos can provide students' real-time progress so that teachers will have a more effective time understanding the needs of the students. According to Poulos & Mahony (2008), students will recognize the feedback effectively if presented individually and given timely. Using the Desmos worksheet, the teacher can provide real-time feedback by sending a private comment through the lesson feedback feature under each answer submission. Students will get a notification once they received the feedback.

Surprisingly, students were unsure whether their increasing understanding is developed because of the exploration skill through visualization content. It is Statements no.7 in **Table 4** confirms where most students (54.7%) are unsure. After checking the content of every worksheet submitted, the researcher found that most teachers still use drills and practice as the content of their worksheets. Only a few teachers can add exploration and analysis content to their worksheets. Students who received non-explorative content will feel excited as this is their first time engage with the tools. However, as time goes by, the understanding will fade out due to drills and practice only during the teaching and learning process (Lehtinen et al., 2017). The drill and practice technique primarily influences student's memory skills (Trowler, 2010). Therefore, to minimize the cognitive load in students' memory, students should be exposed to exploring and analyzing skills in the learning activity. Below (see **Figures 3 and 4**), we provide the explorative and non-explorative taken from the Desmos worksheet created by teachers.

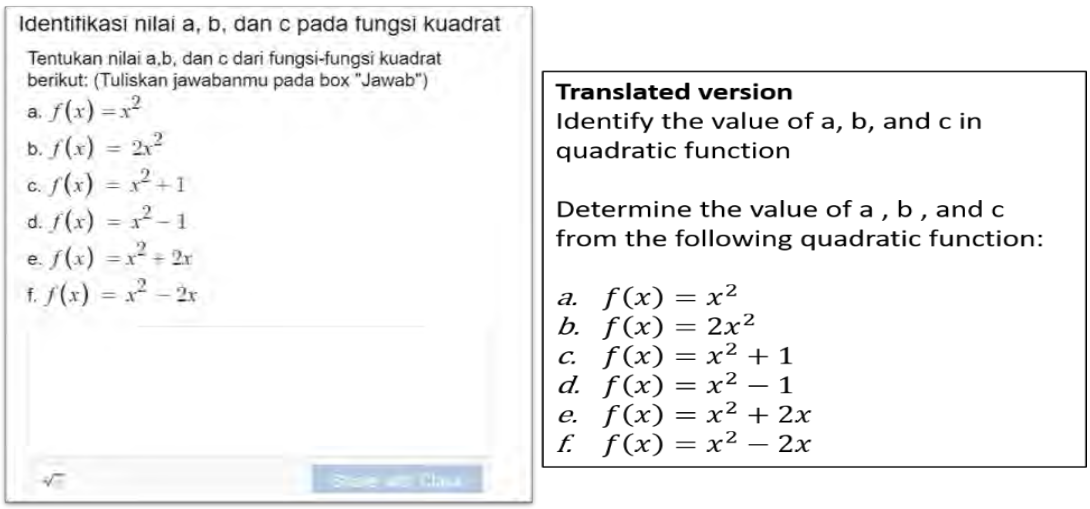

Figure 3: Example of non-explorative material

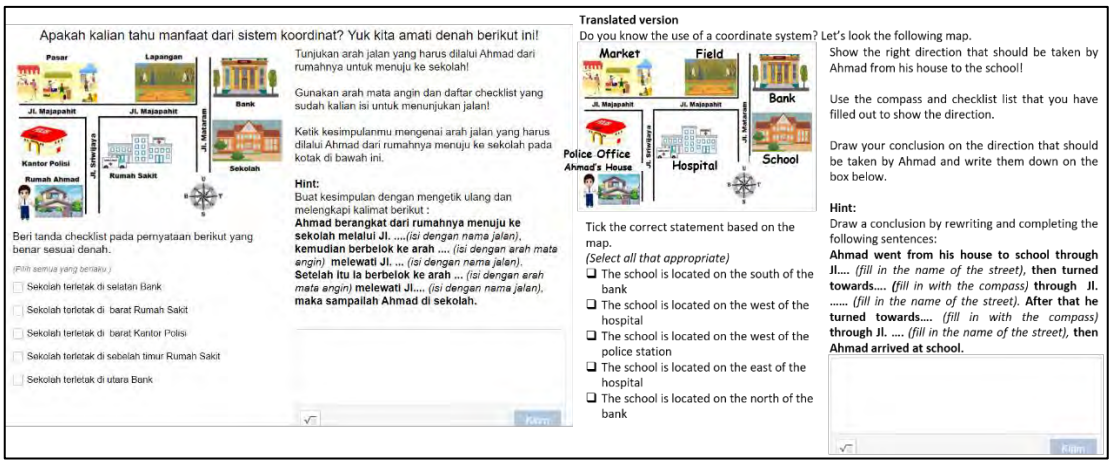

Figure 4: Example of explorative material

3. The proper level of extension

The extension also means connection with the real-life application. To build solid mathematical understanding, mathematical thinking should be started with an embodiment, a physical representation of abstract knowledge of mathematics (Tall, 2013). Furthermore, the representation of abstract knowledge should be provided as close as possible with real-life to bridge the connection between the learned concept in the class and students' everyday life (Liz Kolb, 2017). As we can see in **Figure 5**, before coming to the coordinate system material, the teacher represents the coordinate system by showing the map to find the location, as shown in **Figure 6**. We see the coordinate system's physical representation close to the students' daily routine through this example. The use of technology that can help students make sense of the world around them increases comprehension of that material (Liz Kolb, 2017). Moreover, the extension level successfully exists in the teaching and learning through the supporting

statement in the teacher's reflective report as mentioned in **Table 3** in subtopic enhancement. Finally, some teachers have successfully covered this extension, and students also justified it through students' questionnaires (45.3%), as depicted in **Table 3**.

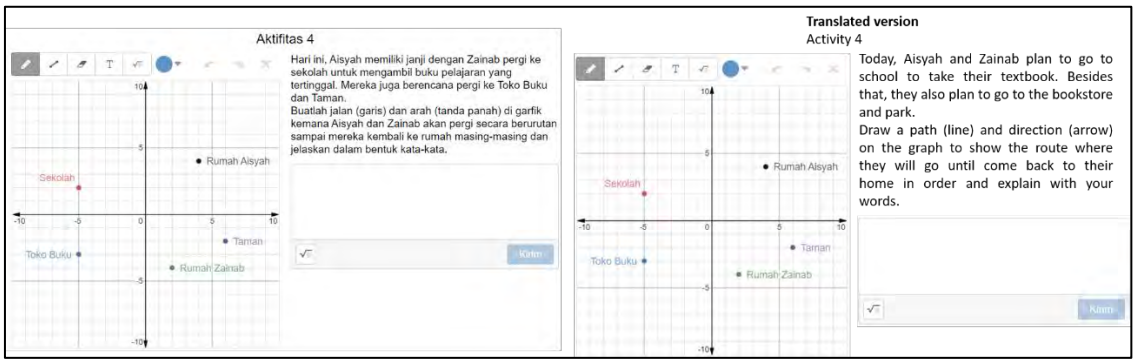

Figure 5: Extension of Knowledge: Introducing the Coordinate Plane

c. Problems in Using Desmos

The researcher confirmed to the teachers what kind of problems they were experiencing during the Desmos Worksheet implementation. There are three central themes for the problem listed in **Table 3** in the topic: Problem in Using Desmos. The first problem is about the creation and utilization of the Desmos worksheet. Some teachers commented that they need more time to prepare the worksheets, especially to include more explorative pages. However, it is contradictory with other teacher statements, which mentioned that it was easy creating the Desmos worksheet, as there are many examples of games, opening, closing, and challenges that can be adopted and used immediately (**Table 3** with the topic: Teaching experience with digital technology). Desmos might be new for some teachers, yet it needs more self-exploration of all the features and try to apply it in the classroom as often as possible.

Most teachers mentioned that an unstable internet connection was the main problem during the implementation. Unstable internet connection is also the current problem of online learning in Indonesia (Senza Arsendy, George Adam Sukoco, 2020). Moreover, the last problem mentioned is the problem of devices. For example, several teachers stated the unpleasant view when working with the mobile phone. Others mentioned that their computer suddenly did not work when opening the Desmos together with the Video conference application. However, those teachers finally solved the issues by opening the video conference app through the phone. Finally, we found no problems related to the content – pedagogical – knowledge being discussed as teachers only mention the technical issues during the implementation.

CONCLUSIONS

This research revealed that using technology-integrated worksheets can increase students' engagement in the discussion and build better understanding as they can explore the content rather than only answer the question. Using a technology-integrated worksheet also allowed them to answer the question and get real-time feedback to enhance their comprehension of the material. Furthermore, the technology-integrated worksheet using Desmos can bring real-life in an interactive and meaningful way for students. Therefore, this research suggests using this kind of worksheet, especially in the pandemic era where engagement becomes the issue. However, teachers need to avoid only giving drills and practice in the worksheet to create a better extension for students. Instead, teachers need to plan the learning goals that want to be achieved and set the exploration and analysis-based activity accordingly. This is in line with a statement from Koehler & Mishra (2006), which mentioned that effective teaching with technology depends on the set learning goals and the pedagogy strategies supported by the technology.

This study has some limitations, such as time limitation to prepare teachers in utilizing the Desmos technology integrated worksheet. This time limitation made some teachers use the Desmos feature limited to have a drill and practice session. Moreover, in this research, teachers were not expected to create a worksheet specifically in geometry. Therefore, we cannot conclude that the use of this technology can promote spatial skills. This research then suggests creating this workshop's

continuation to highlight the Desmos feature in mathematical exploration and geometrical spatial skill.

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