Analysis of Mathematics Learning Needs Using Animated Videos Based on Discovery Learning in Junior High Schools

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Abstract

Video animation plays an important role in learning mathematics because it can present abstract concepts visually and interactively. In addition, the delivery of interesting material through animation can increase students' understanding and interest in learning. Therefore, this study aims to analyze the extent of students' needs in learning mathematics using discovery learning-based animated videos in junior high school. This research uses a quantitative method with a survey approach, where data is obtained through a questionnaire designed to collect information about students' needs for animated video-based learning media. Respondents in this study were thirty students from one of the junior high schools in Indonesia. Respondents were selected using purposive sampling technique. In the process of data analysis, this research utilizes Microsoft Excel to organize, process, and present data in the form of tabulations, tables, and diagrams. The analysis technique used is descriptive quantitative which includes the calculation of mean (average), median, and percentage. This statistical calculation is done to see the tendency of students' answers to the questions given in the questionnaire, so that an overview can be obtained about the extent of their needs for the use of Discovery Learning-based animated videos in learning mathematics. The findings are expected to be the basis for developing more effective and interesting animated video-based learning media. In addition, this research can also provide insight for educators in designing learning strategies that suit the needs of students, so as to improve students' understanding and learning outcomes.

INTRODUCTION

The pace of technological progress is increasing rapidly, especially in terms of utilizing learning media, this shift also has an impact on the pedagogical component (Hartati & Fernadi, 2021). From their physical origins, learning materials have evolved rapidly, today, many of the materials are digitally sourced or available (Hapsari, 2021). This change will modify teachers' teaching methods,

where teachers begin to utilize digital media in learning activities. Math learning is often considered difficult and uninteresting for most learners (Matos et al., 2024; Nisa et al., 2021; Priyanti & Nurhayati, 2023). One of the main challenges in learning mathematics is the use of conventional learning methods that tend to be monotonous and not interactive (Nahampun et al., 2024; Sakiah & Effendi, 2021). Learning that only relies on textbooks and student worksheets is often unable to stimulate students' interest and learning motivation optimally. Monotonous learning methods can result in minimal engagement and learning outcomes (Rahimah, 2023; Surya, 2018). Monotonous and non-interactive learning can lead to a lack of student participation and learning outcomes (Crishmayanty & Simanjutak, 2021).

The use of technology in learning mathematics is also still not optimal. Many teachers have not utilized technology optimally in the learning process. This factor is due to limited access to innovative and interactive learning media in some schools, especially in remote areas. Research by Pratiwi & Dewi, (2024) identified several difficulties faced by teachers in using digital-based mathematics learning media, including limited technology facilities, difficulties in adjusting applications to materials, and challenges in designing learning media using mathematics applications. In addition, according to Nurdyansyah & Aini, (2017) highlighted the challenges faced by teachers in technology-based mathematics learning, such as lack of knowledge and skills in using digital technology, as well as limited supporting facilities and infrastructure. Therefore, the lack of training and adequate facilities is one of the main causes why technology has not been fully integrated in learning in schools.

This is also supported by empirical evidence; for example, a survey of mathematics educators in one Junior High School found that classroom teaching of most students was based on outdated and boring textbooks and worksheets (Nurlatifah & Suprihatiningrum, 2023). As a result, students lost interest and motivation to learn actively, which led to their substandard academic performance. The use of old-fashioned and boring textbooks and worksheets in teaching can cause students to lose interest and motivation to learn actively, which ultimately has a negative impact on their academic achievement. According to Halimah et al., (2023) the use of uninteresting textbooks or Learner Worksheets) can significantly affect student learning outcomes. In addition, according to Ndraha et al., (2022) found that interest in learning has a significant positive relationship with student achievement; when interest in learning decreases, academic achievement tends to decrease. These two studies confirm that uninteresting learning materials can decrease students' interest in learning, which in turn has a negative impact on their academic achievement.

The utilization of technology in the learning stage of mathematics can be said to be very limited. It is still found that many educators have not fully integrated technology in learning, even though technology can make learning more interactive and interesting. According to Taneo & Daniel, (2022) various physical and cultural factors affect teachers' use of information and communication technology, including lack of access to reliable electricity, limited technological infrastructure, and availability of appropriate software. These constraints hinder the integration of technology in mathematics learning. In addition, according to Rahma et al., (2023) revealed that teachers still experience difficulties in operating technology as a learning medium, including due to lack of knowledge and skills in utilizing technology effectively. This has an impact on the low utilization of technology in the mathematics learning process.

Limited facilities and lack of training for teachers are the main causes of the non-optimal utilization of technology. In addition, students often encounter

challenges to understand abstract mathematics material, such as the Two-Variable Linear Equation System, which requires changing information from verbal to symbolic form, this is certainly difficult for most students to understand. Many students have difficulty in solving story problems on the Two-Variable Linear Equation System material, especially in converting story problems into mathematical form (Sundary et al., 2022). This shows that students do not understand the concept of the Two-Variable Linear Equation System well, making it difficult to translate from verbal to symbolic representations. In line with the results of research Indah & Hidayati, (2022) students have difficulty in converting verbal problems into appropriate mathematical models. This difficulty is caused by students' lack of understanding of basic mathematical concepts and inability to identify important information from story problems. The lack of interactive and visual-based learning media also exacerbates this problem, because the material taught is predominantly text-based, which is not effective enough to teach concepts that require visualization (Indah & Hidayati, 2022; Prasrihamni et al., 2022).

In addition, limited access to innovative learning media, such as discovery learning-based animated videos, is also an obstacle in creating a more enjoyable and effective learning experience. Research shows that the use of animation-based learning media can help improve students' understanding and creative thinking in learning (Rochmania & Restian, 2022). In addition, research by Permana & Suniasih, (2021) revealed that the integration of discovery learning-based animated videos can increase students' learning motivation and help them understand abstract concepts better. However, access to this media is still limited due to various obstacles, such as the lack of technological facilities, limitations in providing digital resources, and low teacher skills in developing and operating technology-based media. Therefore, further efforts are needed to improve the utilization of innovative learning media to support students' mathematical understanding more effectively.

Varied and interactive learning media can play an important role in increasing student interest and motivation. A promising learning tool is the discovery learning-based animated video. The use of animation in learning can help visualize abstract concepts and improve student understanding (Gunawan et al., 2015; Melati et al., 2023; Saragih & Sirait, 2023). In addition, the discovery learning approach helps students in finding their own concepts through exploration and problem solving, which can foster critical and creative reasoning skills (Mukaramah et al., 2020). Animated videos not only make math lessons more interesting, but also help students understand advanced mathematical ideas (Mashuri, 2020). Animated videos allow for more dynamic and interactive delivery of topics, and provide quick feedback, which is important in adaptive learning. In addition, the discovery learning method has been proven effective for developing students' concept understanding and critical thinking skills (Hulu & Telaumbanua, 2022).

The use of discovery learning-based animated videos in learning mathematics in junior high school has been the focus of various studies that show a positive impact on student learning outcomes. One of the studies by Gulo et al., (2023) developed a discovery learning-based mathematics learning video that is valid, practical, and effective in improving students' mathematical reasoning skills in junior high school. The results of this study indicate that the learning video developed meets the validity criteria with a high score, is very practical in use by students and teachers, and is effective in improving students' mathematical reasoning skills with an average score that is in the high category. other than that, another study by Sofnidar et al., (2023) developed an animated

video on blended learning with a discovery model to improve students' concept understanding skills. The results of this study indicate that the animated video media developed is effective in improving students' understanding of mathematical concepts. The use of animated videos in the discovery learning model provides a more interactive and interesting learning experience, so that students are more motivated and able to understand the material better.

Research results by Lewa et al., (2024) showed that the application of the discovery learning model assisted by learning videos can improve students' mathematics learning outcomes. This study emphasizes the importance of using interactive learning media to improve understanding of mathematical concepts among junior high school students. These studies confirm that the integration of discovery learning-based animated videos in mathematics learning in junior high school can improve students' reasoning ability and concept understanding. Therefore, the purpose of this study is to examine the need to create discovery learning-based animated films for mathematics education, with the aim of improving student engagement, drive and outcomes. The project aims to design learning materials tailored to the needs and characteristics of students and to uncover factors that influence the successful use of discovery learning-based animated videos in mathematics education. Therefore, it is believed that the findings of this research will be an important asset for initiatives aimed at improving mathematics education in Indonesia.

METHODS

This research uses quantitative methods with a survey approach (Maghfiroh et al., 2024; Oktafiani & Mujazi, 2022; Wahyuni et al., 2022). The data source was obtained through a questionnaire designed to collect information about student needs for animated video-based learning media (Agusti et al., 2018; Syafril et al., 2021; Yeni et al., 2023; Zafirah et al., 2018). The respondents in this study were thirty students from one of the State Junior High School 1 Putra Rumbia, Indonesia. Respondents were selected using purposive sampling technique. In the process of data analysis, this research utilizes Microsoft Excel to organize, process, and present data in the form of tabulations, tables, and diagrams. The analysis technique used is descriptive quantitative which includes the calculation of mean (average), median, and percentage. This statistical calculation is done to see the tendency of students' answers to the questions given in the questionnaire, so that an overview can be obtained about the extent of their need for the use of Discovery Learning-based animated videos in learning mathematics (Kastira & Irwan, 2023).

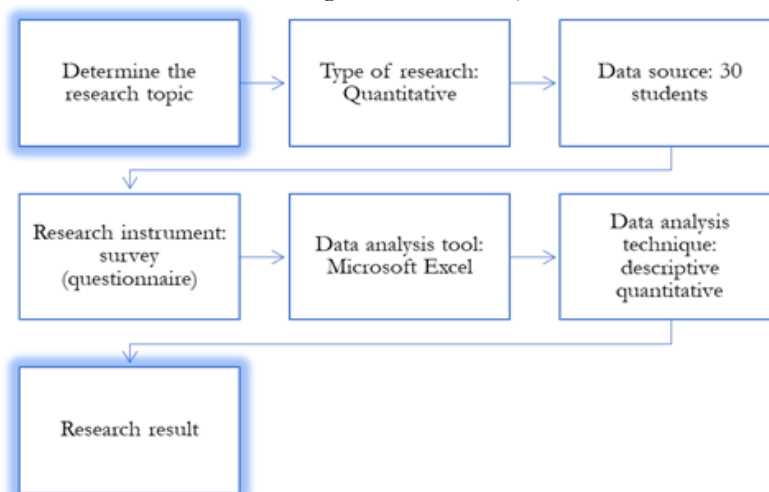**Fig 1. Steps of quantitative research**

RESULT AND DISCUSSION

Based on the author's analysis of the data obtained regarding student needs for animated video-based learning media. Researchers grouped into three themes related to what was analyzed.

The first is the analysis of learning media utilization. Students' preference for learning media is determined through its utilization analysis. The results are shown in table 1 below, which was obtained from examining students' responses and comments on the use of learning media in math sessions.

Table 1. Questionnaire results of students' utilization of learning media

No.	Question	Answer Options			
		Strongly agree	Agree	Disagree	Strongly disagree
1.	Learning math is enough with printed books or student worksheets	0%	6,7 %	33,3%	60%
2.	Learning math will be more interesting when using discovery learning-based animated videos	76,7 %	23,3 %	0%	0%

Referring to table 1, it can be explained that there are 6.7% of students who agree, 33.3% disagree, and there are 60% strongly disagree that learning mathematics is not enough to rely only on printed books or student worksheets. It can be clearly seen that there is a need for instruments that can be utilized by students in helping the stages of learning mathematics. Learning resources have a very important role in improving the quality of learning. Learning resources include various forms, such as messages, individuals, materials, devices, methods, and scope that can be implemented by students at the learning stage to improve the quality of their learning (Samsinar, 2020).

Educators are required to design and develop teaching materials in a structured manner according to the needs in the learning process that will be carried out, as well as considering the characteristics of students who will be involved in learning. Printed materials are just one type of learning resource; other technology-based learning resources include things like powerpoints, videos, blogs, e-modules and interactive learning applications. The choice of learning resources implemented should integrate the use of technology. Based on the data obtained, this is very important, considering that the data in the table shows that 23.3% of learners agree and 76.7% strongly agree that learning mathematics can be more fun if applying discovery learning-based animated videos.

Math learning outcomes can be improved with the use of technology, as students will be more engaged with the subject matter through the applications created (Gulo et al., 2023). As the subject matter is available online anytime and anywhere, the use of technology-based learning resources is also more convenient and productive. Technology-integrated learning is now a necessity in the era of rapid technological development. The utilization of technology in learning is expected to increase effectiveness, efficiency, and variety in the learning stage. An example of technology-integrated learning is the use of discovery learning-based animated video. The attractive and dynamic visuals

in this animated movie have the dual function of arousing students' interest in learning and helping them understand mathematical ideas. Students' ability to think critically and creatively can be enhanced through the use of discovery learning approach, which encourages them to explore and understand new ideas independently.

Furthermore, technology enables the delivery of materials that are more flexible and adaptive to individual learning needs. The flexibility to access course materials when and where they like allows students to learn according to their own needs and preferences. The integration of technology in learning also allows for faster and more effective feedback, so that educators can immediately recognize the difficulties faced by learners and provide the necessary assistance. Thus, the integration of technology in mathematics learning is not only an innovation, but also an urgent need. By utilizing technology, educators can create a learning environment that is more interesting, effective and relevant to the times. An animated video based on discovery learning is a step in achieving this target, through providing a more interesting and meaningful learning experience for students.

Second, material analysis. To improve learning outcomes and attract students' attention, material analysis was conducted to determine the content and subjects required for the development of interactive media. Mathematical concepts were reviewed in this study. The need to use interactive learning tools to help students better understand content that is traditionally considered challenging was the main emphasis of this study. Table 2 below displays the findings from the examination of student responses and responses related to the math subject matter.

Table 2. Results of students' questionnaires about material analysis

No.	Question	Answer Options			
		Strongly agree	Agree	Disagree	Strongly disagree
1.	The system of linear equations of two variables is important material to understand	26,7%	40%	20%	13,3%
2.	The system of linear equations of two variables is a difficult material	66,7 %	33,3 %	0%	0%

Based on table 2 related to the material analysis questionnaire, the results reached 26.7% strongly agree, 40% agree, 20% disagree, and 13.3% strongly disagree that the Two-Variable Linear Equation System is material that is crucial to learn. Meanwhile, for the statement that the Two-Variable Linear Equation System is difficult material, the percentage shows that 66.7% of students strongly agree, 33.3% agree, and no one described disagree or strongly disagree. Several factors may be the cause of students' difficulties in understanding the Two-Variable Linear Equation System. A factor that may be the cause of difficulty is because the material of the Two-Variable Linear Equation System often involves story problems that require students to convert information in the form of stories into mathematical symbols. This process requires a deep understanding not only of mathematical concepts, but also the ability to analyze and transform verbal information into the right symbolic form.

There are two types of influences on student errors: internal and external. Intrinsic issues include things such as students' misunderstanding of how to use the elimination and substitution approach, their difficulty in handling Two-Variable Linear Equation System story problems, and their lack of understanding of the necessary background knowledge. However, external influences include things like students' lack of time and teachers' tendency to skip the "known" and "asked" parts when solving math problems (Aripin, 2018). Students may find this challenge more challenging if they lack experience or proper training in dealing with complex story problems. As a result, students need a more interactive learning environment, more diverse example problems, and more challenging exercises to improve their analytical skills and understanding of the concept of Two-Variable Linear Equation System in order to understand and solve Two-Variable Linear Equation System problems.

Third, needs analysis. Referring to the findings and explanations that have been carried out previously, several important points can be made regarding the needs in this study. First, there is a need for varied learning media. The data listed in table 1 shows that the majority of students feel that learning mathematics using only textbooks or the Two-Variable Linear Equation System is less interesting and ineffective. In contrast, they prefer the use of discovery learning-based animated videos which are considered more interesting and facilitate understanding. This indicates the importance of developing more interactive and innovative learning media to improve interest and learning outcomes. Second, the integration of technology in learning is needed. The use of technology, such as discovery learning-based animated videos, can build a more interesting learning atmosphere, and make it easier for students to understand mathematical aspects in a more visual and fun way. Technology provides flexibility in the delivery of materials and allows for faster and more effective feedback, which is needed in adaptive learning.

Furthermore, there is a need for a more optimized learning approach, especially in complicated materials, such as the Two-Variable Linear Equation System. Based on table 2, the Two-Variable Linear Equation System is an important material but is often considered difficult by students, especially because this material involves story problems and the transformation of verbal information to symbolic forms. Therefore, structured learning methods and special strategies are needed to help students understand and solve Two-Variable Linear Equation System problems better. Finally, internal and external factors need to be considered in learning. Students' difficulties in learning the Two-Variable Linear Equation System are not only influenced by a lack of understanding of the prerequisite material, but also by external factors, such as limited time to learn the material and ineffective teaching methods. To overcome this problem, an approach is needed that accommodates the needs of students, both in terms of time, methods, and understanding of prerequisite material.

CONCLUSION

The results of this study reveal that students really need discovery learning-based animated videos in learning mathematics, especially on the material of the Two-Variable Linear Equation System, because this media can facilitate understanding of concepts, increase interest in learning, and support the achievement of better learning outcomes. This finding contributes to the development of more innovative and interactive learning media, and provides guidance for educators in developing learning strategies that are more in line

with student needs. In addition, this study succeeded in answering the main objective, which was to analyze the extent to which students need animation-based learning media, as evidenced by the data collected through questionnaires. The implications of this research emphasize the importance of utilizing technology in mathematics learning to make the learning experience more interesting, effective, and in accordance with the characteristics of students, as well as being the basis for further development in learning media innovation to improve the quality of education at the junior high school level.

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