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# DEVELOPMENT OF MATHEMATICS INSTRUCTIONAL VIDEOS FOR 8TH GRADE STUDENTS

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**ABSTRACT**

This study investigates the feasibility, practicality, and effectiveness of instructional mathematics videos supported by YouTube as an alternative learning medium for 8th-grade students. The research adopted the Research and Development (R&D) approach using the Borg and Gall model. Data were collected through expert validation, student questionnaires, and achievement tests. Instruments used included a validation rubric for media and material quality, a Likert-scale questionnaire for practicality, and a multiple-choice test to assess effectiveness. Effectiveness was categorized using a theoretical framework based on percentage classifications. The video scored 92% in media quality and 91% in material relevance, placing both in the "Very Valid" category. Small-group trials showed 88.8% practicality based on student feedback. Field tests indicated an effectiveness score of 72.9%, demonstrating improved student performance. The YouTube-based video is a valid, practical, and effective tool for mathematics instruction. It offers significant potential in engaging learners and enhancing conceptual understanding.

**ABSTRAK**

Penelitian dilakukan dengan tujuan mengetahui kelayakan, kepraktisan, dan keefektifan video pembelajaran matematika berbantuan media sosial YouTube sebagai alternatif pembelajaran matematika. Metode yang digunakan dalam penelitian ini adalah metode deskriftif. Adapun metode penelitian dalam penelitian ini adalah Research and Development (R&D). Mengacu pada teori Borg dan Gall, yang memiliki 10 tahapan didalam penelitian pengembangan produk video pembelajaran ini. Hasil validasi ahli pada aspek media memperoleh persentase 92%, pada aspek materi memperoleh persentase 91% Maka dari persentase penilaian kedua aspek tersebut dikategorikan sangat valid karena masuk kedalam kategori rata-rata nilai ≥80%. Hasil angket praktis respon siswa uji coba skala kecil mendapatkan persentase 88,8% sehingga menyatakan produk video pembelajaran tersebut "Sangat Praktis". Hasil tes keefektif pengunaan produk video pembelajaran setelah diterapkan pada kelompok skala luas memperoleh persentase keseluruhan sebesar 72,9% dengan kategori "Efektif". Sehingga produk efektif untuk digunakan dalam proses pembelajaran.

## Introduction

Education is a cornerstone in advancing a nation's intellectual capacity and serves as a critical benchmark for national development. Consequently, continual innovation in instructional methodologies, particularly in mathematics education, is essential. As highlighted by (Gravemeijer, 2024; Maass et al., 2019), mathematics represents a foundational discipline that significantly contributes to advancements in science and technology. To this end, enhancing educational quality must encompass the provision of adequate teaching materials and tools aligned with technological advancements, thereby fostering active student engagement in the learning process.

Mathematics, taught from elementary to tertiary levels, stems from human empirical experiences. These experiences are subsequently processed within rational and cognitive frameworks, resulting in mathematical concepts that are systematically formulated for ease of understanding. The use of universal mathematical language facilitates comprehension and equips students with critical, logical, analytical, and creative thinking skills. Such competencies are indispensable for navigating the increasingly competitive landscape of information management. These findings underscore the importance of mathematics in equipping students with the competencies necessary to navigate an increasingly complex and information-rich world (Whitney-Smith et al., 2022)

An interview conducted with a mathematics teacher at one of middle school in Palembang, revealed that while the teaching methods employed at the school are generally effective, students exhibit diverse learning capabilities. The teacher predominantly relies on conventional teaching methods and homework assignments to encourage students to practice problem-solving. However, the integration of innovative teaching media remains limited, with instructional aids being rudimentary and often leading to monotonous and disengaging lessons. The teacher also noted a lack of exploration into leveraging social media as a pedagogical tool.

Interviews with eighth-grade students at the same institution indicated challenges in understanding certain mathematical concepts. Students reported that the monotony of teaching approaches and the lack of engaging instructional media diminished their interest and comprehension. These findings underscore the need for innovative instructional strategies, prompting the researcher to develop video-based learning materials through the R&D methodology. This approach aims to address the lack of variety and innovation in current instructional practices, which often impede students' understanding of mathematical concepts.

As described by (Ojelade et al., 2020), instructional media encompass diverse formats, including audio, visual, and audiovisual tools. Effective media should be manipulable, visible, audible, and accessible. The rapid advancement of technology and information systems in the current era presents opportunities for integrating modern tools into education as instructional media or learning resources. Online platforms such as e-learning have become widely adopted, offering accessible and flexible learning opportunities. However, text-dominant e-learning platforms often fail to address the need for step-by-step explanations required for understanding complex mathematical concepts (Trgalová & Tabach, 2023). To overcome these limitations, video-based instructional resources provide a promising alternative.

Instructional videos uploaded to social media platforms can serve as effective and accessible mathematics learning resources. Prior research highlights the feasibility and effectiveness of incorporating social media into education. (Novianti et al., 2020) demonstrated the use of Instagram for mathematics instruction, while (Ardiansyah & Nugraha, 2022) utilized YouTube for mathematics education. Similarly, (Anisa, 2022; Humaidi et al., 2022; Wahyuni et al., 2024) implemented YouTube to enhance mathematics learning. These studies consistently emphasize the efficacy and utility of social media in supporting educational objectives.

This study focuses on the potential of YouTube as a medium for mathematics instruction. YouTube, a widely used video-sharing platform, allows users to share and access video content freely, reaching millions of viewers daily. Leveraging YouTube in education has been shown to improve students' understanding, sustain their attention, and provide teachers with tools for fostering a more conducive learning environment. Educational videos on YouTube are designed with engaging content, relatable contexts, and user-friendly language, facilitating the comprehension of mathematical concepts.

In conclusion, the development of innovative instructional media is imperative to optimize the learning process. Engaging and appealing instructional tools can stimulate students' interest and motivation in mathematics. This study aims to enhance mathematics learning through the R&D approach, leveraging social media platforms to encourage active and independent student participation. Additionally, this initiative seeks to promote the constructive use of social media, exploring its potential as an effective medium for mathematics education. The findings contribute to the growing body of evidence supporting the integration of social media into educational practices, particularly for enhancing student engagement and learning outcomes in mathematics.

Although several studies have demonstrated the potential of YouTube in enhancing mathematics learning, few have focused on the comprehensive evaluation of instructional videos using the R&D approach in the context of Indonesian junior high school students. This study aims to developing and validating a YouTube-assisted instructional video for 8th-grade mathematics, specifically on the topic of tangents to circles. The objectives are: (1) to determine the feasibility of the video, (2) to assess its practicality, and (3) to evaluate its effectiveness.

## Method

This research was conducted at SMP Fitra Abdi Palembang, located on Tegal Binangun Street, Plaju Darat Subdistrict, Plaju District, 30267 Palembang, South Sumatra, during the 2023/2024 academic year. The research subjects were selected from the 8th-grade students at SMP Fitra Abdi Palembang. In the first trial, the test was conducted on a population of 10 students, while in the subsequent trial, it was tested on an entire class of 8th-grade students.

In this study, data analysis techniques were employed to determine whether the developed product was feasible. The data collection process focused on three categories: validity, practicality, and effectiveness. The techniques used include walkthroughs, questionnaires, and tests. A walkthrough is a method used by researchers to assess the validity of the product. The questionnaire is designed to measure the practicality of student responses within a small group, helping to assess the effectiveness of the developed product, and test is used to assess the effectiveness of the developed product. The effectiveness based on the percentage score using the classification in Table 1.

Table 1
*Category for Effectiveness Assessment*

| Kelayakan | Persentase (%) |
|---|---|
| Very Good | $K > 80\%$ |
| Good | $60\% < K \leq 80\%$ |
| Fair | $40\% < K \leq 60\%$ |
| Poor | $20\% < K \leq 40\%$ |
| Very Poor | $K \leq 20\%$ |

## Results and Discussion

This research and development process follows the Borg and Gall development model, which consists of several stages, as outlined below:

1. Preliminary Research

At this stage, the researcher gathers essential information required for developing the instructional video. To obtain relevant insights, interviews were

conducted with teachers and students at SMP Fitra Abdi Palembang. From the interviews, it was revealed that the school's mathematics learning system is already well-structured, and each student has unique strengths and weaknesses in the learning process. Teachers tend to prefer conventional teaching methods and often assign homework to encourage students to practice problem-solving regularly. However, the use of instructional media in mathematics lessons remains limited. Teachers have primarily relied on basic teaching aids, resulting in monotonous and less engaging learning experiences. Additionally, social media has not yet been utilized as a learning platform.

2. Planning Stage

The planning phase focuses on developing an instructional video, covering the following aspects: searching for relevant research papers and journals on the development of instructional mathematics videos using YouTube; referring to the Merdeka Curriculum; gathering textbooks and other references related to the topic of tangents to circles; collecting images and visual materials relevant to the subject; using CorelDraw, KineMaster, and InShot for video production; uploading the instructional video on YouTube as a learning platform; preparing assessment instruments to evaluate the validity, practicality, and effectiveness of the developed video.

3. Product Design

At this stage, a storyboard is created to structure the instructional video. The video is designed to be visually engaging and easy to understand for students. Its content aligns with indicators, learning objectives, syllabus, subject matter, example problems, and practice questions. This instructional media follows two theoretical frameworks: (1) APOS Theory (Action, Process, Object, and Schema), applied to structure students' understanding, and (2) Hypodermic Needle Theory, video content is designed to directly influence students' comprehension of the topic, ensuring clear and effective knowledge transfer. Recording video content using a camera to capture the material presentation, and editing process, including: designing introductory visuals and titles using CorelDraw, and enhancing video quality using editing software. This structured approach ensures that the instructional video meets the required standards for engagement, clarity, and effectiveness.

4. Design Validation

Once the instructional video has been designed, the next step is validation to assess its feasibility. This validation process involves three experts (two lecturers and one teacher). The evaluation is conducted using a validation sheet, which assesses two key aspects: Media Aspect: Evaluating the visual quality,

clarity, and technical presentation of the video, and Material Aspect: Assessing the accuracy, relevance, and alignment of the content with the learning objectives. The validation results are illustrated in Figure 1.

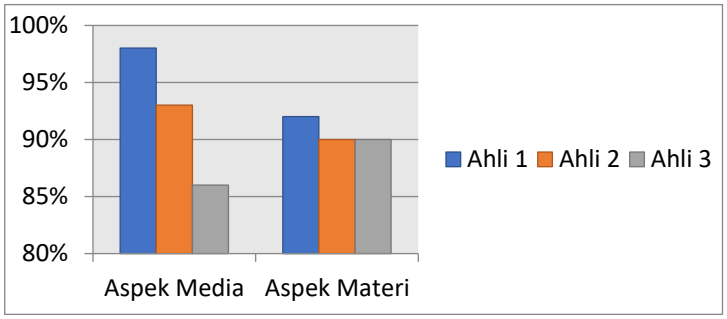


Figure 1. Expert validation results

Based on the Figure 1, the validation data calculation resulted in the following percentages: Media Aspect: The scores given by the three experts were 98%, 93%, and 86%, leading to an average of 92%. This percentage falls under the "Very Valid" category, as it meets the ≥80% threshold. Material Aspect: The scores obtained were 92%, 90%, and 90%, resulting in an average of 91%. This percentage also falls under the "Very Valid" category, as it meets the ≥80% threshold. Since the overall validation percentage indicates that the instructional video is categorized as "Very Valid", the product is considered ready for testing.

5. Initial Product Revision

After the instructional video was validated by experts, the next step was to refine the design based on the feedback, comments, and suggestions provided. Revisions were made to ensure the instructional video met the required quality standards. The example of the revisions that have been made, can be seen in Figure 2.

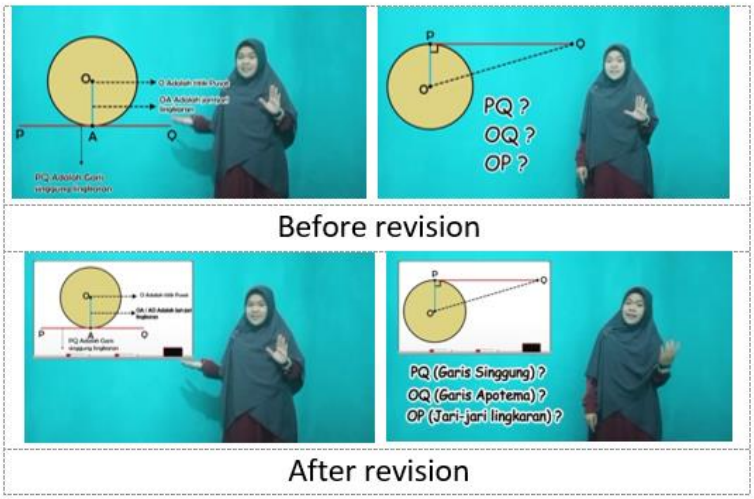


Figure 2. Adding a whiteboard animation

6. Small-Group Trial

The product is tested on a small-group test. At this stage, the small-group is conducted to measure the practicality level of student responses. This trial is carried out with 10 eighth-grade students. The result of this test can be seen in Figure 3.

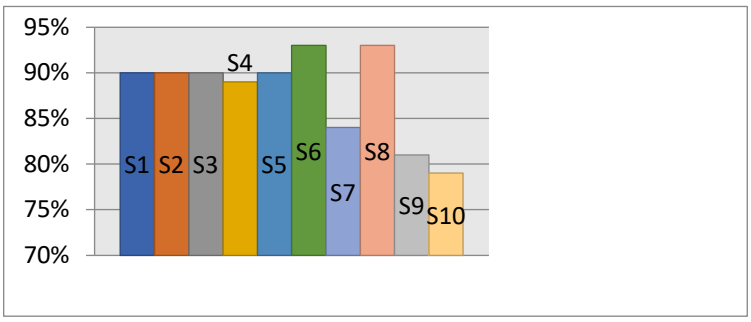


Figure 3. The result of small-group

Based on the diagram above, the calculation data from the student response practicality questionnaire shows an average rating of 88.8%. Since this fall within the ≥80% range, the learning video product can be categorized as "Highly Practical". Therefore, the developed product is deemed practical for use.

7. Operational Product Revision

After conducting a small-scale trial to assess the practicality of the mathematics instructional video assisted by YouTube on the topic of circle tangents, the results indicated that student responses categorized the product as highly practical. Additionally, student comments were positive, suggesting no need for further revision.

8. Field-test

Subsequently, the product was tested on a larger-scale group. At this stage, the large-group field trial aimed to evaluate the effectiveness of the product based on student test results. This trial was conducted in a single class with a sample size of 32 eighth-grade students at SMP Fitra Abdi Palembang. The result of field-test can be seen in Figure 4.

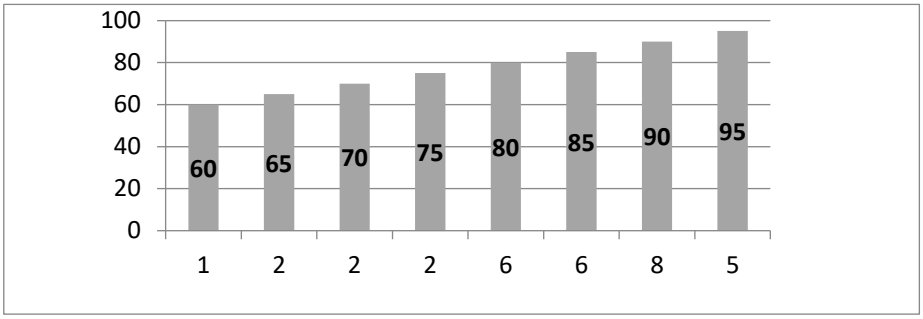


Figure 4. The result of field-test

Based on the diagram, the test results of 32 eighth-grade students from SMP Fitra Abdi Palembang show that 27 students scored ≥75, while 5 students scored <75. Consequently, the overall effectiveness rating of the product is 72.9%, categorizing it as "Effective." Thus, the developed instructional video is deemed effective and suitable for use in the learning process. It is also considered appropriate for distribution via social media platforms such as YouTube.

9. Final Product Revision

After conducting a large-scale trial to assess the effectiveness of the mathematics instructional video assisted by YouTube, the product was categorized as effective. Therefore, the video is suitable for use as a learning medium and can be published on YouTube.

10. Dissemination and Implementation (Uploaded to YouTube)

Following the evaluation by experts, small-group, and field-test, the instructional video was found to be valid, practical, and effective, confirming its suitability for use. The next step involves uploading the mathematics instructional video to YouTube. The video can be accessed via the following link: http://bit.ly/VideoPembelajaranGarisSinggungLingkaran

The development of instructional videos for mathematics, specifically utilizing social media platforms like YouTube, aligns with the increasing integration of digital learning resources in education. The findings of this study indicate that the instructional video developed for tangent lines in circles is valid, practical, and effective, meeting the criteria necessary for educational implementation. The validity of the video was confirmed through expert evaluations, achieving 92% for media quality and 91% for content quality, surpassing the 80% threshold for high validity. Similarly, small-scale trials demonstrated a practicality rating of 88.8%, while large-scale trials confirmed its effectiveness with a 72.9% success rate in student assessments.

These results demonstrate that video-based learning has the potential to enhance student engagement and understanding in mathematics, which has often been perceived as a challenging subject. Research by (Novianti et al., 2020) supports this claim, as their study on Mathematics Instructional Videos using Instagram demonstrated that digital media could serve as an alternative learning tool. Similarly, (Ardiansyah & Nugraha, 2022; Wahyuni et al., 2024) Problem-Solving-Based Instructional Videos on YouTube, which were highly rated by both educators and students. These studies reinforce the idea that integrating social media with instructional content can enhance learning outcomes.

Furthermore, the effectiveness of video-based instruction in mathematics aligns with findings by (Mayer, 2022) on Multimedia Learning Theory, which

emphasizes that students learn more effectively when content is delivered through a combination of visual and auditory elements. The structured nature of video tutorials allows for self-paced learning, enabling students to replay and review concepts as needed. This is particularly beneficial for subjects requiring conceptual visualization, such as geometry and calculus.

## Conclusion

The results of this study indicate that the development of mathematics instructional videos assisted by YouTube as a learning platform has successfully met three key educational criteria: validity, practicality, and effectiveness. Expert evaluations confirmed the high validity of the product, with ratings of 92% for media quality and 91% for content quality, ensuring that the instructional video aligns with pedagogical standards. Moreover, small-scale trials demonstrated that 88.8% of students responded positively, highlighting the practicality of the video as an engaging and user-friendly learning tool. Furthermore, large-scale trials confirmed that 72.9% of students achieved scores above the minimum competency threshold, classifying the video as effective in enhancing students' understanding of circle tangents.

Despite the positive outcomes, several areas for future development remain. One key recommendation is the enhancement of interactive features within the instructional video, such as quizzes, discussion forums, and embedded exercises, to increase student engagement and knowledge retention. The study focused only on one topic and school. Further studies should explore different subjects, student demographics, and platforms. Another important consideration is the longitudinal evaluation of the instructional video's impact on student learning over time, providing insights into knowledge retention and long-term effectiveness. Lastly, integrating this instructional video into formal school curricula could help standardize its use as a supplementary learning resource, enabling students to access high-quality mathematics education beyond the classroom.

## Declarations

**Author contribution.** NA made the instruments, analysis data and write the introduction and method. KA made literature review, result and discussions and conclusion.

**Funding statement.** None

**Conflict of interest.** The authors declare no conflict of interest.

**Additional information.** No additional information is available for this paper.

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