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Development of Interactive Learning Videos to Improve Students' Mathematical Literacy Skills

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Abstract
Mathematical literacy is essential for tackling the issues of the 21st century. Creating educational videos that connect mathematical concepts to their practical use in daily life is important. This study has the following goals: 1) to create interactive video learning tools that enhance students' mathematical literacy; 2) to assess the suitability of these learning video tools according to input from both experts and students; and 3) to evaluate how effective the interactive learning videos are in boosting students' mathematical literacy skills. This study employs a research and development approach, utilizing a modified version of the ASSURE model, which involves only four of its six steps: 1) analyzing; 2) setting objectives; 3) choosing methods, media, and materials; and 4) using the media. The findings of the study include: 1) the creation of an interactive learning video aimed at enhancing students' mathematical literacy; 2) validation results from media specialists showed a score of 91.25%, categorized as very good; 3) validation results for the media content also scored 91.25%, falling under the very good category; and 4) there was a medium improvement in students' mathematical literacy skills, reflected by an N-Gain value of 0.61. Therefore, the interactive learning videos are effective tools for promoting students' mathematical literacy skills.

Keywords: Development, Interactive Learning Videos, Mathematical Literacy

1. Introduction

In the 21st century, the ability to understand and work with numbers is crucial for addressing problems we encounter in daily life (Firdaus et al., 2021; Nur, 2020). This is due to the fact that numerous daily issues include aspects of math. It is essential to develop math skills starting from the time a person begins high school (Maysarah et al., 2023). Consequently, a person with strong math skills is capable of addressing daily challenges. According to PISA, mathematical literacy refers to the capacity to engage in mathematical thinking and utilize mathematical concepts in different real-life situations, including ideas, facts, techniques, and tools, to illustrate, clarify, and anticipate occurrences (Danishwara & Rahma, 2023). A person ought to possess six degrees of mathematical understanding. In the first two levels, they must be capable of understanding and illustrating well-known issues (Amaliya & Farhurohman, 2022; Rismen et al., 2022). At stages

three and four, they ought to integrate and connect all aspects of a scenario into a unique way of addressing problems (Edimuslim et al., 2019; Muslimah & Pujiastuti, 2020; Rismen et al., 2022). They should have the capability to tackle intricate issues, identify mathematical ideas, and apply different techniques at levels five and six in math literacy (Suryapuspitarini et al., 2018).

However, in reality, students' mathematical literacy abilities remain on the lower side. This conclusion comes from interviews conducted with educators at SMA-IT Ar-Rahmah, revealing that students' math literacy is still quite insufficient. One reason for this is that the mathematics instruction at SMA-IT Ar-Rahmah does not include enough real-life applications of math concepts. This finding is further backed by the PISA 2022 results, which indicated that Indonesian students were placed 66th out of 79 countries, achieving an average score of 366 (OECD, 2023).

Ali & Ni'mah, (2023), and Salvia et al. (2022) discovered that various elements contribute to this low proficiency in mathematics, including the insufficient use of mathematical concepts in daily situations. In accordance with that,, Sudi et al., (2022) is covered that educators allocated minimal time to their pupils and failed to connect the subject matter to real-life situations, which contributed to the deficiency in students' mathematical comprehension. Conversely, Ananda & Wandini (2022) indicate that personal, teaching, and surrounding influences are the primary reasons for the poor mathematical literacy among students in Indonesia.

Mathematics can be utilized in daily life through educational videos. According to studies by Ayuni & Kusuma (2022) and Widianta (2021), along with Widianta in 2021, it has been discovered that educational videos serve as effective teaching tools, connecting academic content to real-world applications. For this reason, developing educational videos that relate mathematics to everyday situations is crucial. This is essential since such videos that tie mathematics to practical life scenarios can enhance students' mathematical skills.

According to the study conducted by Anggraeni et al. (2021), the development of multimedia featuring interactive videos can boost students' enthusiasm for learning. Additionally, research by Wardani & Syofyan (2018) ound that Interactive Learning Videos prove to be effective for instructing Integrative Thematic Science specifically regarding Human Blood Circulation. The findings from the media effectiveness evaluation indicate that $t_{count}\ (6.32) > t_{table}(2.05)$, demonstrating that it is beneficial for use in educational settings.

The focus of prior studies has been on creating Interactive Learning Videos for math education, primarily to boost student engagement rather than enhance their math literacy abilities. To address this oversight, researchers carried out an investigation titled "Development of Interactive Learning Videos to Improve Students' Mathematical Literacy Skills". The objective of this research is to create engaging learning videos that enhance students' abilities in mathematics, ensuring they meet standards for validity and effectiveness in boosting students' math literacy.

2. Methods

This research, the ASSURE development framework was utilized since it better facilitates the creation of educational media. The steps of this research include 1) Analyze Learner, 2) State Objective, 3) Select media, methods, and materials 4) Utilize media and materials 5) Require

learner participation and 6) Evaluate and revise(Muflihah & Aziz, 2018; Sezer et al., 2013; Zainiyati, 2017).

This study was carried out in four out of the six phases of the ASSURE development framework. The initial phase of this research is the analysis. This phase involves a preliminary evaluation through interviews and observations related to the learning process. The goal of this analysis phase is to identify the needs and traits of the students (Herliana & Anugraheni, 2020). Following that is the stage of setting objectives. The learning goals are derived from the Learning Objective Flow (ATP) and the Learning Module of the educational content to be taught. These objectives aim to outline the knowledge, viewpoints, and abilities that students will acquire following the learning experience (Herliana & Anugraheni, 2020; Iskandar & F, 2020). The third phase involves selecting media, methods, and materials. In this step, the tools, approaches, and resources intended for the learning activity are chosen (Argarini et al., 2018; Nurmala et al., 2021; Purnamasari & Wahyudi, 2021). The final phase is the use of media and materials. Before this component can be implemented, it is essential to validate and test the developed product (Aprilla et al., 2020).

Validation and testing are designed to assess how practical the product is for use in educational settings. Experts in both content and media conducted the validation process, while twelve students participated in tests that involved Pretests and Posttests. The information collected from expert evaluations and participant testing was quantitative and came from validation surveys. Descriptive statistical analysis was the method employed for analyzing the data, utilizing the formula outlined below (Riduwan & Akdon, 2013).

$$N = \frac{k}{Nk} \times 100\%$$

Description:

N : Score Percentage
k : Value obtained
Nk : Maximum value

From the findings, it can be classified according to the subsequent qualitative standards (Ernawati & Sukardiyono, 2017):

Table 1. Qualitative Criteria

Intervals	Criteria
$81{,}25\% < \text{score} \leq 100\%.$	Very good
$62{,}50\% < \text{score} \leq 81{,}25\%.$	Good
$43{,}75 < \text{score} \leq 62{,}50\%.$	Good Enough
$25\% < \text{score} \leq 43{,}75\%.$	Not good

The N-Gain assessment helps to evaluate if there has been an improvement in students' math literacy abilities, comparing their skills prior to and following the intervention. The formula for calculating N-Gain is as follows: (Riduwan & Akdon, 2013).

$$N - gain(g) = \frac{Post\ test\ score - pretest\ score}{maximum\ score - pretest\ score}$$

Description:
N-gain : Gain factor value
Post test score : Final test result scores
Pretest score : Initial test result scores
Maximum score: Maximum test score

Table 2. Effectiveness Criteria

Intervals.	Criteria.
$g > 0{,}7.$	High.
$0{,}3 \leq g \leq 0{,}7.$	Medium.
$g < 0{,}3.$	Low.

3. Result and Discussion

This research applies four development steps. The four stages are 1) Analyze (Analyze student characteristics), 2) State Objective (State objectives), 3) Select (Choose methods, media, and materials) 4) Utilize (Utilize materials).

3.1 *Analyse*

In the initial phase, an assessment of student needs and traits was performed. The findings from this assessment were gathered through discussions and observations carried out with the X grade instructors at SMA-IT Ar-Rahmah.

The findings from interviews and observations reveal the following: 1) Educational resources for teaching trigonometry include textbooks and workbooks for students, 2) The method of teaching primarily involves lectures, 3) Students tend to lose interest more rapidly when lessons rely solely on textbooks or workbooks, which negatively affects their drive to learn mathematics, 4) School resources, like projectors, are not being used to their full potential.

Drawing from the insights gained through interviews and observations, it can be inferred that auxiliary media are essential for presenting content by making use of available resources. The

purpose of using these resources is to minimize the need for extensive verbal explanations and to foster a more diverse learning environment, thereby enhancing students' motivation to learn.

3.2 *State Objective*

This next phase establishes the educational goals. These educational goals are aligned with the ATP and Teaching Module regarding the content to be taught. In this research, the content to be taught through various media focuses on Trigonometry. The goals of this research include recognizing how angles and sides in a right triangle are interconnected; for right angles, discovering the connection between sine and cosine; and utilizing trigonometric ratios along with the Pythagorean theorem to tackle issues related to right triangles. The table below offers additional clarification.

Table 3. Learning Achievements and Objectives

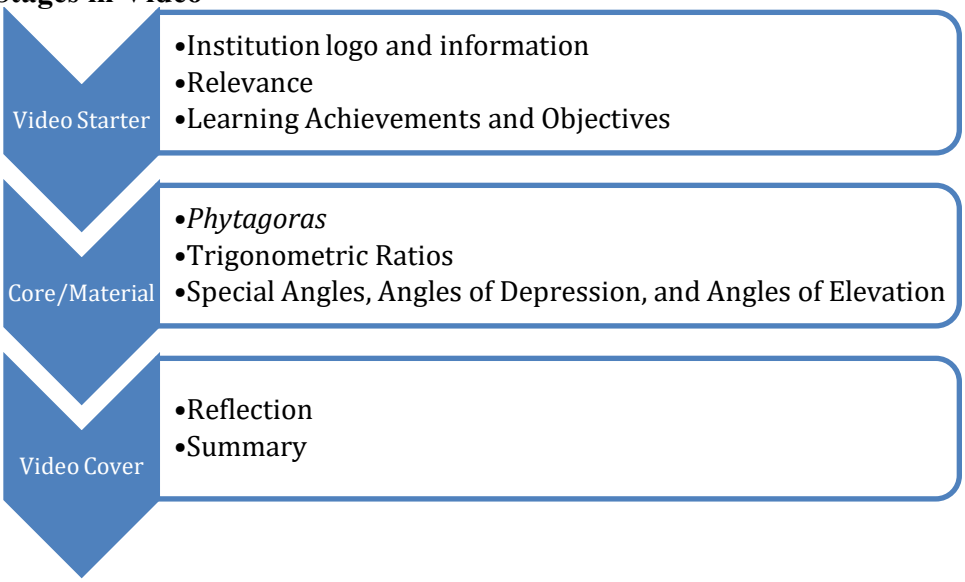
Learning Achievements	Students can solve problems with right-triangles and find trigonometric ratios.
Learning objectives	• Identify the relationship between angles and sides of a right triangle • Use the relationship between sine and cosine for right angles • Use trigonometric ratios and the Pythagorean theorem to solve problems involving right triangles.

3.3 Select methods, media, dan materials

At this point, we determine the methods, tools, and resources that will be utilized in the educational process. Selecting the appropriate methods, tools, and resources is crucial as it enhances the effectiveness and efficiency of learning. There are two options for selecting the methods, tools, and resources needed for material delivery: developing educational tools or using existing ones. In this research, the educational method chosen will be lectures; the format for new product development will be animated videos; the educational resources to be employed consist of textbooks and student worksheets. The choice of media formats aligns with the resources available at the school, including the internet and LCD projectors, which facilitate the creation and use of these tools. Once the media format for development has been decided, the next phase is to produce the educational tools. The media production phase is organized into three stages, namely:

- **Pre-production:** At this point, the tasks being conducted include evaluating the curriculum and creating a media flowchart. The aim is to identify the curriculum and the ATP that are being utilized. This flowchart outlines the material for the upcoming video. The media flowchart can be observed in the graph below.

Picture 1. Stages in Video



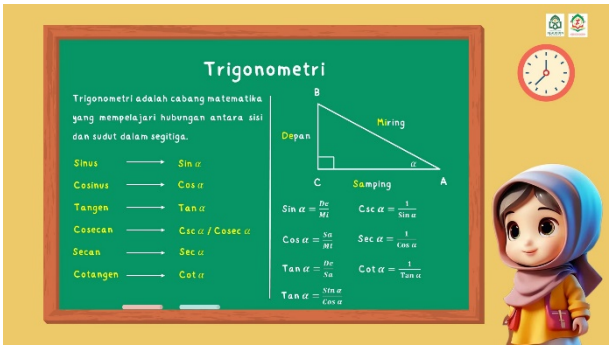
- **Production:** This stage of media creation consists of several steps that use different tools and websites, such as the Canva site, the CapCut app, the PowerPoint software, and the Stylar site. The template generated from Canva will eventually help in creating videos. The development of content is carried out with the PowerPoint application. Animated parts of the video are created using the Stylar website, whereas the CapCut app is responsible for video editing. The finished video is available for viewing on the YouTube platform. To effectively produce this video content, reliable internet access is necessary for the Canva, Stylar, and CapCut applications, while the PowerPoint program can be operated without an internet connection. Some of the aspects of this video media product include the following:

Picture 2. Institution logo and information

Picture 3. Relevance

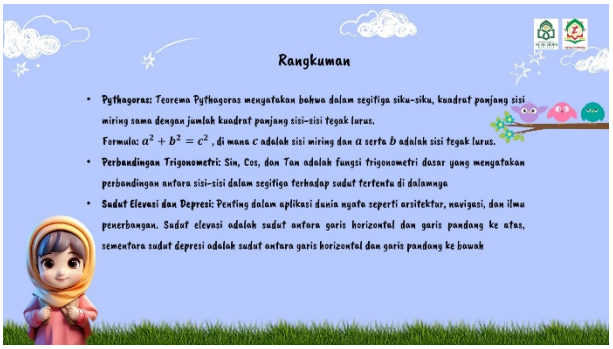
Picture 4. Learning Achievements and Objectives

Picture 5. Materials



Picture 6. Example Questions

Picture 7. Summary of Material



- **Post-production:** In the final stages of production, the content that was generated undergoes an evaluation. This assessment is conducted by researchers who analyze the outcomes of the created content. Once the researchers finish their evaluation, the following phase involves expert assessment and user testing through trial runs.

3.4 *Utilize*

The subsequent phase involves employing the media that has been created. Prior to utilizing the components, it is essential to validate the developed media to confirm its appropriateness for educational purposes. In the process of product validation, both a media specialist and a content specialist carried out an evaluation of Interactive Learning Videos using an assessment form that includes 32 statements concerning the product. This represents the outcome of the media expert's evaluation.

Table 4. Results of Media Expert Validation

Number	Aspect	Score	Max Value	Percentage	Description
1.	Media Quality	49	52	94,2%	Very Good.
2.	Language use	39	44	88,6%	Very Good.
3.	Media Layout	25	28	89,2%	Very Good.

The findings from the media expert assessment indicate that the validation for the quality of the media aspect stands at 94.2%, which is classified as very good. The score for the language use aspect is 88.6%, also in the very good category, while the media layout aspect received a score of 89.2%, falling into the very good range as well. Based on the evaluations of media quality, language usage, and layout, the information illustrates that the Interactive Learning Videos designed to enhance students' math skills are rated as very good.

Next, the evaluation of material validation takes place by presenting Interactive Learning Videos and evaluation sheets with 9 statements concerning the developed products. The findings from the assessment conducted by material experts can be found here.

Table 5. Material Expert Validation Results

Number	Aspect	Score	Max value	Percentage	Description
1.	Accuracy of content with the competencies to be achieved	18	20	90%	Very Good
2.	Completeness of Materials	8	8	100%	Very Good
3.	Collapse of Material	7	8	87,5%	Very Good

Based on the findings from the evaluation conducted by the material experts mentioned earlier, the exactness of the content in relation to the competencies targeted is 90%, the thoroughness of the content is 100%, and the logical flow of the content is 87.5%, all categorized as very good. The information indicates that the Interactive Learning Videos designed to enhance math skills fall into the very good category.

This finding is consistent with the study by Wahyuni et al. (2021) which discovered that media with high validity can be efficiently utilized in education to enhance students' abilities in mathematical literacy. Similarly, Zahroh & Yuliani (2021) reported in their investigation that the outcomes of their products were very valid.

The outcomes from the pretest and posttest for the students in class X at SMA-IT Ar-Rahmah Makassar can help assess the effectiveness of Interactive Learning Videos for enhancing students' abilities in mathematical literacy. Below are the findings from the pretest and posttest.

Table 6. Pre-test and Post-test Results

	N	X	$N-gain$	Description
Pretest	12	26,8	0,61	Medium
Posttest	12	71,6		

Table 6 reveals that the scores on the posttest for students surpass those of the pretest, suggesting that students demonstrate a solid level of mathematical ability both before and after utilizing Interactive Learning Videos. The results from the gain normalization assessment indicate an increase value of 0.61. Following the implementation of Interactive Learning Videos, this increase is classified as moderate. This suggests that Interactive Learning Videos have a positive impact on enhancing students' performance in mathematics. This finding aligns with Khasanah et al. (2024) who discovered that Interactive Learning Videos effectively boosted students' mathematical skills.

Additionally, research conducted by Lase & Hulu, (2022) also confirmed that video-based learning materials are beneficial for use.

4. Conclusion

The outcome of this research is Interactive Learning Videos, designed to enhance the math skills of students, available at https://youtu.be/ZxHBMp1etEI?si=GJOtQZPKr5A2D4sK and https://youtu.be/WvGdq0VQ0mQ?si=SpSZd-l0tjIegH_e. According to the findings, the validation of the media and materials received a rating of very good, achieving a score of 91.25%. Additionally, there was an increase in students' mathematical literacy after using the Interactive Learning Videos. The implementation of these videos led to a rise in students' math literacy abilities. Specifically, students demonstrated improvement in their math literacy, with a pretest average of 26.8 and a posttest average of 71.6; a gain value of 0.61 indicates a moderate improvement. This evidence suggests that Interactive Learning Videos can effectively aid students in enhancing their mathematical literacy skills.

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