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Developing ADDIE-Based Animated Mathematics Videos to Enhance Vocational High School Students' Conceptual Understanding of Circle Geometry

Aeryn Meiska Putri Bangun[1], Ekasatya Aldila Afriansyah[2], Adi Ihsan Imami[3]
[1,2,3] Department of Mathematics Education, Universitas Singaperbangsa Karawang

Corresponding Author: 2210631050001@student.unsika.ac.id

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Abstract

The integration of digital media into mathematics education has become increasingly important for addressing students' difficulties in understanding abstract mathematical concepts, particularly in geometry topics such as circles. However, mathematics instruction in vocational high schools is still frequently dominated by conventional teaching methods with limited use of interactive learning media. This study aimed to develop and evaluate Canva-based animated mathematics learning videos to enhance students' conceptual understanding of circles at SMKN 1 Karawang. The research employed a Research and Development design using the ADDIE model, consisting of analysis, design, development, implementation, and evaluation stages. The participants included 29 students in the experimental class and 15 students in the control class. Data were collected through expert validation sheets, practical questionnaires, observation, and essay-based learning outcome tests. Data analysis involved descriptive percentage analysis, the Shapiro–Wilk normality test, and the Mann–Whitney U test, all conducted in RStudio. The validation results showed that the developed media achieved an overall validity score of 87%, categorized as very valid. The practicality test obtained a score of 76%, indicating that the media was sufficiently practical for classroom use. Furthermore, the effectiveness test revealed a significant difference between the experimental and control groups ($W = 357.5$, $p = 0.0004827 < 0.05$), demonstrating that the animated learning videos improved students' conceptual understanding of circles. The findings indicate that Canva-based animated videos can serve as valid, practical, and effective interactive learning media for supporting mathematics instruction in vocational education contexts.

INTRODUCTION

Mathematics learning increasingly requires instructional approaches that support students in developing meaningful understanding rather than relying primarily on procedural memorization. Conceptual understanding represents a fundamental component of mathematical competence because it enables learners to establish relationships among concepts, interpret mathematical ideas meaningfully, and transfer knowledge into unfamiliar situations. Students with weak conceptual understanding often struggle to solve problems because they focus on isolated procedures rather than the underlying mathematical structures (Kholid et al., 2021). Such challenges become particularly evident in geometry learning because students are required to interpret spatial relationships and mentally organize interconnected mathematical concepts. Previous studies have

shown that learners often encounter difficulties in understanding geometric relationships because these concepts demand high levels of visualization and cognitive integration (Malatjie & Machaba, 2019). Consequently, conceptual understanding remains a central issue in mathematics education because inadequate conceptual mastery can limit students' ability to construct meaningful mathematical knowledge and apply concepts effectively across learning contexts.

Among geometry topics, circle geometry presents distinctive conceptual challenges because students are expected to understand relationships among radius, diameter, circumference, chords, and angle structures simultaneously. These concepts are often perceived as abstract because learners must visualize interactions among multiple geometric components and connect symbolic representations to conceptual meaning. Previous studies reported that students commonly experience difficulties in learning circle geometry because instruction often emphasizes procedural calculations and formula memorization rather than conceptual relationships (Mifetu, 2023). Likewise, learning difficulties often arise when learners fail to establish meaningful connections between mathematical procedures and conceptual understanding (Fauzan, 2025). Such challenges become increasingly relevant in vocational education settings because vocational students generally require learning experiences that are contextual, practical, and closely related to real-world applications. Doli and Armiati (2020) further argued that mathematics learning in vocational contexts should prioritize meaningful learning experiences that facilitate understanding rather than the isolated transmission of content.

Interactive multimedia environments have increasingly attracted attention as potential instructional approaches for addressing conceptual difficulties in mathematics learning. Multimedia learning theory suggests that learners process information through visual and auditory channels simultaneously, thereby enabling more effective cognitive organization when instructional materials are appropriately designed. Research demonstrated that animation-based learning environments can facilitate learning processes by reducing unnecessary cognitive load and improving conceptual organization (Chen et al., 2024). Similarly, Yeh et al. (2012) reported that animation-supported instruction enhanced learning outcomes, as visual representations and feedback mechanisms improved students' information-processing efficiency. The role of visual representation has also been recognized as an important factor in conceptual development, as visual information helps learners transform abstract concepts into meaningful understanding (Edens & Potter, 2001). Furthermore, dynamic learning environments have been shown to strengthen conceptual relationships in geometry learning, as visual interaction enables learners to interpret mathematical structures more effectively (Samphantakul & Thinwiangthong, 2019).

Although previous studies consistently reported positive outcomes associated with multimedia and animation-based mathematics learning, several limitations remain evident in the existing literature. First, prior investigations predominantly focused on elementary and lower secondary educational contexts rather than vocational education environments (Kartika & Apriza, 2025). Second, existing studies have frequently examined general mathematics topics without specifically addressing circle geometry concepts, despite the strong dependence of these concepts on visualization and conceptual interpretation (Abakah & Brijlall, 2024). Third, studies involving Canva-based learning media have primarily emphasized media development and learning outcomes while providing limited evidence regarding conceptual understanding within vocational mathematics contexts (Feladi et al., 2023; Putri & Rusnilawati, 2026). Therefore, this study addresses these limitations by developing animated mathematics learning videos through a structured instructional design process specifically designed for vocational students learning circle geometry concepts. The novelty of this study lies not merely in the use of animation technology

but in the integration of visualization-oriented instructional design with a systematic development framework to support conceptual understanding in vocational mathematics education contexts.

METHODS

Research Design

This study employed a quantitative Research and Development (R&D) approach using the ADDIE instructional design model, consisting of Analysis, Design, Development, Implementation, and Evaluation stages. The R&D approach was selected because the study's purpose extended beyond examining instructional outcomes and involved systematically designing, developing, and evaluating a learning product to address identified instructional problems. Since the introduction highlighted limited visualization support and inadequate instructional media for enhancing conceptual understanding in vocational mathematics learning, a development-oriented methodology was considered more appropriate than a purely experimental approach. The ADDIE model was selected because it provides a systematic and iterative instructional framework that aligns learning needs with media design, implementation, and evaluation processes. Previous studies have demonstrated that ADDIE effectively supports the development of instructional products by ensuring coherence between learning objectives and instructional interventions (Sadiah et al., 2025; Tarigan, 2026). Furthermore, ADDIE-based animated instructional media have shown positive outcomes in supporting the effectiveness of mathematics learning and conceptual development (Rijal & Mulyono, 2026).

Research Setting and Participants

The study was conducted at SMKN 1 Karawang, West Java, Indonesia, during October 2025. The participants consisted of twelfth-grade vocational high school students enrolled in mathematics courses. Participants were selected through purposive sampling because the study required students with specific characteristics relevant to the research objectives and instructional context. Purposive sampling allows researchers to select participants based on their relevance to the study purpose and the specific characteristics required by the research design rather than relying on random selection procedures (Campbell et al., 2020). The inclusion criteria included students who had previously studied prerequisite geometry concepts, had experienced difficulties understanding mathematical concepts through conventional instruction, and had participated fully during the implementation process. The final sample consisted of 29 students from Class XII TP 2 as the experimental group and 15 students from Class XII TPL 2 as the comparison group. The selection of vocational students was theoretically consistent with the research gap identified in the introduction because previous studies have predominantly focused on elementary and lower-secondary educational contexts.

Product Development Procedure

The developed product was a Canva-based animated mathematics learning video focused on circle geometry concepts, including circle elements, central angles, inscribed angles, and contextual applications. During the analysis stage, classroom observations, interviews, and student questionnaires were administered to identify students' learning difficulties and instructional needs. The findings indicated that students had difficulty connecting mathematical procedures to conceptual understanding, particularly when concepts were presented through static explanations and symbolic representations. Based on these findings, the design stage involved formulating learning objectives using the ABCD framework, constructing storyboards, and organizing instructional sequences according to conceptual understanding indicators. During the development

stage, visual animation, narration, contextual illustrations, and interactive explanations were integrated systematically into the instructional media to facilitate meaningful conceptual construction rather than procedural memorization. Such integration was considered important because dynamic visualization has been shown to improve learners' understanding of abstract concepts through interactive cognitive representation (Sung et al., 2017).

Research Instruments

Several instruments were employed to obtain comprehensive evidence regarding product quality and instructional effectiveness. Expert validation sheets were used to evaluate language appropriateness, instructional quality, visual design, and content accuracy. Practicality questionnaires were administered to both teachers and students to examine accessibility, attractiveness, usability, and instructional suitability. Students' conceptual understanding was measured using essay-based posttest questions developed according to curriculum indicators and conceptual understanding dimensions identified in previous studies. Essay assessment was selected because it requires students to demonstrate reasoning, explanation, and conceptual relationships rather than merely identify correct responses. Previous studies suggested that essay-based assessment frameworks provide richer information regarding students' reasoning structures and conceptual comprehension processes (Suminar et al., 2025). Additionally, all instruments underwent expert review procedures to ensure content validity and construct appropriateness, consistent with previous instrument development studies in mathematics education (Nasser & Lian, 2021).

Implementation Procedure

The implementation process involved two phases. Initially, a small-group trial involving five students and one mathematics teacher was conducted to evaluate practicality and identify potential revisions prior to broader implementation. Subsequently, the effectiveness stage employed a Posttest-Only Control Group Design in which the experimental group received instruction using animated mathematics learning videos, whereas the comparison group received conventional mathematics instruction covering identical content and instructional duration. This design was selected because the study aimed to examine the effectiveness of the developed intervention while minimizing potential testing effects associated with repeated measurements. Data analysis involved both descriptive and inferential statistical procedures. Validation and practicality data were analyzed using percentage-based descriptive statistics, whereas learning outcome data were analyzed using the Shapiro–Wilk normality test, followed by the Mann–Whitney U test, because one dataset violated the normality assumption. Statistical analyses were performed using RStudio software.

RESULT

This study aimed to develop and evaluate Canva-based animated mathematics learning videos to enhance vocational high school students' conceptual understanding of circle geometry. The findings are organized according to the stages of product development and evaluation, including needs analysis, product development, validation, practicality, and effectiveness testing. The implementation of the ADDIE instructional design model systematically guided the development process from preliminary analysis to evaluation, ensuring that the resulting learning media aligned with students' instructional characteristics and learning needs. Overall, the findings indicate that the developed animated learning videos demonstrated high feasibility, acceptable practicality, and effectiveness in supporting students' conceptual understanding of circle geometry concepts.

Needs Analysis and Product Development Findings

The development process began with the analysis stage, which aimed to identify learning difficulties experienced by vocational high school students during mathematics instruction. Observation, interview, and questionnaire findings revealed several difficulties students encountered, including remembering mathematical formulas, understanding procedures without visual support, and connecting mathematical explanations to contextual situations. Difficulties were particularly evident when students were required to identify relationships among the components of circles and interpret geometric concepts represented symbolically. During the design stage, learning objectives were formulated using the ABCD framework, focusing on students' abilities to identify circle elements, distinguish central and inscribed angles, and apply circle concepts in problem-solving situations. The instructional sequence was organized into introduction, conceptual explanation, visualization activities, and evaluation tasks. Subsequently, the development stage involved producing a seven-minute animated learning video in Canva, integrating narration, animation, typography, and contextual illustrations to support the presentation of concepts.

Validation Results

The developed learning media underwent expert evaluation involving language, media, and content validation to examine instructional feasibility.

Table 1. *Language Validation Results*

Aspect	TSe	TSh	%	Qualification
Clarity of language	5	5	100%	Very Valid
Appropriateness of mathematical terminology	5	5	100%	Very Valid
Suitability of language level	4	5	80%	Fairly Valid
Text readability	4.5	5	90%	Very Valid
Use of standard language	4	5	80%	Fairly Valid
Spelling and writing accuracy	4	5	80%	Fairly Valid
Conciseness and sentence accuracy	4	5	80%	Fairly Valid
Clarity of instructions	4.5	5	90%	Very Valid
Total	35	40	88%	Very Valid

Table 1 shows that the language and readability aspects obtained an overall score of 88%, categorized as *very valid*. The highest scores were achieved in language clarity and the appropriateness of mathematical terminology, both at 100%, indicating that the instructional content employed clear, accurate mathematical expressions suitable for the target learners. In addition, text readability and clarity of instructions obtained scores of 90%, suggesting that the material presentation supported students in understanding learning directions and content explanations effectively. Several indicators, including the suitability of the language level, use of standard language, spelling accuracy, and sentence conciseness, achieved scores of 80%, indicating minor areas for refinement. Overall, the findings demonstrate that the language components of the developed media were considered understandable, appropriate for vocational high school students, and suitable for supporting instructional implementation.

Table 2. *Media Validation Results*

Aspect	TSe	TSh	%	Qualification
Visual design	3.5	5	70%	Less Valid
Technical media quality	4	5	80%	Fairly Valid
Interactivity	4	5	80%	Fairly Valid
Integration with material	5	5	100%	Very Valid
User experience	4	5	80%	Fairly Valid
Innovation and creativity	4	5	80%	Fairly Valid
Total	24.5	30	82%	Fairly Valid

The media validation results indicate an overall validity score of 82%, categorized as *fairly valid*. The highest score, 100%, was achieved for the integration of media and instructional content, indicating that the developed animation effectively supported the presentation of circle geometry concepts. Technical media quality, interactivity, user experience, and innovation aspects each achieved 80%, suggesting that the media functioned appropriately and provided adequate support for instructional implementation. However, the visual design aspect received the lowest score, 70%, indicating that certain visual components, including presentation appeal and creative design elements, required further improvement. Overall, the findings demonstrate that the developed animated learning media met the essential instructional and technical requirements and were considered appropriate for classroom implementation with minor revisions.

Table 3. *Content Validation Results*

Aspect	TSe	TSh	%	Qualification
Curriculum suitability	5	5	100%	Very Valid
Accuracy of mathematical concepts	4.5	5	90%	Very Valid
Clarity of material presentation	4.5	5	90%	Very Valid
Depth and completeness of material	4.5	5	90%	Very Valid
Contextual relevance	5	5	100%	Very Valid
Total	23.5	25	94%	Very Valid

Table 3 indicates that the content aspect achieved the highest validation score, 94%, and was categorized as *very valid*. The highest ratings were for curriculum suitability and contextual relevance, both at 100%, indicating that the developed material was strongly aligned with curriculum requirements and appropriately connected to students' learning contexts. Additionally, the indicators of mathematical concept accuracy, clarity of presentation, and depth of material each achieved 90%, suggesting that the content provided clear explanations, accurate conceptual representation, and sufficient coverage of circle geometry concepts. These findings demonstrate that the instructional content fulfilled the expected standards for conceptual accuracy and instructional relevance, making it suitable for implementation in classroom learning activities.

Table 4. *Overall Animation Validation Results*

Indicator	TSe	TSh
Language validation	35	40
Media validation	24.5	30
Material validation	23.5	25
Total	83	95
Percentage	87%	100%
Category	Very valid and usable without major revision	

Overall, the developed Canva-based animated mathematics learning video achieved a total validity score of 87%, categorized as *very valid*. This result reflects a combined evaluation of language, media, and content, indicating that the developed instructional product met the established quality criteria across multiple dimensions. The language component demonstrated clear communication and appropriate readability for vocational high school students, while the content component showed strong alignment with curriculum requirements and conceptual accuracy. Furthermore, the media component indicated adequate technical quality, usability, and instructional integration. The overall findings suggest that the developed animated learning video fulfilled the necessary instructional, visual, and content-related standards and was considered appropriate for classroom implementation without requiring major revisions.

Practicality Findings

Practicality evaluation involved students and mathematics teachers to examine the usability, accessibility, and instructional suitability of the developed animated learning media during classroom implementation.

Table 5. *Students' Practicality Results*

Indicator	TSe	TSh	%	Qualification
Accessibility	7.4	10	74%	Fairly Practical
Clear instructions	8.4	10	84%	Fairly Practical
Interactive design	8.2	10	82%	Fairly Practical
Language	8	10	80%	Fairly Practical
Learning interest	6.6	10	66%	Less Practical
Attractiveness	7.4	10	74%	Fairly Practical
Material understanding	7.4	10	74%	Fairly Practical
Student engagement	7.2	10	72%	Fairly Practical
Digital data usage	7.8	10	78%	Fairly Practical
Total	68.4	90	76%	Fairly Practical

Table 5 shows that the students' practicality evaluation obtained an overall score of 76%, categorized as *fairly practical*. The highest scores were found in instructional clarity and interactive design, indicating that students perceived the media as understandable and visually supportive for

learning activities. Lower scores were observed in the learning interest indicator, suggesting variation in students' adaptation toward technology-assisted instructional environments.

Table 6. *Teacher Practicality Results*

Indicator	TSe	TSh	%	Qualification
Accessibility	5	5	100%	Very Practical
Clear instructions	5	5	100%	Very Practical
Design	5	5	100%	Very Practical
Language	5	5	100%	Very Practical
Time allocation	5	5	100%	Very Practical
Attractiveness	5	5	100%	Very Practical
Suitability with learning objectives	5	5	100%	Very Practical
Student engagement	5	5	100%	Very Practical
Digital data usage	5	5	100%	Very Practical
Total	45	45	100%	Very Practical

Table 6 indicates that teachers evaluated the developed media very positively, with all indicators achieving a score of 100%, categorized as *very practical*. The findings suggest that the animated learning media supported instructional implementation and aligned well with classroom learning activities and objectives.

Effectiveness Findings

The effectiveness test employed a Posttest-Only Control Group Design involving experimental and control groups. Prior to hypothesis testing, the normality assumption was examined using the Shapiro–Wilk test.

```
        Shapiro-Wilk normality test

data:  x
W = 0.88328, p-value = 0.003988

> shapiro.test(x)

        Shapiro-Wilk normality test

data:  y
W = 0.89321, p-value = 0.075

> shapiro.test(y)
```

Figure 1. *Shapiro–Wilk Normality Test Results Using RStudio*

The normality assumption of posttest scores was examined using the Shapiro–Wilk test prior to inferential analysis. The results indicated that the experimental group data did not satisfy the assumption of normality ($W = 0.88328$, $p = .003988$), as the obtained probability value was below the significance threshold of .05. In contrast, the control group data were normally distributed ($W = 0.89321$, $p = .075$), with the probability value exceeding the significance criterion. Since one dataset violated the normality assumption, the distribution of posttest scores across groups could not be considered homogeneous under parametric requirements. Consequently, a non-parametric statistical procedure, namely the Mann–Whitney *U* test, was employed to compare students' conceptual understanding outcomes between the experimental and control groups.

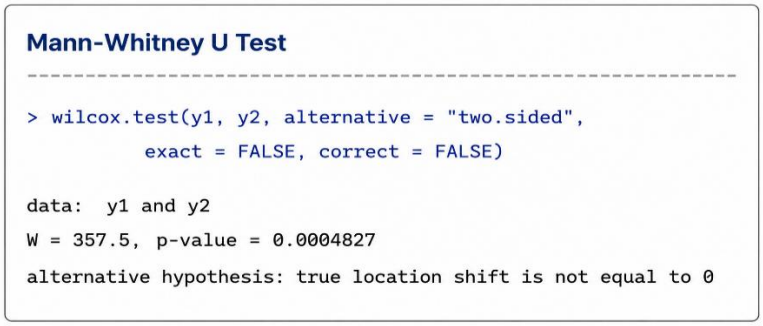

Figure 2. *Mann–Whitney U Test Results Using RStudio*

The Mann–Whitney U test produced $W = 357.5$ with $p = 0.0004827$, indicating a statistically significant difference between the experimental and control groups. Based on students' responses to conceptual understanding tasks, students in the experimental class demonstrated stronger performance across the measured indicators, including identifying circle elements, distinguishing central and inscribed angles, and applying circle concepts to problem-solving situations. Greater improvement was observed, particularly in concept identification and visual interpretation tasks requiring students to establish relationships among geometric components. Observational findings during classroom implementation also indicated that students showed greater participation and attention toward animated visual explanations during instructional activities.

DISCUSSION

The findings of this study demonstrate that the developed Canva-based animated mathematics learning videos were valid, practical, and effective in enhancing students' conceptual understanding of circle geometry. Students in the experimental group showed stronger performance across conceptual understanding indicators, particularly in identifying circle elements, distinguishing central and inscribed angles, and applying circle concepts in problem-solving situations. These findings indicate that conceptual understanding may improve when students are provided with opportunities to construct relationships among mathematical ideas rather than relying exclusively on procedural memorization. Conceptual understanding in mathematics extends beyond obtaining correct answers and involves learners' abilities to interpret, explain, justify, and connect mathematical representations meaningfully (Niemi, 1996). Likewise, students with stronger conceptual understanding tend to demonstrate greater flexibility in interpreting mathematical structures and solving problems through interconnected reasoning processes (Ningrum et al., 2022). Therefore, the improved performance observed in this study suggests that animation-assisted learning may help students develop more meaningful conceptual structures in geometry.

The findings can also be interpreted in light of the role of representations in mathematics learning. Geometry concepts require students to mentally organize relationships among mathematical objects and translate abstract structures into understandable forms. However, preliminary findings revealed that students had difficulty connecting mathematical procedures to conceptual meaning when instruction relied predominantly on symbolic explanations and static presentations. The role of representation has been recognized as a fundamental component of mathematical understanding because learners construct meaning by shifting among visual, symbolic, and conceptual forms of representation (Pape & Tchoshanov, 2001). Similarly, students'

conceptual understanding develops more effectively when they can transition flexibly among different representational systems during mathematical reasoning (Jäder & Johansson, 2025). In the present study, the integration of visual animation and contextual explanation may have facilitated such representational transitions, enabling students to understand relationships among circles more systematically.

The positive outcomes observed in this study may further be explained through visualization processes embedded within the developed media. Students demonstrated stronger performance in identifying conceptual relationships among radius, diameter, and angle structures after learning through animated videos. Previous studies have indicated that visual representations play a significant role in supporting geometry learning, as visual structures help students organize spatial information and interpret abstract mathematical concepts (Žakelj & Klančar, 2022). Similar findings showed that improving visual representation skills positively contributed to students' conceptual understanding and reduced learning difficulties in geometry contexts (Veasna & Heng, 2024). Dynamic visualization environments have also been found to strengthen conceptual understanding because learners can directly observe changes and relationships among mathematical objects (Lavy, 2007). More recently, a meta-analysis demonstrated that dynamic mathematical visualization significantly improves students' mathematical learning and conceptual interpretation processes (Zhang et al., 2025). These findings suggest that animated instructional environments may provide learners with additional support for constructing meaningful conceptual relationships.

From a cognitive perspective, the effectiveness of the developed media may also be associated with multimedia learning processes. The instructional media developed in this study integrated narration, animation, typography, and contextual illustrations within a single learning environment. Multimedia learning environments may support conceptual learning by presenting information simultaneously through visual and verbal channels, enabling learners to process and organize it more efficiently (Chiu & Churchill, 2015). However, animations do not automatically improve learning outcomes because excessive visual information may increase cognitive demands and reduce learning effectiveness (Schnotz & Rasch, 2005). Similarly, animation may create a sense of transience when information changes too rapidly for learners to process adequately (Ng et al., 2013). Therefore, the positive findings observed in this study may indicate that the developed media maintained an appropriate balance between visual movement and conceptual explanation, allowing students to process information without excessive cognitive burden.

Another important finding concerns students' responses and participation during classroom implementation. Students showed greater attention and participation during instructional activities involving animated learning videos. Increased engagement may positively contribute to conceptual learning because active participation allows learners to interact directly with instructional content and knowledge-construction processes. Previous studies have shown that interactive learning environments improve student engagement, as visual and technology-supported activities increase learners' attention and participation in mathematics learning (Lo & Hew, 2021). Likewise, active classroom participation has been identified as an important factor influencing students' mathematical learning experiences and conceptual development (Skilling et al., 2016). In animation-supported environments specifically, students often demonstrate higher levels of engagement and retention because visual movement and interactive content maintain learners' attention throughout instructional activities (Yıldırım & Demirkaya, 2025).

The present study also contributes to the growing literature on mathematics learning within vocational education contexts. Existing studies on instructional technology integration have

predominantly focused on general educational settings, whereas evidence related to vocational mathematics learning remains relatively limited. Mathematics learning in vocational contexts often requires instructional approaches that connect abstract concepts to practical, meaningful learning experiences (FitzSimons, 2000). Similarly, digital instructional materials have been found to improve learning experiences for vocational students because they provide more contextual and accessible learning opportunities (Zwart et al., 2017). The findings of this study, therefore, extend existing literature by providing evidence that visualization-oriented instructional media developed through a systematic framework can support conceptual understanding in vocational mathematics learning environments.

CONCLUSIONS

This study concludes that the developed Canva-based animated mathematics learning videos are valid, practical, and effective in enhancing vocational high school students' conceptual understanding of circle geometry. The developed media successfully fulfilled instructional, content, and technical quality criteria, indicating its suitability for classroom implementation. Students who learned through animated learning videos demonstrated stronger conceptual understanding, particularly in identifying circle elements, distinguishing geometric relationships, and applying concepts in problem-solving situations. The findings suggest that visualization-oriented instructional environments may facilitate students' abilities to construct meaningful relationships among mathematical concepts and reduce dependence on procedural memorization. This study also contributes to mathematics education by demonstrating that animation-based instructional media can function not only as technological tools but also as pedagogical interventions designed to support conceptual understanding in vocational learning contexts. The contribution of this study lies in integrating a systematic instructional development process with visualization-based learning design to address conceptual difficulties in geometry learning. Nevertheless, the study was limited to a single educational context and focused exclusively on circle geometry material. Future studies are recommended to involve broader participant groups, investigate additional mathematical topics, and examine the long-term impact of animation-based learning environments on conceptual understanding and higher-order mathematical thinking skills.

ADDITIONAL INFORMATION

Section	Description
Funding	This research received no external funding.
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Conflict of Interest	The author declares no conflict of interest.
Data Availability	The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions	The author was responsible for conceptualization, research design, data collection, media development, data analysis, manuscript writing, and final approval of the submitted version.

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