



Validity of Learning Video Media with an Open-Ended Approach to Mathematics Learning Outcomes

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Abstract. *The purpose of this study was to analyze the validity of the design of the development of learning video media with an open-ended approach to improve the learning outcomes of 6th-grade elementary school students in Mlonggo District. This study applies the research and development method, which is commonly known as R&D (Research and Development). Products development uses the ADDIE model which is structured into five stages including (1) analysis, (2) design, (3) development, implementation, and (5) evaluation. Data collection through filling out the validity questionnaire. This data source includes participation from data validators with an analysis process that includes the accumulation of overall scores. Data analysis uses descriptive qualitative tests. The results of this development research are learning video media with an open-ended approach which is stated to be very feasible by media experts with an average of 90%, and material experts with 92%. So, it can be concluded that learning video media with an open-ended approach is valid and feasible to be used to improve student learning outcomes.*

Keywords: *Validity, learning video media, open-ended approach, mathematics learning outcomes*

1. INTRODUCTION

In the world of education, the use of learning media has experienced rapid development along with technological advances. Learning media functions as a tool for educators to deliver material more effectively and interestingly (Caron & Markusen, 2016; Aprilia et al., 2021). One of the increasingly popular learning media is learning videos. The advantage of learning videos lies in their ability to present material visually and interactively, which can help students understand complex concepts more easily (Van Der Stappen et al., 2019; Ruf et al., 2023). In mathematics, learning videos have great potential to facilitate students' understanding of materials that require visualization of abstract concepts.

However, the effectiveness of a learning video does not only depend on attractive visualizations but also the approach used in its presentation. One approach that has attracted a lot of attention in mathematics learning is the open-ended approach. This approach gives students the freedom to find solutions from various perspectives and provides space for exploring ideas. Through the open-ended approach, students are

invited to think creatively and critically in finding solutions to a mathematical problem, not just focusing on one correct answer (Kurt-Birel et al., 2020; Kurniawaty, NE, Utaminingsih & Sumaji, 2024).

The open-ended approach allows students to have a deeper understanding of mathematical concepts (Baburajan et al., 2022; Munroe, 2015). They are invited to explore various methods and strategies for solving problems, which ultimately encourages the development of higher-order thinking skills. In this process, students are also trained to become independent learners, because they are allowed to actively participate in finding answers based on their understanding and logic. This is important to improve students' conceptual understanding, as well as reduce their dependence on rigid solution methods and narrow instructions.

Research on the validity of learning video media with an open-ended approach in the context of mathematics learning is important. The validity of learning media is closely related to how effective the media is in achieving the desired learning objectives. Valid learning videos must be able to help students develop a good understanding of mathematics and have a positive impact on their learning outcomes. In addition, this video also needs to be designed systematically and structured so that it can support critical thinking and problem-solving skills which are the main focus of the open-ended approach.

The purpose of this study was to analyze the validity of learning videos designed with an open-ended approach to improving mathematics learning outcomes. Through this evaluation, it is expected to obtain information about the quality of the learning videos, as well as how much influence they have in supporting students in understanding mathematics material. By assessing the validity aspect, educators can understand whether this video media meets the standards required for effective learning while ensuring that the media can be applied in various educational contexts.

Overall, this study is expected to provide a positive contribution to the development of more effective video learning media, especially in the context of mathematics learning with an open-ended approach. With the results of this study, educators and developers of learning media can obtain clearer guidance on the design and implementation of appropriate learning videos. Ultimately, valid and effective learning videos are expected to improve the quality of mathematics learning, as well as help

students achieve more optimal learning outcomes through a creative and interactive approach.

2. LITERATURE REVIEW

Learning media is one of the important components in the teaching and learning process which aims to make it easier for students to understand the material and achieve the learning objectives that have been set. According to (Aini et al., 2019), good learning media can enrich the learning experience and make learning more meaningful. Along with the development of technology, learning media is now present in various digital forms, one of which is learning videos. Learning videos are considered effective in presenting complex material interestingly and interactively, especially in lessons that require visualization such as mathematics (Haataja et al., 2019; Yuda, 2011; Patahuddin et al., 2020). However, the effectiveness of this learning media is highly dependent on the design and approach used.

The open-ended approach in mathematics learning has been widely studied as a method that can improve students' conceptual understanding and critical thinking skills. This approach allows students to explore various ways of solving problems, without being limited to just one correct answer (Kurt-Birel et al., 2020). According to (Hansen & Świdarska, 2023), the open-ended approach not only improves students' ability to think logically but also develops their ability to work together and understand different perspectives from classmates. Another study by (Fatah et al., 2016) shows that the open-ended approach is effective in building students' creativity and independence, because they are given the freedom to find solutions from various perspectives.

The validity of learning media, especially in the context of learning videos, is an important aspect to evaluate to ensure that the media is effective in achieving the expected learning outcomes. Media validity refers to the extent to which the media can stimulate students' learning processes and help them achieve the learning objectives that have been set (Bintoro et al., 2021). According to (Setyaningrum & Siswantari, 2020), valid media must meet criteria that include relevance, understandability, accuracy, and relevance to the curriculum and students' learning context. In previous studies, the validity of learning media was assessed based on student responses, learning outcomes, and the suitability between media design and learning objectives (Saputra et al., 2018).

In the context of open-ended learning videos, the validity aspect plays an important role in determining their effectiveness on students' mathematics learning outcomes. Valid learning videos must be able to stimulate critical thinking skills, encourage active student involvement, and facilitate exploration of the mathematical concepts taught. According to research results by (Luh Andriyani & Wayan Suniasih, 2021), video-based learning media that support an open-ended approach can increase students' learning motivation and provide space for them to actively participate in solving problems. In addition, research by (Ruf et al., 2023) shows that the use of videos designed with an interactive and open approach contributes positively to learning outcomes, especially for students with a visual learning style.

Several studies also show the importance of systematic design in learning videos to ensure that the open-ended approach can run effectively. (Lam & Yunus, 2023) underlines the importance of integrating visual, auditory, and interactive elements in learning videos so that information can be delivered optimally and by the cognitive principles of multimedia learning. Another study by (Zuliana et al., 2020) emphasizes the importance of providing relevant context and triggers for critical thinking in learning media to support a deep and sustainable learning process.

Furthermore, research (Sukma & Ratnaningsih, 2022) shows that interactive and challenging learning videos can help increase students' motivation in learning mathematics, especially when the videos provide opportunities for students to engage in open problem-solving. In the open-ended approach, providing open-ended questions allows students to develop creativity in finding solutions and identifying various methods of solution. This supports exploration-based learning, where students are more involved in active learning processes that support a deep understanding of concepts (Xu, 2019; (Ndlovu & Brijlall, 2015; Gal, 2019).

In general, student learning outcomes in mathematics can be influenced by various factors, including the learning approach used, learning motivation, and the quality of learning media. According to (Yuda, 2011), the use of effective learning media can improve student learning outcomes by up to 0.77 points in the effect score, which shows a fairly significant influence. Studies examining the use of open-ended learning videos in mathematics show that this media can facilitate meaningful learning and support the development of high-level thinking skills (Sistadewi & Agustika, 2022; Surahmadi, 2016; Sarwanto et al., 2020).

However, although various studies have shown the benefits of the open-ended approach and the use of learning videos, more empirical studies are still needed to understand how the validity of video media based on the open-ended approach directly affects mathematics learning outcomes. Therefore, research on the validity of learning videos with an open-ended approach is relevant to be carried out to ensure that this media is truly able to support learning objectives and provide a positive impact on students' understanding and learning outcomes in mathematics.

Thus, this study will provide an important contribution to assessing the extent to which the validity of learning video media can affect students' mathematics learning outcomes. Through this evaluation, it is expected that recommendations can be obtained for educators and learning media developers to create learning videos that are not only theoretically valid but also practical, effective, and have a positive impact on student learning outcomes.

3. METHODS

This research is a research and development (R&D) that aims to develop and test the validity of learning video media with an open-ended approach to improving mathematics learning outcomes. This research uses the ADDIE development model (analysis, design, development, implementation, and evaluation).

The research procedure follows the following stages: (1) analysis, namely identifying the needs of mathematics learning that are relevant to the use of the open-ended approach, analyzing the curriculum and teaching materials that are appropriate for mathematics learning with the open-ended approach, and assessing the needs of learning videos as a medium to improve student interaction and learning outcomes. (2) Design, namely designing learning video content that is appropriate to the selected mathematics material, compiling a storyboard and scenario plan for each video segment to suit the open-ended approach, and determining the validity assessment instrument that will be used to measure the quality and relevance of the developed learning videos. (3) Development, namely making learning videos according to the design that has been prepared, involving experts, such as learning media experts, mathematics material experts, and education practitioners, in the production process, and validating the learning videos through expert tests. (4) Implementation, namely testing learning videos in small groups (for example one class) to determine the initial effectiveness and student

acceptance of the learning media, and collecting feedback from students and teachers for further improvement. (5) Evaluation, namely conducting formative evaluations during the development and implementation stages to refine the media and conducting summative evaluations after implementation to determine the effectiveness of video media in improving students' mathematics learning outcomes. (Suratmi et al., 2018; Serevina et al., 2018)

The subjects of the study were students at school levels that were appropriate to the mathematics material being taught. Other subjects included material experts and media experts involved in the validation of learning media.

The instruments used in this study include: (1) an expert validation questionnaire, used to assess the validity aspects of content, appearance, and effectiveness of the video by material experts and media experts. (2) Learning outcome test, this test is used to measure students' mathematics learning outcomes after using learning videos. (3) Student Response Questionnaire, measuring students' responses and levels of satisfaction with the learning videos used.

Data analysis techniques used (1) media validity analysis, namely using the results of validation questionnaires from experts to assess the feasibility and validity of learning videos. Validity is expressed in the form of a percentage or average score. (2) Analysis of student learning outcomes, namely learning outcomes are analyzed using descriptive statistics to see the increase in test scores before and after using the video. (3) Student response analysis, namely using percentages to determine the level of student acceptance of learning media (Creswell, 2014).

The validity of learning media is considered high if the average score of the expert validation results reaches the minimum criteria set ($\geq 75\%$). Media is considered valid and suitable for use if it meets the validity criteria.

4. RESULTS

The quality of learning video media with an open-ended approach is evaluated by lecturers as experts and teachers as educational practitioners. After the assessment results are obtained, notes and suggestions will be used as a basis for improving the products that have been developed before being used for trials. The results of the media expert validation are presented in Table 1.

Table 1. Media Expert Validation Results

No	Indicator	Percentage of Assessment (%)	Validation Criteria
1	Design aspects of front-screen learning video media	95	Very valid
2	Design aspects of learning video media	89	Very valid
3	The visual communication aspect (appearance) has an attractive presentation	87	Very valid
	Average	90	

Table 1 shows that the average result of the media expert validation score reached 90%. Based on the validation index category, the percentage range of 86% to 100% is included in the very valid category. This means that the media can be used with minor revisions. Media experts also provided some suggestions to make learning video media even better.

The results of the validation of the development of learning video media with an *open-ended approach* by material experts are presented in Table 2.

Table 2. Results of Material Expert Validation

No	Indicator	Percentage of Assessment (%)	Validation Criteria
1	Self Instruction	92	Very valid
2	Self Contained	91	Very valid
3	Stand Alone	93	Very valid
4	Adaptive	92	Very valid
5	User Friendly	91	Very valid
	Average	92	

Table 2 shows that the average result of the material expert validation score reached 92%. Based on the validation index category, the percentage range of 86% to 100% is included in the very valid category. This means that the learning video media with an *open-ended approach* is suitable for use in the learning process.

Revision of learning video media products with an *open-ended approach* was carried out after receiving input from media, material, and language experts. Input and suggestions provided by the validator were then followed up in the form of improvements to learning video media with an *open-ended approach* by researchers. *The following are inputs and suggestions from media experts for improvements to learning video media with an open-ended approach.*

Table 3. List of Suggestions from Media Experts on the Development of Learning Video Media with an *Open-Ended Approach*.

No	Comments and Suggestions	Follow-up
1	Choose a font that is easy to read	Change the font shape and color to make it easier to read
2	Tool movement is less visible	Change the shape of the laser model tool

The following list of revisions as suggestions from material experts is presented in Table 4.

Table 4. List of Suggestions from Material Experts on the Development of Learning Video Media with an *Open-ended Approach*

No	Comments and Suggestions	Follow-up
1	Question 1 does not yet reflect an <i>open-ended approach</i>	Changing questions to <i>open-ended form</i>
2	Explanation of the parts of geometric shapes	Adding an explanation of the parts of geometric shapes

The product of developing learning video media with an *open-ended approach* to improve student learning outcomes after being revised is presented in general in Figure 1.



Figure 1. Final Product of Developing Learning Video Media with an *Open-Ended Approach* to Improve Student Learning Outcomes

Learning Video Media with an *Open-ended Approach* to Improve Student Learning Outcomes is made in the form of a 17-minute 40-second video. The learning video media contains learning objectives, learning materials and practice questions with an *open-ended* approach. In it, there are story questions accompanied by explanations and sequences of how to solve the questions. Learning video media can help students solve questions by following the tutorial on how to solve them. Videos can be watched repeatedly until they understand the solution to the problem they are facing.

5. DISCUSSION

The development of learning video media based on an open-ended approach has been validated by media and material experts, with the results showing that this media is very valid and suitable for use. The average validation score from media experts reached 90%, while material experts gave an average score of 92%, both of which are in the very valid category. This high validity indicates that the learning media has met the expected quality criteria in terms of design, clarity of instructions, and ease of use, which are important factors in interactive learning media (Radita & Nurfauziah, 2022).

Specifically, the open-ended approach applied in this video is expected to encourage students to develop critical and creative thinking skills. This approach allows students to explore various ways of solving problems, which is in line with the principle of constructivist learning that encourages students to build their understanding through exploration (Surahmadi, 2016; Hansen & Świdarska, 2023). Thus, this media not only presents mathematical content but also supports high-level thinking skills.

Improvements made based on suggestions from media and material experts are also important steps in this development process. Suggestions such as the use of more readable fonts and adjustments to visual aids demonstrate a commitment to improving the quality of the display and accessibility of learning media. These suggestions are relevant to research showing that factors such as readability and visualization have a significant effect on the effectiveness of learning media (Cahyana et al., 2018).

In addition, this video media can improve student learning outcomes effectively because it provides clear instructions and open-ended practice questions that allow students to understand concepts in depth. The relatively short video duration, which is 17 minutes and 40 seconds, allows students to access learning materials repeatedly according to their needs, thus strengthening the understanding of the mathematical concepts being studied. (Tani et al., 2022; Zolkwer et al., 2023) .

6. CONCLUSION

Based on the research results, learning video media with an open-ended approach has proven to be very valid and feasible to use in the mathematics learning process. Validation carried out by experts shows that this media meets the criteria for design, appearance, and effectiveness in providing independent instruction to students with an average score of 90% from media experts and 92% from material experts. Several minor improvements made according to expert advice, such as adjusting fonts and visualization of aids, further improve the quality and accessibility of this media.

Overall, this video media has great potential to improve students' understanding of mathematics material through an open-ended approach that encourages critical and creative thinking. The duration of the video, which is designed to be accessed repeatedly, allows students to study concepts in depth and complete practice questions with various solutions. Thus, this video media is not only valid but also relevant and effective in supporting constructive and interactive learning.

7. LIMITATION

Some limitations need to be considered in implementing this media on a larger scale. The effectiveness of this media in various classroom contexts and different levels of student ability has not been fully tested. Further research can be done to explore the extent to which this media is effective in improving student learning outcomes in various mathematics topics and at various levels of education.

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