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Exploring Students' Thinking Skills through Motivational Video-Based Learning on Systems of Two-Variable Linear Equations

Jihan Anisah Zahra[1], Sellen Venita Aurelia[1], Nonik Indrawatiningsih[1]

[1]Jl. Ketintang, Ketintang, Kec. Gayungan, Surabaya, Jawa Timur, Surabaya State University
Email: jihan.23228@mhs.unesa.ac.id

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ABSTRACT

This study aims to investigate how motivational videos can enhance students' mathematical thinking skills. The research employed a qualitative exploratory descriptive method involving two eighth-grade students at SMP Negeri 22 Surabaya who were selected based on high pretest scores. The students were given a motivational video designed to present the concept of Systems of Linear Equations of Two Variables through real-life applications and visual explanations. Data collection was conducted through pretest and posttest tasks and analyzed using document analysis techniques to observe students' development in forming mathematical models, selecting appropriate strategies (substitution and elimination), and drawing logical conclusions. The results showed significant improvements in students' problem-solving abilities, conceptual understanding, and confidence in applying systematic procedures. Qualitative changes were also evident in their metacognitive behaviors, such as planning and evaluating solution steps. In addition, the videos reduced students' anxiety towards mathematics and increased their motivation to learn. These findings indicate that motivational videos, when designed pedagogically and contextually, can effectively support the development of higher-order thinking skills in mathematics learning. The study suggests that teachers integrate digital media into classroom instruction to foster deeper cognitive engagement. Although limited to two subjects, this research provides important insights and encourages further studies with broader samples to evaluate the long-term impact of video-based learning on student thinking development.

Keywords: *motivational video, thinking skills, mathematics learning, Systems of Linear Equations of Two Variables, problem solving*

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INTRODUCTION

Mathematics education plays an important role in shaping students' logical and analytical thinking skills. However, conventional learning approaches are often ineffective in increasing student interest and understanding of complex mathematical materials. Along with the development of technology, the use of video-based learning media has become a promising alternative to improve the quality of learning. Research shows that the use of learning videos can increase student interest in learning mathematics (Saragih et al., 2024). In addition, learning animation videos has also been shown to be effective in improving student math learning outcomes (Prasetya et al., 2021). The use of video media in learning mathematics can also increase student learning motivation (Ramadhanty et al., 2024; Coles, 2019).

One of the topics in mathematics that students often find difficult is the System of Linear Equations of Two Variables. This difficulty can be caused by the abstractness of the concept and the lack of connection to real life. The use of motivational videos that relate the System of Linear Equations of Two Variables to everyday situations can help students understand the concept more concretely. Research shows that the use of learning videos can improve student math learning outcomes in elementary school (Astuti, et al., 2024). In addition, the use of animated videos in learning mathematics can also improve students' mathematical understanding (Suhra et al., 2023). The use of learning video media can also improve the mathematics learning outcomes students (Nisa' & Saraswati, 2023; Yulianto et al., 2024; Sumarno et al., 2023).

Various studies have shown that video integration in mathematics learning can improve students' critical thinking and problem-solving skills. For example, the use of interactive learning videos in mathematics learning can improve student learning outcomes about vectors (Gede & Putri, 2021). In addition, the use of mathematics learning videos can also improve learning achievement in lesson study-based online learning (Farahsanti et al., 2021). The use of learning videos can also increase motivation to learn mathematics in elementary school students (Fazila & Khatimah, 2023). However, further research is needed to understand how motivational videos can specifically improve student thinking skills in the context of the System of Linear Equations of Two Variables.

Although many studies have addressed the use of videos in mathematics learning, there is still a gap in understanding the specific impact of motivational videos on student thinking skills, especially in the context of the System of Linear Equations of Two Variables. Most of the previous studies focused more on aspects of concept understanding or learning outcomes in general, without highlighting student thinking processes in depth (Gede & Putri, 2021; Astuti, et al., 2024). In addition, research conducted by Suhra et al. (2023) emphasized more on concept understanding, not on higher-level thinking skills such as analysis and synthesis. Likewise, the research of Farahsanti et al. (2021) shows an increase in learning outcomes but has not specifically reviewed aspects of thinking skills. Therefore, further research is needed that specifically examines how motivational videos can encourage the development of students' thinking skills in learning mathematics, especially in the System of Linear Equations of Two Variables material.

This study aims to explore the effect of using motivational videos on student thinking skills in learning the System of Linear Equations of Two Variables material. Motivational videos can be a tool that not only attracts students' attention but also stimulates deeper cognitive engagement (Fazila & Khatimah, 2023). Research by Ramadhanty et al. (2024) showed that the use of video media had a positive impact on learning motivation, which is an important factor in the development of thinking skills. In addition, Nisa' and Saraswati (2023) showed that the use of learning videos can improve learning outcomes that correlate with student

thinking activities. Thus, through this research, it is hoped that an in-depth understanding of how motivational videos can be used to develop student thinking skills in the context of the System of Linear Equations of Two Variables problem solving can be obtained.

The results of this study are expected to make a significant contribution to the field of mathematics education, especially in the development of effective learning strategies to improve student thinking skills. In line with the findings of Saragih et al. (2024), the integration of digital media such as videos in learning has great potential to improve the quality of learning interactions in the classroom. In addition, Prasetya et al. (2021) emphasized the importance of innovative approaches such as animated videos to help students understand difficult mathematical material. This study also supports Fazila and Khatimah's (2023) efforts in utilizing video media as a tool to improve student motivation and cognition simultaneously. In other words, the results of this study can serve as an important foundation for educators in designing learning that emphasizes aspects of thinking skills through the appropriate integration of technology.

METHODS

This research uses a qualitative approach with an exploratory descriptive type. This approach was chosen because it aims to explore and describe students' thinking skills after being given treatment in the form of motivational videos in the learning System of Linear Equations of Two Variables material. The exploratory descriptive approach allows researchers to understand changes in students' thinking processes in detail without generalizing to a wider population (Sugiyono, 2017). The main focus in this study is to describe students' thought processes as shown through their responses to System of Linear Equations of Two Variables problems after watching motivational videos. This design is by studies conducted by Fazila and Khatimah (2023) and Astuti et al., (2024), who used similar methods to reveal the impact of learning media on students' cognitive aspects.

The research was conducted in class VIII B of SMP Negeri 22 Surabaya in the academic year 2024/2025. The research subjects were selected through the process of giving pretests to all students in the class to find out their initial mathematical thinking ability on the System of Linear Equations of Two Variables material. From the pretest results, two students with the highest scores were selected as the main research subjects, because they were considered to represent more complex thinking potential. The two students were then given treatment in the form of a motivational video that contained an explanation of the application of the System of Linear Equations of Two Variables in everyday life and a description of the System of Linear Equations of Two Variables solution met, such as elimination and substitution. This video was designed to motivate and enrich students' understanding of linking mathematical material with real contexts. After watching the video, both students were given a posttest with a similar structure and difficulty level to measure changes in their thinking skills (Farahsanti et al., 2021; Ramadhanty et al., 2024; Suhra et al., 2023).

The data analysis technique used in this research is document analysis. This technique was carried out by systematically reviewing the pretest and posttest answer sheets of the two students. Researchers identified changes in the quality of responses in solving System of Linear Equations of Two Variables problems by paying attention to indicators of thinking skills, such as the ability to create mathematical models, choose solution strategies, and draw logical conclusions. The analysis process was carried out by recording and categorizing the development of students' thinking based on the content of their answers, without the need for observation sheets. This document analysis allows researchers to gain an in-depth

understanding of students' mathematical thinking through written artifacts produced before and after treatment (Bowen, 2009; Gede & Putri, 2021).

RESULTS AND DISCUSSION

Figure 1. Motivational Video 1

Figure 2. Motivational Video 2

Figure 3. Motivational Video (Explanation)

The main objective of this study was to investigate the development of students' mathematical thinking skills after receiving treatment in the form of motivational video shows that link the concept of System of Linear Equations of Two Variables with real-life situations. The focus of this research lies on two main indicators, namely the ability to form a mathematical model of the story problem, as well as the skill in choosing and applying the right System of Linear Equations of Two Variables solution method. Based on the analysis of the pretest and posttest work of the two students who were used as subjects, a striking improvement in both aspects was found. These skills are very important in learning mathematics because they reflect students' logical and systematic thinking abilities. Therefore, the use of learning media such as motivational videos becomes very relevant to help students develop these thinking skills.

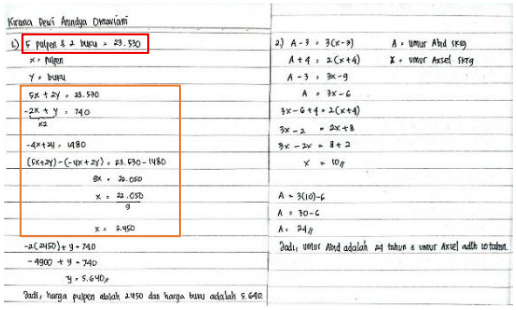

Figure 4. Pre-test Answer of Student 1

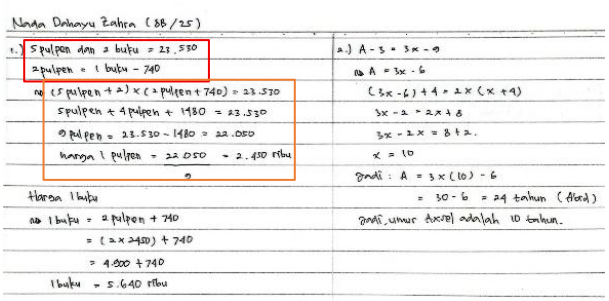

Figure 5. Pre-test Answer of Student 2

At the initial stage before intervention, both students could answer two pretest questions correctly, but the strategies used did not follow the systematic steps of mathematics. Completion was done intuitively or by guessing, without the use of substitution or elimination techniques that should be used in the System of Linear Equations of Two Variables. This indicates that students' understanding of the System of Linear Equations of Two Variables concept is still superficial and not well internalized. Students also appeared to have difficulties when trying to identify variables and construct mathematical models from story problems. Their doubts were reflected in their facial expressions, confusion in erasing and rewriting, and verbal comments such as “not sure” or “confused”.

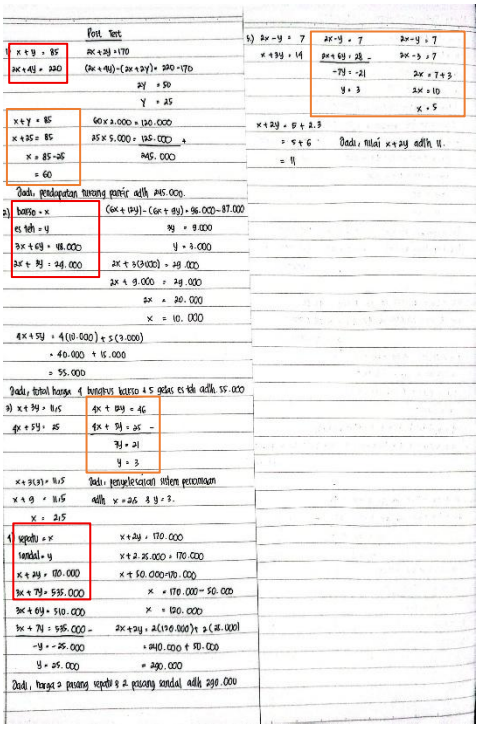

Figure 6. Post-test Answer of Student 1

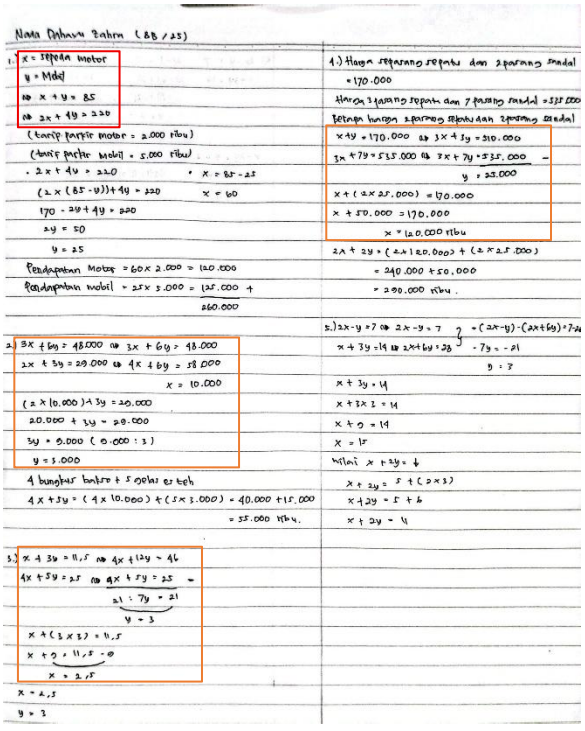

Figure 7. Post-test Answer of Student 2

After watching the motivational video, significant changes began to appear. Students successfully answered five posttest questions using correct mathematical procedures, such as substitution or elimination. They showed a deeper understanding in choosing a solution strategy that suited the characteristics of the problem. The ability to construct mathematical models also improved, as seen from the accuracy in selecting variables and composing relevant equations. Students' confidence also seemed to increase in solving problems independently and logically.

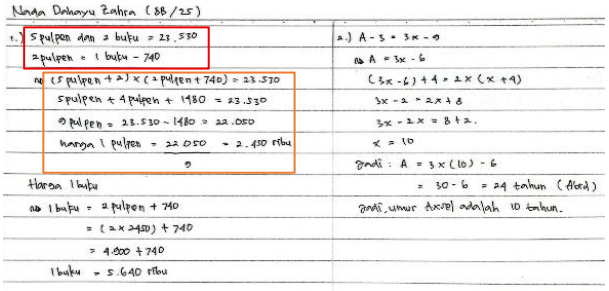

Figure 8. Student Completion Before Treatment

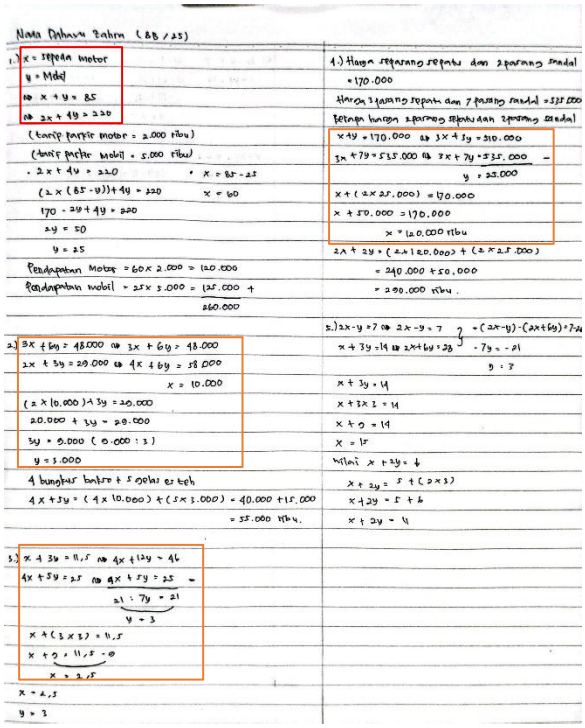

Figure 9 Student Completion After Treatment

After watching the motivational video, although the student's scores on the pretest and posttest remained the same, the qualitative improvement in the student's problem-solving process was visible. In Figure 8, Student 2 attempted to solve the system of linear equations in two variables but was unable to construct two linear equations from the given story. The variable identification was not explicit, and the student performed numerical operations without establishing a clear equation structure. There was no indication of using substitution or elimination methods. This shows a lack of modeling skills and an unstructured problem-solving strategy. The student appeared hesitant, frequently erasing and rewriting answers, which indicated uncertainty in their thinking process.

Figure 9 illustrates that Student 2 successfully created accurate mathematical models. They clearly defined the variables, such as “x = number of notebooks” and “y = number of pencils,” and formed two equations from the narrative. They selected the substitution method and executed it properly to reach the correct solution. These skills demonstrate strategic planning, method application, and self-evaluation. The student began to show flexibility in choosing the most appropriate method for each problem. This shows a clear change towards structured and logical reasoning. The student can translate the context into a system of equations and choose the appropriate solution method. This change reflects an increase in metacognitive awareness, including the ability to analyze, compose, and evaluate problem-solving strategies. Thus, the motivational video serves as an intermediary for cognitive aspects that encourage structured mathematical thinking.

The changes that occurred were measured qualitatively. The quality of responses improved, with more systematic elaboration of steps and logical arguments for the strategies taken. Students also showed flexibility in choosing the most efficient method for each problem. This indicates that they have a stronger conceptual understanding and can apply it in varied situations. This flexibility reflects critical and adaptive thinking skills that are important in mathematical problem solving.

This finding is in line with Bruner's (1966) view, which emphasizes that understanding is more easily achieved through visual representations and concrete contexts. In this context, motivational videos provide visual and narrative illustrations that not only convey the System of Linear Equations of Two Variables procedure but also explain its practical benefits in life, such as calculating costs or dividing tasks. Visual media makes it easier for students to connect theory with the practice they experience daily. Concept understanding becomes easier to form because the information is conveyed in an interesting and easy-to-understand form. This strengthens students' engagement in the learning process and improves their memory of the material.

Additional support comes from the research results of Wirth & Greefrath (2024) which showed that the use of videos in mathematics learning can improve students' reflective ability and procedural understanding. In the study, students who received video learning performed better than those who did not receive similar treatment. This shows that visual media can be an effective tool in learning mathematics. Similar findings also emerged in this study, where students demonstrated an improved ability to apply methods for solving systems of linear equations of two variables appropriately. Thus, motivational videos are proven to be able to develop students' cognitive aspects significantly.

Research by Suhra et al. (2023) also reinforced these findings, stating that motivation-based media and real applications can increase students' cognitive engagement. The video presentation that provides reasons for the importance of understanding the System of Linear Equations in Two Variables also fosters students' curiosity and enthusiasm for learning. They became more active in participating in learning activities and more confident in completing the tasks given. Students' intrinsic motivation increases along with the understanding that the material they learn has relevance in everyday life. This is evidence that affective aspects of learning are crucial to supporting academic success.

From the perspective of constructivism, meaningful learning is the process of building new knowledge based on the experiences and understandings that students already possess. The motivational video in this study provides a context that enables knowledge construction. Students not only learn how to solve systems of Linear Equations of Two Variables, but also understand the importance of their application in real situations. This helps students develop higher-order thinking skills, such as analysis, synthesis, and evaluation. This approach makes students active subjects in the learning process, who are responsible for their progress.

In addition, videos also help to create a more pleasant learning atmosphere and reduce math anxiety. As stated by Astuti et al., (2024), video presentations that include positive emotional aspects have an impact on reducing learning anxiety. In the context of this study, students showed a change in attitude from fear of mistakes to being more willing to try and explore solutions. This suggests that an emotionally supportive learning environment is essential for shaping positive attitudes towards mathematics. This impact also affects students' more active participation in discussions and problem solving. The use of motivational videos in learning mathematics in junior high school is proven to be able to increase students' metacognitive awareness. Students began to show behaviors such as planning strategies, evaluating solution steps, and reflecting on their answers more independently. This is reflected in a more planned and reflective posttest process, as well as neater solution notes. Research by Dayutiani and Fitrianna (2021) shows that learning videos used as a medium for learning mathematics in junior high school students are effective in increasing students' interest in learning, activeness, and understanding, so that students not only absorb information, but also develop independent learning skills.

The positive results of using video also require teachers to choose media wisely and design them pedagogically. Videos used in learning are not just entertainment tools, but are

designed as educational tools that are tailored to the context of student learning. When teachers are able to adapt video content according to students' backgrounds and needs, deep understanding of mathematical concepts becomes easier to achieve. Research at Alkarim Junior High School in Bengkulu City proves that the application of video-based learning media makes learning more interesting, can increase the enthusiasm for learning, and the media display is clear and easy to understand, so the teacher has a central role in ensuring the effectiveness of video use (Selviani, 2022).

This approach also encourages innovation in the learning process, where teachers can act as facilitators who guide students to explore the meaning of each material learned. Recent research has shown that effective utilization of mathematics learning videos can improve learning motivation, student engagement and long-term learning outcomes. Classroom action research at SMP Negeri 2 Bengkulu City proved that the application of learning videos can improve students' learning outcomes in learning mathematics, as seen from the increase in average scores and classical learning completeness (Rahmawati & Hanifah, 2021). Thus, video-based learning not only enriches concept understanding, but also builds students' independence and strategic thinking skills.

Although the subjects in this study were limited to two students, the results obtained still provide important insights because simple media such as motivational videos are proven to be able to change students' perspectives and thinking strategies towards mathematics. Further research with a wider sample, various ability levels, and long-term observation is needed to evaluate the consistency of learning outcomes and the development of students' critical thinking skills, as well as examining the impact of video media on other aspects such as cooperation, creativity, and digital literacy in order to increase the contribution of video media in education. Research by Dayutiani and Fitrianna (2021) also emphasizes that the use of mathematics learning videos at the junior high school level is effective in increasing student interest and activeness, so it can be the basis for developing innovative and adaptive learning media to student needs (Dayutiani & Fitrianna, 2021).

The use of contextualized and pedagogically structured motivational videos can improve students' mathematical thinking skills, especially in modeling and selecting strategies for solving the Two-Variable Linear Equation System. Teachers are expected to be more creative and reflective in designing media-based learning that is not only interesting, but also encourages higher-order thinking skills and strengthens inclusivity and accessibility in the classroom, where every student gets the opportunity to develop according to their potential. Research by Kusmaryono & Basir (2024) shows that learning videos that are designed contextually and adaptively can improve concept understanding and student involvement in learning mathematics, so that learning becomes more meaningful and effective.

The positive results shown by both research participants prove that an appropriately designed media-based approach not only helps concept understanding, but also increases students' confidence, motivation, and metacognitive skills. The role of the teacher as a facilitator in providing assistance and reflection remains very important, as also confirmed by Selviani's research (2022) that the application of structured video-based learning media can significantly increase students' enthusiasm for learning and understanding. In addition, research by Rahmawati & Hanifah (2021) added that the application of learning videos can significantly improve students' mathematics learning outcomes, as seen from the increase in average scores and classical learning completeness.

CONCLUSION

This study shows that the use of motivational videos in learning mathematics, especially on the material of the System of Linear Equations of Two Variables, can improve students' mathematical thinking skills. The video, designed with a contextual approach, helps students build a more concrete understanding of the concept and connect it to everyday life. After watching the video, students were able to form mathematical models more precisely and choose appropriate solution strategies, such as elimination and substitution methods. Improvement was also seen in the accuracy and systematicity in answering the questions, which reflected the development of logical thinking skills. This proves that appropriately designed visual media can stimulate deeper thought processes.

In addition to cognitive improvement, the use of motivational videos also had a positive impact on students' affective aspects, including increased motivation and reduced anxiety towards math. The presentation of material that is interesting and close to reality makes students more interested in learning and more confident in solving problems. Students' attitudes towards mathematics become more positive because they understand the relevance of the material in everyday life. The learning atmosphere becomes more conducive and supports the exploration of ideas and the courage to try. Students' activity and involvement in the learning process also showed that video media can strengthen participation and emotional involvement in learning.

Overall, the results of this study provide a strong basis for teachers to integrate motivational video media in mathematics learning to develop higher-order thinking skills. Teachers need to design videos with content that is appropriate to the context and needs of students for optimal effectiveness. In addition, this approach is in line with constructivist learning principles that place students as active subjects in constructing knowledge. Although this study was limited to two subjects, the findings obtained can be a reference for further research with a wider scope. With pedagogically designed media-based learning strategies, the process of learning mathematics can be more enjoyable, meaningful, and empowering for students as a whole.

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