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Learning Videos and Geogebra: Do They Really Help Students Solve Their Answers?

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Abstract: Multimedia is a combination of various media elements, such as text, images, audio, video, and animation used by teachers to deliver teaching materials effectively and innovatively. There are various types of interactive multimedia that can be used, one of which is that teachers often involve videos and GeoGebra to help students learn mathematics. In practice, this assistance often makes students take a longer path to achieve learning goals. This study provides another perspective to determine the implications of learning videos and GeoGebra in completing answers that help students. With a descriptive method, this study took students as its subjects whose results were analyzed qualitatively using data descriptions, data reduction and presentation of conclusions. It turns out that videos are less able to help students complete their answers and GeoGebra can make students less than optimal in improving their thinking skills. However, the use of learning videos can be used by students to remember continuously to be used as independent learning materials and the use of GeoGebra can be used to correct answers that have been obtained using manual methods.

Keywords: assessment; geogebra; learning videos.

INTRODUCTION

The rapid development of technology has a direct and indirect impact on most aspects of human life, including in the field of education (G. F. Khairunnisa & Ilmi, 2020). One of the most obvious impacts is the change in the role of teachers. Today's teachers not only need to master the subject matter, but teachers must also be able to package learning as innovative and interesting learning in accordance with the times (Hasan & Wijayanti, 2018). In line with this, innovative learning needs to be applied in mathematics learning (Saadah & Budiman, 2022). Innovations that can be used by teachers to overcome these problems and to respond to the industrial revolution 4.0 are by using technology-based learning such as learning with interactive multimedia (Mimbadri et al., 2019). Interactive multimedia is an innovation in the development of learning media (Sakiah & Effendi, 2021). According to Mureiningsih, interactive multimedia is a media that combines text, sound, animated images, and videos to convey messages through electronic media (Astri et al., 2022; Layyin & Haqiqi, 2022). Interactive multimedia can make learning effective so that it can generate positive reactions in students, provide information that satisfies students' needs, and have a positive impact on students (Gufron et al., 2018; Handayani & Rahayu, 2020; Manoi & Soesanto, 2022). Macaulay's research shows that the use of multimedia can help the mathematics learning process to achieve learning objectives as shown by the results of students' mathematics scores who use multimedia being higher than those who do not use multimedia (Artikel, 2016). Through this, the use of interactive multimedia can dispel the paradigm of some people's assumptions about mathematics which state that mathematics is difficult and confusing material (Batubara, 2015). According to (Ngazizah, 2016), there are some teachers who have not been able to utilize interactive multimedia optimally. As a result, learning is carried out in a conventional way even though multimedia devices are fully available in the classroom (Anwar & Anis, 2020). Although there are some teachers who have not been able to utilize interactive multimedia, many young teachers have been able to use it optimally. The examples of multimedia that can be used in learning is learning videos and Geogebra.

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With the help of learning videos, especially with the addition of animations in them, it can attract students' attention because without innovation, students will feel bored and tired because students only see mathematical formulas (Suci Tama & Sumargiyani, 2022). In addition to having an impact on students, teachers also become more creative and innovative in delivering material (Dayutiani & Fitrianna, 2021; Maryani, 2014). Learning videos can be an alternative path for students in online mathematics learning (Munadhiroh & Mawarsari, 2020). At SMP Swata Pemda, class VII C students gave a positive response to the use of animated videos in learning integer operations. Based on the results of the questionnaire and interviews, it showed that the average result was 67.58 with a high category. The minimum score obtained by students was 61 and the maximum score was 88 out of 31 students (Hariati et al., 2020). In line with this, at SMP N 2 Sawan, class VIII D has achieved the established success indicators after using interactive multimedia, where each meeting experienced an increase in student interest and learning achievement (I. P. Agus et al., 2018). The increase in mathematics learning outcomes was also felt at MTs Ma'arif 2 Nurul Huda East Lampung with posttest results higher than pretest results and reinforced by the warm response results of students reaching a percentage of 82.8% to the use of interactive multimedia based on video (Marjuki et al., 2021). The collaboration between the open-ended learning model with the help of videos at SMP Ma'arif Batu can also improve students' mathematical thinking compared to conventional learning (Bastylova, 2019). Not only in junior high schools, but also in vocational schools, it has a positive impact on the use of interactive multimedia, namely at one of the vocational schools in Trenggalek. The use of learning videos with LKPD in the material of sine and cosine rules with the area of triangles in trigonometry material provides students with enthusiasm for learning because the video can be played by students repeatedly and wherever they are (Yulianto et al., 2022). Unlike others, the use of learning videos of zilat board teaching aids is effectively used in one of the private junior high schools in Malang City, class VII in learning the material on addition and subtraction of integers, but there is no influence on students in understanding the concept of multiplication and division operations (Susanto & Yudanti, 2020).

In learning related to geometry material, teachers can use interactive multimedia in the form of geogebra which can optimize students' mathematical representation abilities (Nugraha, 2022; Supriadi, 2015). Geogebra is a dynamic software that combines geometry, algebra, and calculus which is used as a tool in learning mathematics (Bernard & Sunaryo, 2020; Pianda, Didi, 2020). Through the visual and geometric display of mathematical concepts in geogebra, it can encourage students to think actively in making connections and conclusions about mathematical concepts (Rahmadi et al., 2015). In addition, students also feel motivated by the use of the geogebra application, as shown by the level of student interest of 75% in the indicator of interesting activities in learning (Dewi et al., 2020). This was proven in SMP Negeri 3 Metro class IX through the discovery learning model with the help of geogebra, there was an increase in student learning motivation, so that learning activities also increased with an average of 60.83% in cycle I to 89.38% in cycle III (Firdayati, 2020). A similar thing also happened at SMP Negeri 6 Buton Tengah in the learning process using interactive multimedia based on geogebra can support understanding of spatial concepts. The results of the analysis showed that the average score of students' conceptual understanding in the experimental class was 84.72%, while the average score of students in the control class was 78.84% (Arbain et al., 2024). At MT Al-Barry, class VIII A students also showed a positive response to the use of the geogebra application in mathematics learning. On average, students showed strong indicators of learning interest and obtained a percentage of 69.46% (Hanipa, 2019). The use of geogebra-based interactive multimedia at SMA Negeri 1 Buru in mathematics learning is very different from learning that does not use the geogebra application. It can be seen from the mathematical abilities applied through the geogebra

application that it is better and more effective compared to those who do not use the application, this is supported by an average result of 76.74%. In the learning process, it has an influence of 31.6% on the post-test score. While the increase in mathematical communication skills between the pretest and posttest scores is 11.6%. Therefore, it can be concluded that the use of interactive multimedia based on geogebra is very effective in mathematics lessons (Magfirah et al., 2021).

As the 21st century progresses, teachers can use geometry-related software as a tool to solve mathematics learning problems related to visual skills. One such software is Geogebra 3D. Geogebra 3D itself is software that can display 3D images from 2D images. This software has an augmented reality (AR) feature that makes 2D images look like 3D images (Aditya et al., 2022). In other words, augmented reality (AR) is a technology that combines real and virtual objects in the same space and as if the virtual objects really exist. The application of augmented reality (AR) in mathematics education has the potential to increase mathematical activities conceptually and technically and make students more motivated (S. Khairunnisa & Aziz, 2021; Meilindawati et al., 2023). So the use of augmented reality can improve learning outcomes and can improve many students' mathematical abilities (Ridlwaniyyah, 2024). Because by using the augmented reality (AR) feature, students can see in real time and directly imagine the results of their learning process (Herman et al., 2023). The use of augmented reality (AR) features in mathematics learning is often used in geometry material, because this material requires students to visualize an object (Haryani et al., 2024; Nurfaidah et al., 2023). In junior high schools in Bogor Regency, grade VIII students proved that in learning flat-sided spatial geometry material, there was an increase in student learning outcomes in the cognitive domain using interactive multimedia in the form of augmented reality (AR)-based geomegebra better than learning using spatial geometry teaching aids (Nurhaliza et al., 2022). In addition, ethnomathematics learning about the concept of spatial geometry with the help of augmented reality (AR) has also been shown to increase student motivation and improve students' mathematical understanding. Because through real visualization, students can understand the shape of space and traditional musical instruments in Indonesia (Nasichah et al., 2023). Thus, the application of augmented reality in mathematics learning can improve students' understanding of mathematical materials. By increasing students' understanding, students can solve various problems given (Albar et al., 2022).

The explanations above show an increase in students' mathematical understanding abilities using interactive multimedia in learning. The abilities of students who use interactive multimedia are better than those using conventional learning. In addition, there is also an increase in students' mathematical communication skills (Fajriati & Murtiyasa, 2023; Purnamasari & Herman, 2017). Because there is an increase in students' mathematical understanding and mathematical abilities, their mathematical problem-solving abilities also increase (Asmara, 2016). The increase in mathematical abilities is influenced by the aspect of learning interest. When learning is carried out conventionally, students' interest in learning is very low because it is boring and difficult to understand. So that the presence of interactive multimedia can increase students' interest in learning which has an impact on student learning outcomes (Wulandari, 2020). Students' representation abilities can be shown by how well a student understands concepts and can solve mathematical problems correctly (Puspita, 2023). The use of technology in learning such as interactive multimedia can provide stimulation to all senses, so that it can maximize the capture of learning messages or materials in the learning process (Dian Nur Septiyawati Putri, Fitriah Islamiah, Tyara Andini, 2022). For example, interactive multimedia can present rare objects and abstract concepts that are converted into real concepts (Sarah, 2016). Interactive multimedia can present various interesting display concepts due to the combination of images, animations, and sounds. From

this collaboration, it can help students overcome boredom with monotonous learning (Ardiansyah, 2021; Novitasari, 2016). Examples of interactive multimedia are learning videos, Adobe Flash, Geogebra, and Augmented Reality (AR) which have been proven to receive positive responses from students which can be seen from the increasing achievement of student learning outcomes. The selection of learning models is also important to achieve the desired results (Majalengka & Vii, 2023). The selection of interactive multimedia-based learning models has also been shown to improve student learning outcomes. To provide confidence that interactive multimedia can improve students' mathematical understanding, this study aims to analyze the role of interactive multimedia in improving students' mathematical understanding.

METHODS

This study uses a descriptive method with a qualitative approach to obtain an overview of the implications of the use of interactive multimedia on students' test results. The subjects of this study were students of class VIII of SMP N 3 Sokaraja consisting of 5 students. The research instruments used were tests and interviews. The test technique in the form of a written test was used to obtain data related to the implications of the use of interactive multimedia on students' mathematical understanding test results. The interview used in this study was a semi-structured interview with the aim of determining the extent to which the use of interactive multimedia can help students in completing students' mathematical understanding test answers. The interactive multimedia used in this study were learning videos and geogebra applications.

This research is divided into three stages, namely planning, implementation, and reporting. The first stage is planning, the researcher prepares the test instruments that will be tested on students including test grids and test assessment rubrics. The next stage is the implementation stage. Before students answer the test, students first watch a learning video related to the material on the system of linear equations of two variables. After students watch the video, students answer questions consisting of 2 non-contextual questions and 2 contextual questions in two ways, namely manually as in the learning video and using the geogebra application. Furthermore, students are interviewed to strengthen and deepen the information on the test answer results written by students. The last stage is reporting, researchers process and analyze data obtained during the research and compile a report.

This study uses source triangulation, method triangulation, and theory triangulation to validate the results. These methods aim to reduce bias and increase the reliability of research findings. Source triangulation used in this study involves collecting data from various sources such as test results and literature records. In addition, this study involves method triangulation, namely observation and documentation, and theory triangulation, namely comparing new findings with findings from various previous studies.

The data analysis techniques used consist of data reduction, data presentation, and drawing conclusions. Reducing data means summarizing, choosing important things, focusing on important things, looking for themes and patterns, and removing unnecessary things. In this way, data reduction provides a clearer picture and makes it easier for researchers to collect and search for data if needed. Then, presenting or displaying data makes it easier to understand what is happening. The data presented can be reduced to test results and interview results and presented in written format. The final stage of drawing conclusions is carried out by collecting the data presented and adjusting it to the problem formulation. At this stage, conclusions are drawn based on data presentation, with the aim of drawing conclusions about the influence of interactive multimedia on students' understanding of mathematics.

RESULTS AND DISCUSSION

Based on the research results, the test results were obtained to measure the effectiveness of interactive multimedia in improving students' mathematical understanding. The questions created in this study have their respective objectives such as: question number one is used to determine the implications of using learning videos in improving mathematical understanding skills, question number two is used to determine the implications of using the geogebra application in improving mathematical understanding skills, and questions number three and four are used to measure the effectiveness of using learning videos and geogebra applications in improving mathematical understanding skills on HOTS questions. The following are the test results that have been carried out by students.

Question number one is used to measure the effectiveness of using learning videos in improving mathematical understanding skills. Before working on the questions, respondents were asked to watch a learning video that explains how to solve problems with a system of linear equations in two variables using the graphical method. Here is the link to the learning video: https://youtu.be/sqjgu8laIpk?si=yA_Y5eAjBP0dNIl7. Based on the results of observations and interviews with respondents, the use of learning videos cannot improve respondents' mathematical understanding, especially in the material on systems of linear equations in two variables. Respondents have received SPLDV material at school but they forget the steps to solve SPLDV problems using the graphical method. Although respondents have seen the learning video, they still cannot remember and find it difficult to understand the steps used to solve SPLDV problems, so the researcher explained the contents of the video directly. After the researcher explained it again, respondents were able to accept the material well and were able to solve the problems that had been given, this is evidenced in table 1. Research conducted by Marjuki et al., 2021 has different results from this study. In a study conducted by Marjuki et al., 2021, at MTs Ma'arif 2 Nurul Huda East Lampung, learning videos can improve students' mathematical understanding abilities as indicated by an increase in mathematics learning outcomes with posttest results higher than pretest results and reinforced by the warm response results of students reaching a percentage of 82.8% for the use of interactive multimedia based on videos.

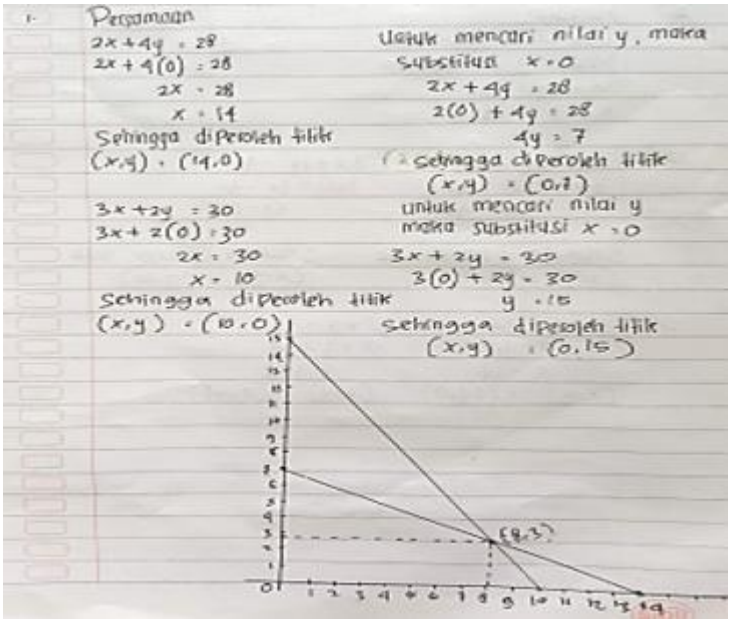

Figure 1. Results of Answer to Question Number 1

All respondents can solve question number 1 correctly but the speed in solving the problem varies. Respondent 1 can solve it in 5 minutes 41 seconds which is the fastest respondent in solving question number 1 while the respondent who takes the longest time is respondent 2 with a time of 15 minutes. The length of time respondents work on the questions can indicate the respondent's ability to understand mathematical problems and numerical abilities. So it can be said that respondent 1 has the best ability to understand mathematical problems and numerical abilities compared to other respondents.

Table 1. Duration of Time to Complete Students' Answers

	Question Number			
	1	2	3	4
Respondent 1	05′ 41″	01′ 35″	14′ 20″	06′ 59″
Respondent 2	15′ 00″	03′ 46″	20′ 09″	24′ 14″
Respondent 3	12′ 06″	02′ 40″	20′ 00″	22′ 8″
Respondent 4	05′ 56″	03′ 29″	22′ 54″	16′ 34″
Respondent 5	09′ 33″	05′ 10″	20′ 18″	22′ 19″

Question number two is used to measure the effectiveness of using the Geogebra application in improving mathematical understanding skills. Based on the results of observations and interviews with respondents, the use of the Geogebra application can help respondents in working on SPLDV problems because they do not need to calculate the length to get results and do not take a long time. This can be proven in table 2, all respondents can answer the questions correctly in a short time. Respondent 1 can answer question number 2 in 1 minute 35 seconds which is the fastest respondent in answering question number 2 and the respondent who took the longest time was respondent 5 with a time of 5 minutes 10 seconds. This is in line with research conducted by Magfirah et al., 2021, the use of the Geogebra application at SMA Negeri 1 Buru is better and more effective in the mathematics learning process which has an influence of 31.6% on the posttest score and there is an increase in mathematical communication skills between the pretest and posttest scores by 11.6%.

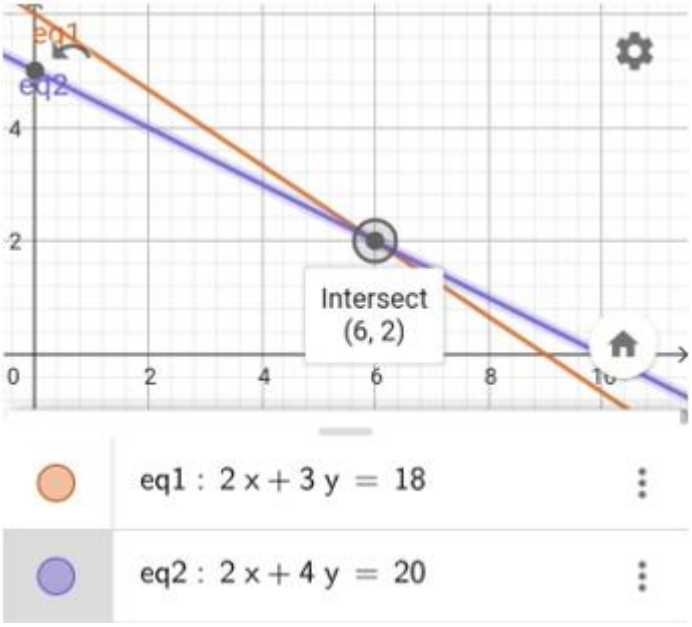

Figure 2. Results of Answer to Question Number 2

Geogebra application can help students in working on SPLDV problems, but on the other hand, the geogebra application has a disadvantage, namely that it can make students feel lazy to calculate manually so that they will rely on the application to answer questions. If this is done continuously, students can forget the steps in solving SPLDV problems manually. The geogebra application can be used by students to check the answers when students have tried to solve the problems manually so that this can avoid the negative impacts that arise.

Question number three is used to measure the effectiveness of using learning videos and geogebra applications in improving mathematical understanding skills in HOTS questions. Based on the results of observations and interviews with respondents, the use of learning videos cannot improve respondents' mathematical understanding skills because they need a re-explanation from the researcher regarding the contents of the video, this is like the case in number 1. The difficulty experienced by respondents in completing question number 3 is that respondents have difficulty understanding the question and find it difficult to change it into mathematical language so that respondents need quite a long time to complete the question. The fastest time to complete question number 3 is 14 minutes 20 seconds by respondent 1 and the longest time is 22 minutes 54 seconds by respondent 4. Although all respondents' answers are correct, they have different completion times. The collaboration between the manual method in solving SPLDV questions with the graphic method and the use of the geogebra application is a good combination because with the manual method respondents can understand the steps in working on it and do not eliminate the ability to count, while the use of the geogebra application is used to confirm answers that have been completed manually.

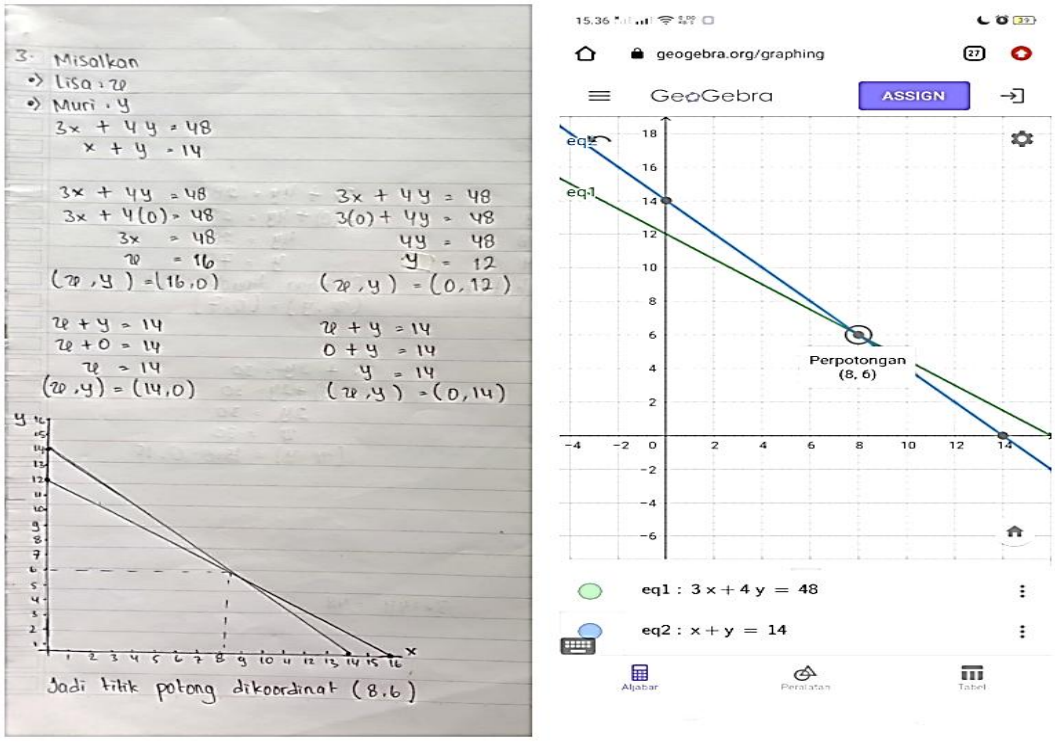

Figure 3. Results of Answer to Question Number 3

Question number four has the same function as question number three, which is used to measure the effectiveness of using learning videos and geogebra applications in improving mathematical understanding skills in HOTS questions, but in question number four the numbers used in the question are larger. Based on the results of observations and interviews with respondents, the use of learning videos cannot improve respondents' mathematical understanding skills as in the previous question. In question number four, there are several

errors that appear, such as those made by respondent 4, namely in the last step the y value has not been divided by 4 so that the graph does not find the intersection point. Although wrong in manual calculations, the answer using the geogebra application is correct. This should have been followed up by respondent 4 because the answers manually and with the application are different, but respondent 4 did not follow up to confirm the answer.

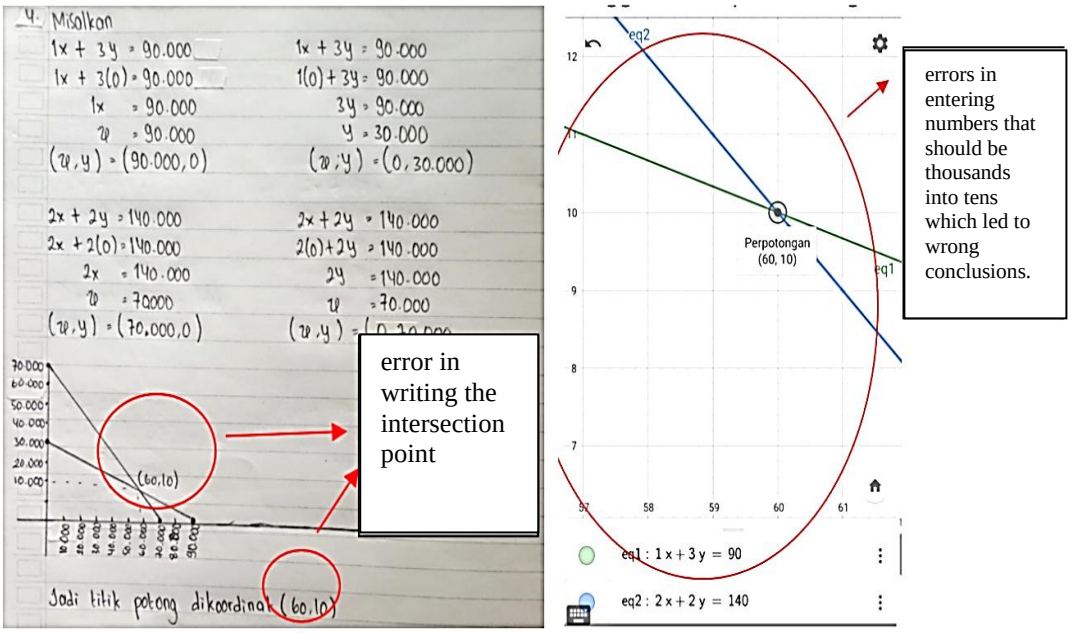

Figure 4. Results of Answer to Question Number 4

In addition, errors also occurred in respondent 2 who was less careful in understanding the questions. Respondent 2's manual calculation used units in the form of thousands but when entering the graph, respondent 2 used units in the form of tens and this also happened when entering numbers into geogebra. Often the geogebra application also simplifies the equation automatically so that the units used can change by themselves. This is one of the weaknesses of the geogebra application. The respondent who can answer question number 4 quickly is respondent 1 in 6 minutes 59 seconds and the respondent who answered the question the longest is respondent 2 with a time of 24 minutes 14 seconds.

CONCLUSION

Based on the results of the study above, it can be concluded that not all interactive multimedia can improve students' mathematical abilities. One of them is that learning videos cannot improve the mathematical abilities of class VIII students of SMP N 3 Sokaraja on the material of two-variable linear equation systems with graphical methods. Unlike learning videos, the geogebra application can improve mathematical abilities when students use it for the right purpose. The geogebra application can be used to compare the results of manual work with those using the application. So, if there is a difference in the results of the solution, students can re-analyze where the error is. The geogebra application can produce answers quickly, but this application also has shortcomings, namely when entering large numbers, it cannot display graphs with specific numbers and sometimes the application immediately simplifies automatically. The shortcomings of the application do not mean that the geogebra application is a less good interactive multimedia because all interactive multimedia have their own advantages and disadvantages. Interactive multimedia has many types that can be used in learning, but in selecting multimedia, it must be chosen according to the needs of learning, must understand the advantages and disadvantages of the interactive multimedia that will be

used, and must pay attention to the abilities possessed by students, so that the use of interactive multimedia can improve students' mathematical understanding.

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