Jurnal Pengembangan Pembelajaran Matematika (JPPM)
Volume 5, Issue 2, August 2023
Available online at: https://ejournal.uin-suka.ac.id/tarbiyah/jppm/index
Print ISSN : 2656-0240, Online ISSN : 2655-8750

APPLICATION OF VIDEO-ASSISTED ONLINE INTERACTIVE LEARNING TO IMPROVE STUDENT MATHEMATICS LEARNING OUTCOMES

Agus Miftakus Surur[1*], Muhammad Khoiril Akhyar[2], M. Ubaidillah Ridwanulloh[3], Hasnah Binti Mohamed[4], Hatıra Günerhan[5], Naesla Fifi Wahyuni[6]

[1*,2,3,6] Institut Agama Islam Negeri Kediri, Indonesia

[4] Universiti Teknologi Malaysia

[5] Kafkas University, Turkey

Email: surur.math@iainkediri.ac.id

* Corresponding Author

Received: 15-05-2023	*Revised: 25-08-2023*	*Accepted: 31-08-2023*

ABSTRACT

Rapid technological developments should support improving the quality of learning, one of which is online learning. . Online learning is carried out because learning in class is limited by space and time, thus limiting learning interactions. This study aims to describe and analyze student learning outcomes in mathematics by using video-assisted online interactive learning. Classroom Action Research (CAR) is used in this study with some stages namely preparation, action, observation, and reflection. The results of online learning using interactive videos are cycle I on student learning outcomes that obtain scores exceeding the minimum completeness score of 57% and are said to be complete. However, there are still 43% of students who obtain learning outcomes that are less than the minimum standard of completeness or have not been completed. The cause of this is the initial adaptation of students to using media that is packaged interactively. It was continued in the second cycle of learning to produce a learning completeness percentage of 86% for students who had exceeded the minimum standard of mastery scores. This shows an increase from cycle I to cycle II. In cycle II, the process of adaptation and the active participation of students began to have an impact on learning outcomes. Continuing in cycle III shows that the number of students who complete learning reaches 86%, the same as in cycle II, but there are still differences. Cycle II to Cycle III experienced an increase in the average value of learning outcomes, namely cycle II of 76.36; in cycle III, it increased to 78.79. These results indicate that online interactive learning using video can improve student mathematics learning outcomes.

Keywords: interactive learning, learning outcomes, mathematics, online learning, videos

How to cite

Surur, A.M., Akhyar, M.K., Ridwanulloh, M.U., Mohamed, H.B., Günerhan, H. & Wahyuni, N.F. (2023). Application of video-assisted online interactive learning to improve student mathematics learning outcomes. *Jurnal Pengembangan Pembelajaran Matematika*, 5(2) 130-144. https://doi.org/10.14421/jppm.2023.52.130-144

INTRODUCTION

Mathematics education is a type of mathematical inheritance for the next generation (BP et al., 2022), a process to empower the potential of mathematics to educate the nation's life (Satiadarma & Waruwu, 2003). Mathematics education plays an important role in the growth and development of a country as it faces various global changes and more difficult situations. The process of learning mathematics is the main means for students to obtain information and understand scientific mathematics (UURI, 2011). It makes the task of a mathematics teacher very crucial (Arifin, 1991); the teacher must master the class, understand student character, and master the learning material.

Mathematics teachers can influence students to participate in mathematics learning by cultivating a mathematics learning environment that is consistently learning and enthusiastic in teaching (Nidawati, 2020; Baier et al., 2019; Rahmi, 2019). Mathematics teachers must understand the complexity of work with the various tasks and responsibilities assigned (Khosiyah, 2012). Teachers help the learning process by using certain methods to produce changes in knowledge, attitudes, and behavior (Isjoni, 2006), increase student motivation (Kurniasari, 2018), carry out teaching-learning interactions, and achieve learning goals (Saputro, 1993). Thus, mathematics learning methods can increase student involvement, make learning activities enjoyable, increase cognitive capacity, help develop abilities, and teach students how to solve problems (Sanusi, 2009). It will obtain good learning outcomes if it provides space for students to be active in learning (Akhyar, 2019; Twigg, 2003).

Online learning for the twenty-first century, as well as the COVID-19 pandemic recovery transition. Learning that was originally done in class turned into virtual communication. This still makes an impression today, so learning that can already be done offline is set to be done online (Lowe et al., 2016). This (online learning) is the right step to keep up with technological developments. If there are still obstacles to learning, then it is the teacher's job to find solutions to provide the best service for students. Teachers can use certain learning methods to instruct students in class so that the lesson is accepted, understood, and used correctly by students (Ahmadi, 2005; Borba et al., 2016).

The findings when conducting class observations on learning mathematics show several problems. Among them is that when learning in class, students only use textbook media without any innovations made by the teacher, so they are passive in learning and only listen to the material explained by the teacher. This condition makes students not focus on learning (Cooney & Wiegel, 2003). Students' defocus was shown by being engrossed in chatting alone with their friends, being silent when asked by the teacher, and not responding when asked to do work in front of the class. As a result, at the end of learning, students ask the teacher to re-explain the material that has been delivered. In addition, there is a lack of opportunities for students to learn mathematics by using media that are appropriate to the material. Variation in teaching is an important element of less optimal learning (Lo & Hew, 2020). Even during the pandemic season, the media used was still focused on textbooks, which made students less able to master the math material that had been delivered by the teacher. Learning becomes teacher-centered. This condition also had an impact on students' mathematics learning outcomes, with only 33% of students whose average score in mathematics met the minimum completeness criteria. Whereas classically, it is required that students who complete or meet the minimum

completeness criteria reach 75% or more. Thus, teacher-centered learning makes student scores below standard (Rashidov & Rasulov, 2020).

Improvements in learning are achieved by using learning media that are adapted to technological developments, as well as videos, which are effective in use. Some research on the use of videos shows that the use of videos is effective in learning (Nurhayati et al., 2018), learning is very interesting using videos (Mustofa et al., 2018), learning videos are appropriate for use in learning activities, and can improve learning outcomes (Dewi & Suniasih, 2022), and there is an effect of using learning video media (Prastica et al., 2021). Thus, the selection of videos for learning shows positive results and is suitable to be used as learning media, namely using a video in which it invites students to take part in learning from beginning to end in the form of orders or questions, sequentially according to the material being delivered. The results of the student's work are then sent to the teacher for assessment and evaluation.

The video has been used in online learning (Brame, 2016), which generates the idea that online learning does not only use various media but also gives a new touch (Lange & Costley, 2020). Meanwhile, the online or online learning process gets a bad response from students due to the influence of places that do not allow signals (Astuti et al., 2022). To run as planned, online learning is carried out by technological developments when the media used is in the form of interactively designed videos (Handayani & Rahayu, 2020; Lestari et al., 2019). The use of appropriate interactive media in learning shows effective results in training students' understanding of concepts. Interactive learning media can increase understanding of material in mathematics subjects (Toha & Khasanah, 2020). Based on the previous research above, it shows that the use of learning media in the form of videos has a positive impact, but it needs to be demonstrated so that student learning outcomes are visible. Online learning also remains relevant as long as the learning is still carried out interactively. Departing from this, this research uses video by giving a touch of innovation to the video so that learning using video becomes interactive. The difference between the video in this lesson and other videos is that students are expected to follow the lesson from start to finish because, on average, every minute there are orders or questions that must be done or carried out. These activities are to ensure that students follow the learning as a whole. The material in the video is about the Greatest Common Factor (GCF) and Least Common Multiples (LCM).

Videos can be played repeatedly as needed. It can also be accessed anytime and anywhere. It is also equipped with interactive questions to maintain communication with the teacher, which take the form of giving questions related to the material. Video media was chosen because it can be adapted to needs, achieve goals, and be packaged attractively. Students are allowed to work both independently and in groups. Maximizing student involvement in learning Thus, the purpose of this research is to improve student learning outcomes in mathematics by utilizing video-assisted online interactive learning.

METHODS

Type of Research

Researchers use a qualitative approach without using statistics (Anselm, 1997; Bungin, 2010), using more data in the form of words and data in the form of numbers only to search around the concentration of data. The type of research used is classroom action research (CAR)

develops or improves teaching and learning activities to help students who have difficulty learning and improving the learning environment, which follows four stages (Arikunto, 2010). The stages of this research are preparation, action, observation, and reflection which described in Figure 1.

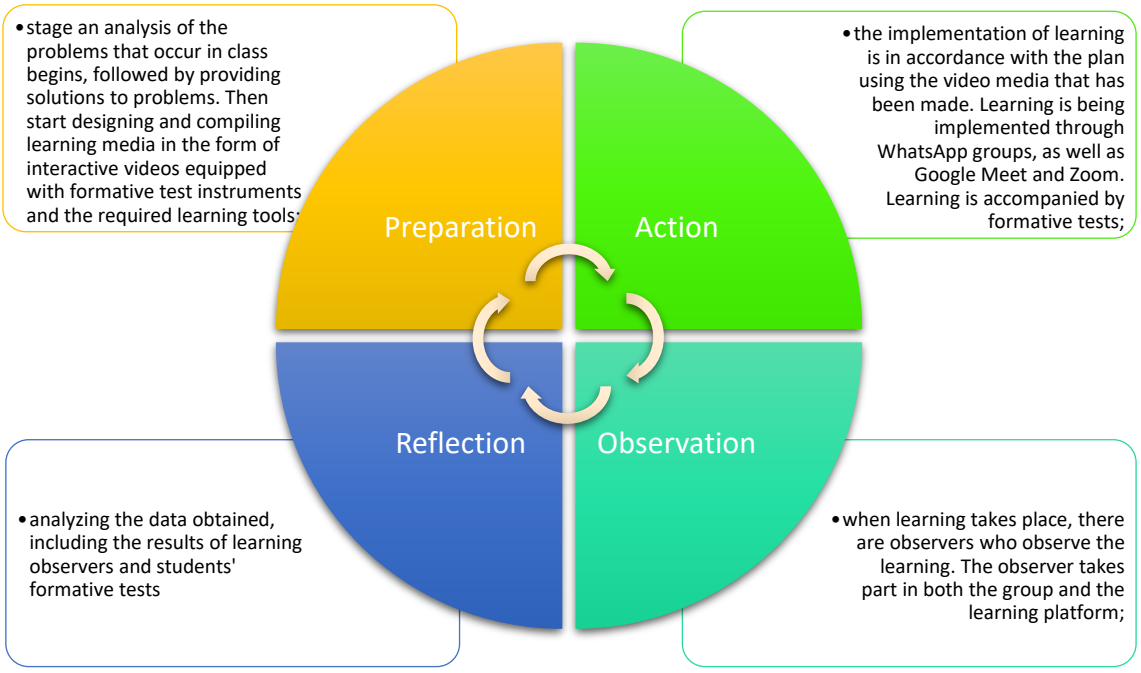


Figure 1. CAR Stages in Video-Assisted Online Interactive Learning

Data Collection

The techniques used to collect data in the field to explain and address the problem being investigated is test, observation, and documentation method. Test is used to find out the results of students' mathematics learning in the form of questions that are completed by students. The results of this test will show how well the student has studied. If students achieve a score of 75, then their learning is considered complete; otherwise, their learning is considered incomplete. In the other hand, observation method involves monitoring and carefully documenting every symptom that appears in research subjects (Margono, 2017), using direct observation to collect data. When observations are made during classroom action research, information about student interactions, student activities, and all the facts that exist during the learning process are collected. The last technique is Documentation Method to find information about objects or variables in the form of photos (Arikunto, 2003), namely, photographs that photograph the environment in the classroom when learning takes place.

Data Analysis

The next stage is to process the collected data. Data analysis was carried out in three steps: data reduction, data presentation, and drawing conclusions. The data reduction stage involves the process of selecting, centralizing, and abstracting raw data into useful information. The "data exposure stage" is the act of presenting data in a way that is easier to understand. Meanwhile, data inference is the act of capturing the essence of the organized data display (Muslich, 2009). To determine learning outcomes, an evaluation of the data in each cycle is

carried out. The following activity analysis was obtained: 1) from Cycle I to Cycle III, student learning outcomes are measured by formative test scores; 2) The success cycle of interactive learning methods is determined by the following details: a) The cycle is considered failed if less than 75% of all students score below standard; b) If the same number or more than 75% of all students get scores above the standard, then the cycle is considered successful.

The way to analyze it is calculated to assess the formative test by finding the average value, the researcher added up the test scores of all students, then divided them by the number of students in the class. The formula is as follows:

$$\bar{X} = \frac{\sum X}{N}$$

Information:

N : the number of students

$\sum X$: the sum of all students' formative test scores.

$\bar{X}$: Average value (mean)

For the sake of thoroughness in research, there are two types of mastery learning: classical and individual. A class is said to be completed classically if 75% of the students in that class achieve an absorption power of more than or equal to the minimum mastery criteria, while a class is said to be completed individually if the class average shows a value equal to or greater than the specified the minimum mastery criteria, which is 75.00. To calculate the percentage of learning completion, the following formula (Arikunto, 2007). is used:

$$P = \frac{\sum(\text{Students who have finished studying})}{\sum \text{Students}} x\ 100\%$$

Information:

P : learning completion percentage

This analysis was carried out at the reflection stage. The findings of this study form the basis for planning the next cycle. The study's findings are also used as a basis for reflection to revise the learning stages and steps of the learning methods that were used, or even as a material consideration in choosing other learning models that are more appropriate to apply in learning. While the percentage of the average value is sought using the following formula in Table 1, to obtain the results of observations of learning activities (Anas, 2017):

$$\text{Average value percentage (N)} = \frac{\text{Total Score}}{\text{Maximum Score}} x\ 100\%$$

Table 1. Criteria for the Level of Success of Student Actions

No	Success Rate (N)	Letter Value	Weight	Predicate
1	85-100 %	A	4	Very good
2	76-85 %	B	3	Good
3	60-75 %	C	2	Suffices
4	55-59 %	D	1	Less
5	$\leq$ 54 %	E	0	Once or twice

RESULT AND DISCUSSION

The learning that is applied in class follows the CAR flow that has been previously determined. There are four stages of the flow used, starting with planning by analyzing the conditions in the class and also preparing the activities to be implemented. Then proceed with the implementation of activities in class in accordance with what has been prepared beforehand, along with observing the learning that is being implemented in class. Then it ends with an evaluation of the learning that has been implemented. A more detailed explanation is presented in the following section.

Planning

According to the researchers' observations, before the research was conducted, students who took part in the learning process tended to pay less attention and were enthusiastic about what the teacher conveyed. Instead, they preferred other activities, talked about themselves, and made comments unrelated to the lesson, and one student was even lazy. This situation has an impact on student understanding.

There are many types of elements that affect learning, divided into two categories: internal and external factors. Internal factors include physical and psychological factors such as weakness, fatigue, and others. External factors include those related to the environment, school, family, and others (Slameto, Slamet, & Slameto, 2003).

The planning stage begins with determining the problems to be solved. There are two types of analysis performed: system analysis and functional analysis. In the two analyses, the conditions that occur in the field are described, which are used as problems, and the solutions that become solutions to the problems raised are also described. The analysis performed is presented in the following table 2.

Table 2. Analysis

No	Analysis	Conditions	Solution
1	System	The learning system uses conventional methods with material delivered by the teacher.	There must be learning that engages students in their learning rather than allowing the teacher to dominate it.
		Learning has been carried out offline, but students are still doing things that make the class unconducive, crowded, and passive.	Learning is carried out online using interactive video assistance, which monitors student activities and also prepares forums for discussion.
2	Functional	Functional Learning uses book media that has been provided by the school and is used as the main reference for learning.	Thneedeeds to be appropriate media, namely video, which has been packed with interactive questions as a way for students to participate in learning from beginning to end.

Furthermore, based on table 2, preparing the implementation of learning using video media will provide relatively consistent treatment (Abdurrahman, 2003; Moreno-Guerrero et al., 2020). The media to be used is based on PowerPoint, which is then converted into a video combined with explanations from the teacher according to needs (Croft & Ward, 2001;

Daryanto, 2012; Hada et al., 2021; Mahnun, 2012; Riyana, 2007; Sablić et al., 2021). The video is also inserted with formative questions that will be worked on by students and also as material for the teacher's assessment. These questions are an interactive form for students and follow from the beginning to the end of learning. Interactive learning can be developed, motivated, and directed to support students in finding their answers to encourage enthusiasm in student learning by giving them time to reflect, answer, and collaborate when studying the problems presented by the teacher (Buehl, 2017; Majid, 2016; Nurhadi, 2002; Silverthorn, 2006; Suprayekti, 2008; Surur, 2021).

The questions displayed are designed sequentially, with the hope that it will make it easier for students to achieve learning targets. The video will be used in learning that is designed online as a communication and interaction tool (Cairncross & Mannion, 2001; Kilicman et al., 2010; Moradi et al., 2018; Surur et al., 2023). The use of video assistance to adopt online interactive learning, aims to improve student learning outcomes, beginning with the teacher asking questions to students about the subject currently being discussed.

The task for students is to find solutions that they have to find on their own. Interactive online learning with the use of videos is used to increase motivation, which has an impact on student learning outcomes, allowing one student to work on and share the results so that learning outcomes can be improved. In addition, it still gives good motivation for learning, increasing students' encouragement to learn because the level of learning achievement of a student is influenced by his motivation (Engelbrecht et al., 2020; Khosiyah, 2012; Nusir et al., 2013; Santrock, 2007; Untari, 2020; Yang et al., 2021).

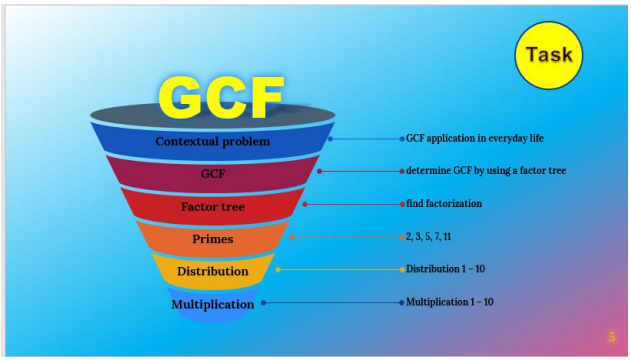


Figure 2. The material to be studied and the task symbol information

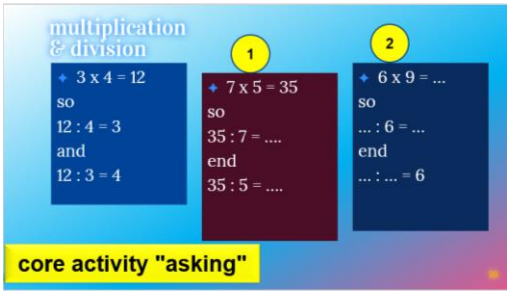
Figure 2 shows that the material to be studied has 6 points. starting with multiplication and division of 1 to 10, as a basis for calculations, up to the main material, namely being able to determine GCF and also apply it. Figure 2, in the upper right corner, there is a yellow symbol containing the number of questions that students must later work on, which will be taken as a result of the formative test scores.

Classes are also available in the form of a WhatsApp group as a place to send videos and a link for collecting student answers. Student answers are sent to the teacher, not through the group but through the form provided by the teacher. In addition, if in working on questions students experience difficulties or do not understand, then it is permissible to ask the teacher through the group.

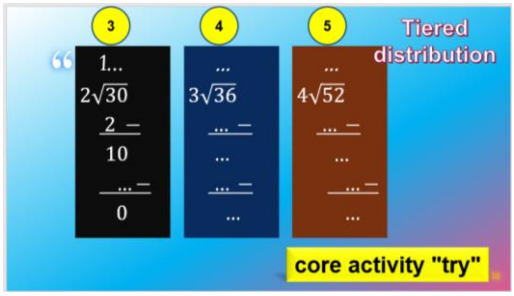
Action

Learning is carried out online, using the WhatsApp group platform. The teacher opened the lesson by greeting the students, asking how they were doing, and asking them to send their names as a form of attendance. Furthermore, the teacher motivates the benefits of studying the material and the learning objectives. By being motivated, you can increase your motivation to learn and be easily directed and enthusiastic (Santrock, 2007).

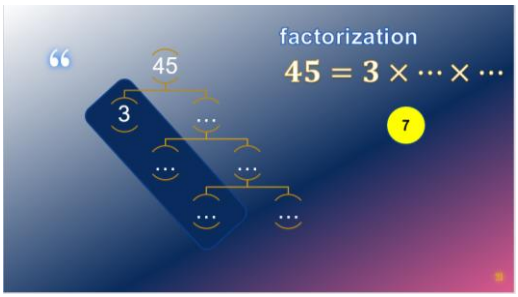
(a)



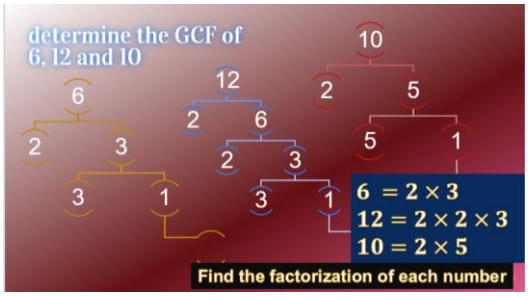
(b)



(c)

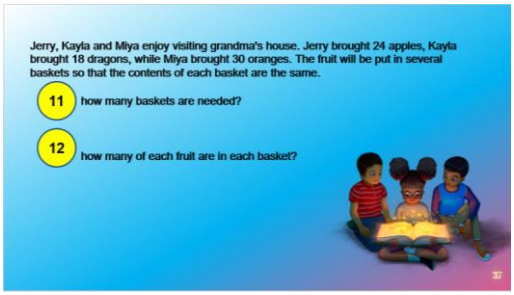


(d)



(e)

(f)



(g)

(h)

Figure 3. (a) Learning preparation, **(b)** Multiplication material and questions worked on, **(c)** Division of tiered**, (d)** Factorization, **(e)** Determine the factorization of three numbers, **(f)** Determining 3-digit GCF, **(g)** Contextual problems related to GCF**, (h)** Material for the next meeting

- The form of motivation given by the teacher is shown in Figure 2 so that students know what will be learned. As well as allowing students to prepare some snacks and drinks so that they are more relaxed when participating in learning, as shown in Figure 3 (a).
- Learning begins in the order in which the material is shown in Figure 2. The first material discussed is multiplication. Multiplication material has been studied in previous classes (Twigg, 2003). It is used as a hierarchical form of sequential math material, and the concept of multiplication is used in the core material. The use of abstract mathematical concepts to solve real-world problems (den Heuvel-Panhuizen, 2020).
- You must master the concepts of multiplication and division while looking for GCF. It does not require students to memorize (although doing so will make it easier), and they can also use the multiplication table they already have. Figure 3 (b) above shows the relationship between multiplication and division.
- The multiplication concept will later be brought into the division concept. The method of division used is tiered division, as shown in Figure 3 (c). This method will later be used in the search for GCF by first finding the factorization.
- The process of finding the factorization form begins with recalling prime numbers, at least the first five prime numbers that need to be known, complete with their multiplication from 1 to 10. To answer what is shown in Figure 3 (d), use the concepts of division and prime numbers.
- The factorization concept is then applied to determine GCF. The way to do this is to find the factorization of each number, as shown in Figure 3 (e). The GCF can be determined by following the instructions in Figure 3 (f). Finally, the GCF of 3 numbers like the example above can be found.
- After knowing how to find GCF, the concept is then used to solve contextual problems. The problem is shown in Figure 3 (g), which is the task of being able to use the concepts that have been studied before.
- As shown in Figure 3 (h), the teacher conveys the day's learning conclusions, then conveys the next material to be studied, and concludes the class by greeting.

Students' answers to the questions shown in the video are written on their respective sheets of paper. If the video is felt to be too fast in conveying the material, students can stop the video first while working on the problem and continue when they have finished working on it. If it is not clear, you can independently repeat the explanation in the video, or you can also ask the teacher directly. After finishing work, the results of student answers are sent to the teacher, and then an assessment will be carried out.

Observation

The application of online interactive learning from Cycle I to Cycle III has improved learning outcomes. The observations found various findings from observations made during the learning process activities from cycle I to cycle III with the help of videos in mathematics. The

following are the results of learning that are manifested by students' formative test scores from cycle I to cycle III, as follows:

Table 3. Class Learning Completeness for each Cycle

No	Cycle	Complete Score (%)
1	I	57
2	II	86
3	III	86

Based on table 3, it can be seen that Cycle I, Students gave a good response to the use of online learning with the help of videos in Cycle I. This was demonstrated by following the teacher's instructions, such as answering greetings, taking attendance, and following learning material, though the changes in attitudes and student learning outcomes were less significant; nonetheless, 57% of the students received a complete score at the end of the course. Students who are already enthusiastic about participating in online learning contribute to this percentage. There are already around 57% of students showing formative test results above the minimum standard. This shows that there are still students whose learning outcomes are lacking; namely, there are 43% of students who have not completed. This shows that the situation is not very good and that further improvements are still needed to improve student learning outcomes by the objectives of the minimum mastery criteria in mathematics. However, as the beginning of learning, obtaining these results is already a positive result, considering that it is already more than 50% and that there has also been an increase compared to before the treatment.

Cycle II, active student participation in implementing online learning has an impact on increasing learning outcomes in cycle II. As a result, improvements will be made in several parts so that the scores achieved by students increase and meet the minimum mastery criteria target (minimum completeness requirements) for the specified mathematics subject. The results of the second cycle of learning showed that 86% of students had completed their studies and mastered the material, while 14% had not achieved completeness. This shows an increase from cycle I to cycle II. Active student participation in implementing online learning has an impact on increasing learning outcomes in cycle II. As a result, it must be increased once again so that the scores achieved by students meet the minimum mastery criteria target (minimum score of learning completeness) in the specified mathematics subject. The class average score for cycle III is 76.36, indicating that these results have met the Mathematics Minimum Completeness Criteria.

Cycle III, the ability of students to learn and understand the subject matter as a whole is the result of an increase seen in cycle III. The enthusiasm to be involved in the learning process is shown by the enthusiasm for student learning. Compared to cycle II, student learning outcomes in cycle III increased, although the increase was not too large (the average score of students from cycle II was 76.36, becoming 78.79 in cycle III). The learning process can be made more effective and efficient by inviting students to interact and show cohesiveness in a given learning process. 86% of the learning outcomes achieved by students in cycle III were complete. This demonstrates that overall student learning outcomes from cycle II are similar. Although there are still students who have not completed cycle III, their learning outcomes have not

changed much. The class average score for cycle III is 78.79, indicating that these results have met the Mathematics Minimum Completeness Criteria.

There was an increase and decrease in each cycle, according to the general findings from cycle I to cycle III, which the researchers concluded from the results of observations made during the learning process activities. It can be seen that the learning outcomes in Cycle III are better than those in Cycle I and Cycle II based on the findings of observations collected during the learning process. Nevertheless, the good results obtained in cycle III have increased (J. Lee et al., 2019), which is the impact of improvements from cycle I and cycle II, because these results are caused by an activity or previous process (Van Alten et al., 2019).

A class can be said to have completed learning if 75% of the class has achieved an absorption capacity greater than or equal to the Minimum Completeness Criteria for the Mathematics class, namely 75. Because the average score is already at its maximum, learning is carried out up to cycle III. namely, achieving 86% of the class achieving learning mastery and obtaining an average class score of 78.79 from the minimum class value set at 75.

The findings collected and the overall value of the learning outcomes show success, even exceeding the minimum mastery score that has been set. As a result, student learning outcomes have increased. Improved student learning outcomes can be used as evidence that the use of online interactive mathematics learning with the help of videos has improved student learning outcomes (Jacobs, 2005).

Reflection

Learning outcomes are skills that children acquire after being involved in learning activities, which is the process of someone trying to obtain a kind of behavior that is relatively consistent (Abdurrahman, 2003). Learning objectives help teachers and students determine the level of student understanding and the next steps to be taken (Khosiyah, 2012). Students have varying abilities (Cevikbas & Kaiser, 2020), so the learning outcomes they achieve may differ from one another (Nason & Woodruff, 2004). The teacher measures effectiveness by looking at the attitudes and skills shown by students after completing the teaching and learning process in the previous cycle (C.-H. Lee et al., 2019).

Improvements were seen in the satisfaction of some students regarding the use of videos in online learning. His enthusiasm to participate in the learning process This is because learning can be done offline, and there is still a feeling of boredom when participating in online learning. Meanwhile, other students who cannot master learning material well experience a lack of motivation (Duy et al., 2020; Slameto, Slamet, & Slameto., 2003). However, some students struggle to fully understand the lesson because the teacher has also conveyed the lesson that will be carried out in the future. There are still students who do not want to focus on the information conveyed by the teacher. Even though children can study anywhere, some still choose not to attend lessons for various reasons.

Students can follow and adjust the online learning process using videos. This shows that there has been an increase in the quality of learning. Student learning outcomes in cycle II increased more than in cycle I. Students who were not active or tended to be passive began to decrease. Most student to follow the instructions given by the teacher. Some students still collect their homework after class ends. It's not too much of a problem; the most important thing is to keep the tasks piled up and not drag on too much.

The learning process carried out in cycle II seems to have improved learning outcomes over cycle I, but researchers still find things that need to be improved so that students can improve. Things that need to be corrected are the negative attitudes shown by some students during the learning process, including the fact that some students remain silent without giving a response even though the teacher has appointed them, some students give comments off-topic, and some students do not fill out their attendance forms. Regarding the decline, some students still have less motivation to learn, which has an impact on their ability to master the material and their acquisition of learning outcomes. There are still some students who are apathetic and less eager to pay attention to the teacher's instructions and orders.

CONCLUSION

The uses of online interactive learning with the help of videos can improve student learning outcomes in mathematics. The teacher asks questions to students in the application of online interactive learning with the help of this video. Students are asked to find solutions that they have to find on their own, as well as work on formative test questions. It has been proven that video-assisted online interactive mathematics learning can improve students' mathematics learning outcomes. The increase from cycle I to cycle III isproof. The Minimum Completeness Standard for mathematics is 75%, so in cycle III the class studied can be said to have completed learning because it has more than 75% of students who exceed the specifiedminimum mastery criteria. As a result,student learning outcomes have increased. Improved student learning outcomes can undoubtedly be used as an indicator that interactive online learning using videos has improved student learning outcomes.

ACKNOWLEDGMENTS

Thank you, we say to the parties involved in writing this scientific work. We hope that we can continue to carry out cooperation and collaboration, mutual benefits, and exchange of experiences.

REFERENCES

Abdurrahman, M. (2003). *Pendidikan bagi anak berkesulitan belajar*. Rineka Cipta.

Ahmadi, A. (2005). *Strategi belajar mengajar*. Pustaka Setia.

Akhyar, M. K. (2019). “Hasil UN buruk HOTS yang salah, benarkah?” Analisis HOTS pada soal UNBK terhadap hasil UN matematika SMA di Indonesia. *Factor M: Focus ACTion Of Research Mathematic*, *1*(2), 143 – 159. https://doi.org/10.30762/factor_m.v1i2.1518

Anas, S. (2017). *Pengantar evaluasi pendidikan* .Raja Grafindo.

Anselm. (1997). *Dasar-dasar penelitian kualitatif (Prosedur, tehnik dan teori grounded)*. Bina Ilmu.

Arifin. (1991). *Kapita selekta pendidikan: Islam dan umum*. Bumi Aksara.

Arikunto, S. (2003). *Prosedur penelitian suatu pendekatan praktik*. Bumi Aksara.

Arikunto, S. (2007). *Penelitian tindakan kelas* . Bumi Aksara.

Arikunto, S. (2010). *Research procedure a practical approach*. Rineka Cipta.

Astuti, Firdaus, L. ., Hardiana, & Sumarno. (2022). Respons peserta didik terhadap pembelajaran online, blended learning dan tatap muka pada pembelajaran matematika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(3), 2999–3013.

Baier, F., Decker, A.-T., Voss, T., Kleickmann, T., Klusmann, U., & Kunter, M. (2019). What makes

a good teacher? The relative importance of mathematics teachers' cognitive ability, personality, knowledge, beliefs, and motivation for instructional quality. *British Journal of Educational Psychology*, *89*(4), 767–786. https://doi.org/10.1111/bjep.12256

Borba, M. C., Askar, P., Engelbrecht, J., Gadanidis, G., Llinares, S., & Aguilar, M. S. (2016). Blended learning, e-learning and mobile learning in mathematics education. *ZDM*, *48*(5), 589–610. https://doi.org/10.1007/s11858-016-0798-4

BP, A. R., Munandar, S. A., Fitriani, A., Karlina, Y., & Yumriani. (2022). Pengertian pendidikan, ilmu pendidikan dan unsur-unsur pendidikan. *Al Urwatul Wutsqa: Kajian Pendidikan Islam*, *2*(1). https://journal.unismuh.ac.id/index.php/alurwatul/article/view/7757

Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE—Life Sciences Education*, *15*(4). https://doi.org/10.1187/cbe.16-03-0125

Buehl, D. (2017). *Classroom strategies for interactive learning*. Stenhouse Publishers.

Bungin, B. (2007). *Qualitative research methodology: Methodological actualization towards contemporary variants*

Cairncross, S., & Mannion, M. (2001). Interactive multimedia and learning: Realizing the benefits. *Innovations in Education and Teaching International*, *38*(2), 156–164.

Cevikbas, M., & Kaiser, G. (2020). Flipped classroom as a reform-oriented approach to teaching mathematics. *Zdm*, *52*(7), 1291–1305.

Cooney, T. J., & Wiegel, H. G. (2003). *Examining the mathematics in mathematics teacher education. In A. J. Bishop, M. A. Clements, C. Keitel, J. Kilpatrick, & F. K. S. Leung (Eds.), Second international handbook of mathematics education*. Springer Netherlands. https://doi.org/10.1007/978-94-010-0273-8_26

Croft, A., & Ward, J. (2001). A modern and interactive approach to learning engineering mathematics. *British Journal of Educational Technology*, *32*(2), 195–207. https://doi.org/10.1111/1467-8535.00190

Daryanto. (2012). *Media pembelajaran*. PT. Sarana Tutorial Nurani Sejahtera.

den Heuvel-Panhuizen, V. (2020). *National Reflections on the Netherlands didactics of mathematics: Teaching and learning in the context of realistic mathematics education*. Springer Nature.

Dewi, P. D. P., & Suniasih, N. W. (2022). Media video pembelajaran matematika berbasis etnomatematika pada muatan materi pengenalan bangun datar. *Jurnal Edutech Undiksha*, *10*(1), 156–166. https://doi.org/10.23887/jeu.v10i1.44775

Duy, N. B. P., Binh, L. C., & Giang, N. T. P. (2020). Factors affecting students' motivation for learning at the industrial University of Ho Chi Minh City. *Proceedings of the Future Technologies Conference*, *2*, 239–262.

Engelbrecht, J., Llinares, S., & Borba, M. C. (2020). Transformation of the mathematics classroom with the internet. *Zdm*, *52*(5), 825–841.

Hada, K. L., Maulida, F. I., Dewi, A. S., Dewanti, C. K., & Surur, A. M. (2021). Pengembangan media pembelajaran blabak trarerodi pada materi geometri transformasi: Tahap expert review. *Jurnal Pendidikan Matematika*, *4*(2), 155–178.

Handayani, D., & Rahayu, D. V. (2020). Pengembangan media pembelajaran interaktif berbasis android menggunakan I-Spring dan APK Builder (Development of android-based interactive learning media using I-Spring and apk builders). *MATHLINE: Jurnal Matematika Dan Pendidikan Matematika*, *5*(1), 12–25.

Isjoni. (2006). *Gurukah yang dipersalahkan: Menakar posisi guru di tengah dunia pendidikan kita*. Pustaka Pelajar.

Jacobs, K. L. (2005). Investigation of interactive online visual tools for the learning of mathematics. *International Journal of Mathematical Education in Science and Technology*,

36(7), 761–768. https://doi.org/10.1080/00207390500271149

Khosiyah. (2012). Pengaruh strategi pembelajaran dan gaya belajar terhadap hasil belajar Pendidikan Agama Islam siswa SD Inti No. 060873 Medan. *Jurnal Tabularasa PPS Unimed*, *1*(2).

Kilicman, A., Hassan, M. A., & Husain, S. K. S. (2010). Teaching and learning using mathematics software "The new challenge." *Procedia - Social and Behavioral Sciences*, *8*, 613–619. https://doi.org/10.1016/j.sbspro.2010.12.085

Kurniasari, R. (2018). Pemberian motivasi serta dampaknya terhadap kinerja karyawan pada perusahaan telekomunikasi Jakarta. *Widya Cipta*, *2*(1).

Lange, C., & Costley, J. (2020). Improving online video lectures: Learning challenges created by media. *International Journal of Educational Technology in Higher Education*, *17*(1). https://doi.org/10.1186/s41239-020-00190-6

Lee, C.-H., Yeh, D., Kung, R. J., & Hsu, C.-S. (2019). The influences of learning portfolios and attitudes on learning effects in blended e-learning for mathematics. *Journal of Educational Computing Research*, *37*(4), 331–350. https://doi.org/10.2190/EC.37.4.a

Lee, J., Song, H.-D., & Hong, A. J. (2019). Exploring factors, and indicators for measuring students' sustainable engagement in e-learning. *Sustainability*, *11*(4), 985.

Lestari, A. I., Senjaya, A. J., & Ismunandar, D. (2019). Pengembangan media pembelajaran berbasis android menggunakan Appy Pie untuk melatih pemahaman konsep turunan fungsi aljabar. *Pedagogy*, *4*(2), 1–9.

Lo, C. K., & Hew, K. F. (2020). A comparison of flipped learning with gamification, traditional learning, and online independent study: The effects on students' mathematics achievement and cognitive engagement. *Interactive Learning Environments*, *288*(4), 464–481. https://doi.org/10.1080/10494820.2018.1541910

Lowe, T., Mestel, B., & Williams, G. (2016). Perceptions of online tutorials for distance learning in mathematics and computing. *Research in Learning Technology*, *24*.

Mahnun, N. (2012). Media pembelajaran (Kajian terhadap langkah-langkah pemilihan media dan implementasinya dalam pembelajaran). *Jurnal Pemikiran Islam*, *37*(1).

Majid, A. (2016). *Strategi pembelajaran*. PT Remaja Rosda Karya.

Margono. (2017). *Metodologi penelitian pendidikan*. PT Rineka Cipta.

Moradi, M., Liu, L., Luchies, C., Patterson, M. M., & Darban, B. (2018). Enhancing teaching-learning effectiveness by creating online interactive instructional modules for fundamental concepts of physics and mathematics. *Education Sciences*, *8*(3). https://doi.org/10.3390/educsci8030109

Moreno-Guerrero, A.-J., Aznar-Díaz, I., Cáceres-Reche, P., & Alonso-García, S. (2020). E-learning in the teaching of mathematics: An educational experience in adult high school. *Mathematics*, *8*(5), 840.

Muslich, M. (2009). *Melakukan PTK Itu mudah*. Bumi Aksara.

Mustofa, S. P., Wihidayat, E. S., & Hatta, P. (2018). Can the use of video learning increase student's interest in traditional music? *IJIE (Indonesian Journal of Informatics Education)*, *2*(1). https://doi.org/10.20961/ijie.v2i1.12998

Nason, R., & Woodruff, E. (2004). Online collaborative learning in mathematics: some necessary innovations. In *Online Collaborative Learning: Theory and Practice; IGI Global*. https://doi.org/10.4018/978-1-59140-174-2.ch005

Nidawati. (2020). Penerapan peran dan fungsi guru dalam kegiatan pembelajaran. *Pioner: Jurnal Pendidikan*, *9*(2). https://doi.org/10.22373/pjp.v9i2.9087

Nurhadi. (2002). *Pembelajaran dengan pendekatan kontekstual*. Depdiknas.

Nurhayati, I., Khumaedi, M., & Yudiono, H. (2018). The effectiveness of the use of video media on learning on the competence of scalp and hair care of Vocational High School Students of Beauty Department. *Journal of Vocational and Career Education*, *3*(1).

Nusir, S., Alsmadi, I., Al-Kabi, M., & Sharadgah, F. (2013). Studying the impact of using multimedia interactive programs on children's ability to learn basic math skills. *E-Learning and Digital Media*, *10*(3), 305–319.

Prastica, Y., Hidayat, M. T., Ghufron, S., & Akhwani. (2021). Pengaruh penggunaan media video pembelajaran terhadap hasil belajar pada mata pelajaran matematika siswa sekolah dasar. *Jurnal Basicedu*, *5*(5).

Rahmi, Z. (2019). Learning Environment as Classroom Management: A Literature Review. *E-Tech: Jurnal Ilmiah Teknologi Pendidikan*, *7*(2). https://doi.org/10.24036/et.v7i2.107071

Rashidov, A., & Rasulov, T. (2020). The usage of foreign experience in effective organization of teaching activities in Mathematics. *International Journal of Scientific and Technology Research*, *9*(4), 3068–3071.

Riyana, C. (2007). *Pedoman pengembangan media video*. Program P3AI Universitas Pendidikan Indonesia.

Sablić, M., Mirosavljević, A., & Škugor, A. (2021). Video-based learning (VBL)—past, present and future: An overview of the research published from 2008 to 2019. *Technology, Knowledge and Learning*, *26*(4), 1061–1077.

Santrock, J. W. (2007). *Perkembangan anak. Jilid 1 edisi kesebelas*. PT. Erlangga.

Sanusi, A. D. (2009). Efektivitas model pembelajaran kooperatif tipe tps dan nht terhadap prestasi belajar matematika ditinjau dari aspek self concept. *Jurnal Pendidikan Mipa*, *1*(1). https://doi.org/10.31957/jipi.v5i3.317

Saputro, S. (1993). *Dasar-dasar metodologi pengajaran umum*. IKIP Malang.

Satiadarma, M. P., & Waruwu, F. E. (2003). *Mendidik kecerdasan*. Pustaka Populer Obor.

Silverthorn, D. U. (2006). Teaching and learning in the interactive classroom. *Advances in Physiology Education*, *30*(4), 135–140.

Slameto, Slamet, & Slameto. (2003). *Belajar dan faktor-faktor yang mempengaruhinya*. Rineka Cipta.

Suprayekti. (2008). *Interaksi belajar mengajar*. Depdiknas.

Surur, A. M. (2021). *Pengembangan media pembelajaran*. K-Media.

Surur, A. M., Fanani, M. Z., Septiana, N. Z., Purnomo, N. H., Ridwanulloh, M. U., & Soimah, Z. (2023). Management of developing mathematics learning modules to reduce students' academic stress. *AIP Conference Proceedings*. https://doi.org/10.1063/5.0123808

Toha, A. F. M., & Khasanah, F. N. (2020). Media pembelajaran interaktif untuk mata pelajaran matematika. *Jurnal Kajian Ilmiah (JKI)*, *20*(2), 145 – 156.

Twigg, C. A. (2003). Models for online learning. *Educause Review*, *3*(8), 28–38.

Untari, E. (2020). Efektivitas model pembelajaran kooperatif tipe think pair share (TPS) dan tipe time token arends terhadap prestasi belajar matematika ditinjau dari kemampuan berinteraksi siswa. *Focus ACTion Of Research Mathematic*, *3*(1). https://doi.org/10.30762/factor_m.v3i1.2460

UURI. (2011). *Undang-Undang Republik Indonesia nomor 14 tahun 2005 dan Peraturan Menteri Pendidikan Nasional nomor 11 tahun 2011 tentang Guru dan Dosen*.

Van Alten, D. C., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review*, *28*.

Yang, Q.-F., Lin, C.-J., & Hwang, G.-J. (2021). Research focuses and findings of flipping mathematics classes: A review of journal publications based on the technology-enhanced learning model. *Interactive Learning Environments*, *29*(6), 905–938.