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Research Article

Ethnomathematics-Based Interactive Video of Dermo Temple to Enhance Numeracy Skills of Elementary School Students

Via Yustitia[1]*, Septiana Wijayanti[2], Luluk Faridah[3], Nadia Putri Emilia[1], and Dian Kusmaharti[1]

[1]Universitas PGRI Adi Buana, Surabaya, Indonesia
[2]Universitas Widya Dharma, Klaten, Indonesia
[3]Universitas Islam Darul Ulum, Lamongan, Indonesia

ORCID
Via Yustitia: https://orcid.org/0000-0002-1396-0639

Abstract.
Since numeracy is an important skill that elementary school students must have, it is necessary to develop learning media to improve this skill. Educational videos using Dermo Temple ethnomathematics can be used as an alternative method of teaching. This study aims to develop and assess the effectiveness of an interactive ethnomathematics-based video of Dermo Temple. It focuses on numeracy as an essential skill for students to tackle mathematical problems. This study employed the 4D development model, conducted at SDN Anggaswangi 2 during the academic year 2023/2024. Data were gathered through interviews, observations, questionnaires, scales, and tests. Based on the research result, it was inferred that i. the ethnomathematics-based video was developed using 4D models until the development stage, ii. the media feasibility test results on the language aspect were 93.33% with very feasible criteria, the media appearance aspect was 87.77% with very feasible criteria, and the material aspect was 86.66% with very feasible criteria, and iii. the practicality of the Dermo Temple ethnomathematics-based video was 83.57% which showed very interesting criteria. For this reason, the interactive video proves to be effective in enhancing numeracy of elementary school students.

Keywords: ethnomathematics, dermo temple, elementary school student, numeracy

Corresponding Author: Via Yustitia; email: via.yustitia@unipasby.ac.id

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1. Introduction

Numeracy is the ability to understand and use various kinds of numbers and symbols related to basic mathematics and analyze information displayed in various forms (graphs, tables, charts, etc.) to solve practical problems in various contexts of daily life (Yustitia et al., 2021; Yustitia et al., 2022; Kusmaharti et al., 2023). Numeracy ability is an important aspect in creating competent and characterful human resources, but the facts show that the numeracy ability of students in Indonesia is still low. This can also be seen from the 2022 AKM SD results which show that numeracy results are lower than literacy and scientific and social skills results (Hidayat & Ismail, 2022).

In the current educational landscape of the 21st century, learning is intentionally designed to align with the pace of technological advancements. Schools support this endeavor by providing adequate facilities and learning resources. One such facility is electronic equipment, including computers, LCD projectors, and other similar tools. However, these electronic resources have yet to be fully harnessed by teachers to support the utilization of instructional media. Instructional media encompasses everything used in learning activities, serving as a conduit for messages and information. This, in turn, can cultivate students' interest in learning, stimulate their minds, and capture their attention and emotions, ultimately facilitating the learning process (Mashuri, 2019). The effectiveness of the learning process is significantly influenced by the judicious use of instructional media by both teachers and students. This ensures that the learning process becomes not only captivating for students but also encourages their active participation.

Mathematics is one of the subjects that demands students to think critically and creatively. Therefore, its teaching and learning process must be effective. In the 21st century, mathematics learning is required to be student-centered (Sa'idah & Walida, 2020). Many elementary school students perceive mathematics learning as difficult and boring. Therefore, it is necessary to use suitable instructional media for mathematics learning to assist in students' understanding and make the learning process more engaging. One effective method is through the use of audio-visual instructional media as it is considered more effective (Dewi & Suniasih, 2022). Moreover, an approach is needed to ensure that the implementation of mathematics learning runs effectively and captures the students' interest. One of these approaches is to connect the material with daily life and tangible objects in teaching (Dharmayanti et al., 2019). This is because elementary school students are primarily situated in the concrete operational stage, as per Piaget's theory, during which their thinking is predominantly influenced by phenomena observed in daily life and tangible objects in their immediate surroundings (Ramadhiyani & Mariana, 2022).

One aspect closely intertwined with students' daily lives is their local culture, wherein local culture can be integrated into mathematics learning. This form of learning harnesses the cultural wisdom known as ethnomathematics, which results from the fusion of mathematics and culture. Understanding this connection can be leveraged to improve students' comprehension of mathematical concepts, making ethnomathematics learning more meaningful and engaging for students (Ramadhiyani & Mariana, 2022). One cultural object that can be employed as an alternative to mathematics learning is a

temple. Temples can serve as an alternative for ethnomathematics learning, particularly in the topic of plane geometry. In exploring temples suitable for ethnomathematics learning alternatives, one notable example in the students' vicinity is Dermo Temple. Dermo Temple is located in Candinegoro Village, Wonoayu District, Sidoarjo Regency. According to Ramadhiyani & Mariana (2022), the Dermo Temple is one of the remnants of the Majapahit Kingdom, which has undergone restoration and was completed in 2021. Consequently, the temple stands firmly once again, and its various parts exhibit geometric concepts that can be used as an alternative in mathematics learning.

Extensive research has been conducted on the utilization of Dermo Temple as an alternative in mathematics education. A noteworthy study by Ramadhiyani & Mariana (2022) specifically delves into the exploration of Dermo Temple as a pedagogical tool for geometry learning at the elementary school level. Furthermore, Inda Rachmawati's research findings (as cited in Ramadhiyani & Mariana, 2022) demonstrate the presence of geometric concepts within Dermo Temple. Despite the existing body of research on Dermo Temple, there remains a gap in the literature as there is currently no study that employs Dermo Temple as a foundational element in video-based learning.

Based on observations conducted at SDN Anggaswangi 2 in Sidoarjo, the teaching of plane geometry is notably void of instructional media, relying exclusively on textbooks or available images within the school premises. This apparent lack stems from teachers' limited proficiency in leveraging information technology. Despite the provision of electronic facilities conducive to learning within the school, instructors (teachers) predominantly elucidate plane geometry concepts from textbooks. Subsequently, students engage in exercises found within these textbooks, potentially resulting in diminished interest. Furthermore, while students exhibit a satisfactory comprehension of examples presented by the teacher, challenges arise when confronted with slightly varied scenarios. Recognizing these pedagogical challenges, the researcher endeavors to address them by developing an ethnomathematics-based instructional video. This innovative approach incorporates Dermo Temple as a pedagogical tool for imparting plane geometry concepts at SDN Anggaswangi 2.

2. Method

This study adopts a Research and Development (R&D) approach a method utilized to develop and validate a product. The focus of this research is the creation of an instructional video grounded in ethnomathematics, specifically centered on Dermo

Temple. The aim is to establish the video as an effective teaching tool for the plane geometry topic on numeracy.

The method employed in this research and development adheres to the 4D development model. This model comprises four distinct stages: defining, designing, developing, and disseminating. Each stage is elucidated as follows.

2.1 Defining

This stage involves two approaches: literature review and needs analysis.

2.1.1 Student needs analysis: The researcher analyzes students' needs, facilitating the development of customized media to cater to their learning necessities.

2.1.2 Competency analysis: This pertains to an examination of learning outcomes, serving as the foundation for the development of relevant products or media.

2.2 Designing

The designing stage encompasses the following steps to be undertaken.

2.2.1 This stage involves crafting the initial design/storyboard for the forthcoming video in line with the preceding stage. The initial design/storyboard is available in Appendix 8.

2.2.2 The preparation of the material is aligned with the fundamental competencies and learning objectives of the plane geometry topic for 1st-grade elementary school students.

2.3 Developing

This stage is aimed at producing the product. It is executed through the following procedural steps.

2.3.1 Expert validation: conducted by the researcher to confirm that the developed product is appropriate and suitable for use in learning.

2.3.2 Revision: carried out by the researcher if the developed product is deemed less suitable or inadequate according to expert validators.

2.3.3 Practicality testing of the media (student responses): conducted by the researcher to obtain students' responses or comments regarding the practicality of the developed product.

2.4 Disseminating

This stage was not carried out by the researcher due to time constraints and impractical conditions.

This research took place at SDN Anggaswangi 2 in the first semester of the academic year 2023/2024. Purposive sampling was utilized, and Class I-A consisting of 24 students was chosen as the research subjects based on their alignment with the criteria for the development of the ethnomathematics-based instructional video of Dermo Temple. The criteria included a lack of understanding in recognizing plane geometry shapes.

3. Result and Discussion

The development of the ethnomathematics-based instructional video of Dermo Temple as a teaching tool for the plane geometry topic at SDN Anggaswangi 2 is executed through the following stages.

3.1. Defining

This stage involves two approaches: literature review and needs analysis.

a) Student needs analysis: The impetus for this research stems from observational findings at SDN Anggaswangi 2, revealing a concerning trend related to the insufficient comprehension of plane geometry concepts among 1st-grade students. It became evident that these students encountered difficulties in distinguishing various plane geometry shapes. Through identification, the researcher pinpointed the root cause of this challenge: the lack of engagement in the teaching methodology, where instructors refrained from utilizing instructional media. The observations further led to the conclusion that students exhibit heightened interest in digital learning resources. Given this insight, the chosen digital learning medium for this study is instructional videos. The rationale behind this selection lies in the accessibility of instructional videos for 1st-grade students, providing ease of use and the flexibility for students and teachers to replay content as needed.

b) Competency analysis: The competency analysis is closely linked to the achievement of learning outcomes. In this analysis, an evaluation is undertaken concerning the learning outcomes specified in the Decision of the Head of the Education Standards, Curriculum, and Assessment Agency No. 033/H/KR/2022. Specifically, the learning outcomes in Phase A for the geometry element encompass the recognition of various plane geometry shapes (triangle, quadrilateral, polygon, and circle), as well as spatial shapes (rectangular prism, cube, cone, and sphere). Notably, for Grade 1, the competency revolves solely around recognizing plane geometry shapes. Consequently, the

foundational goal guiding the development of this instructional video is for students to proficiently recognize and comprehend diverse plane geometry shapes following the viewing of the instructional video.

3.2. Designing

The designing stage involves crafting a video design tailored to the specifications outlined in the defining stage. During this stage, *Procreate* and *CapCut* applications are employed for video creation. The procedural steps taken by the researcher in product development are outlined as follows.

a) Capturing footage and photos of Dermo Temple: The documentation process involved capturing video footage and several photos highlighting sections resembling plane geometry shapes. The video and photo capture of Dermo Temple utilized an iPad 9 (2019) selected for its perceived superior camera clarity.

Figure 1: Roof Section of Dermo Temple.

b) Designing animation: The selected animation features a character named “Emil,” portrayed as a young girl adorned in traditional Javanese attire. The choice of the name “Emil” is derived from the researcher’s surname. Emil’s character is intentionally crafted in traditional Javanese attire, aligning with the video’s core concept of leveraging and showcasing elements of Javanese culture. Following the design of Emil’s character, a meticulous coloring process ensued. Subsequently, various dynamic movements were incorporated, encompassing hand gestures to the right and left, mouth movements during speech, expressive head shaking, a waving

hand motion, and the subtle blink of the eyes. This bespoke animation design was crafted personally using the *Procreate* application, rendering it exclusive to the instructional video meticulously developed by the researcher.

Figure 2: The initial design of Emil's character before the application of coloring.

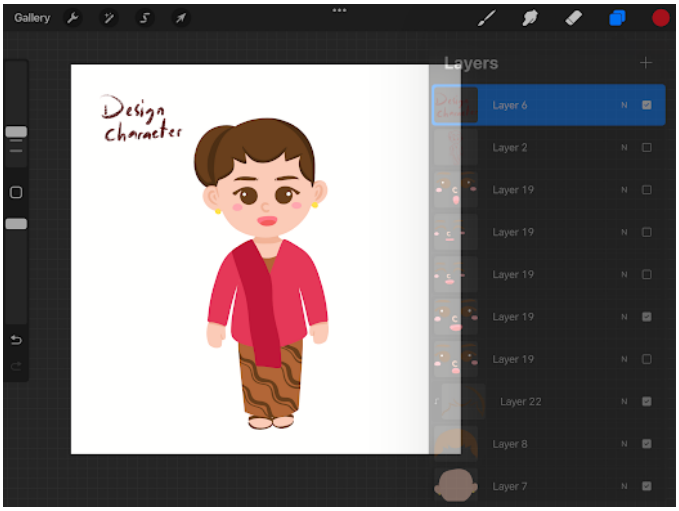

Figure 3: The final design of Emil's character after coloring and animation sequences.

c) Highlighting sections of Dermo Temple with red lines: Specific segments of Dermo Temple are emphasized by adding red lines that correspond to the plane geometry shapes found in those areas. For instance, the door of Dermo Temple is accentuated by adding a red line, outlining a rectangular shape. Highlighted sections of the temple include the temple door, temple roof, temple stairs, lower part of the temple wall, and the Yoni artifact. This procedural step is executed using the *Procreate* application.

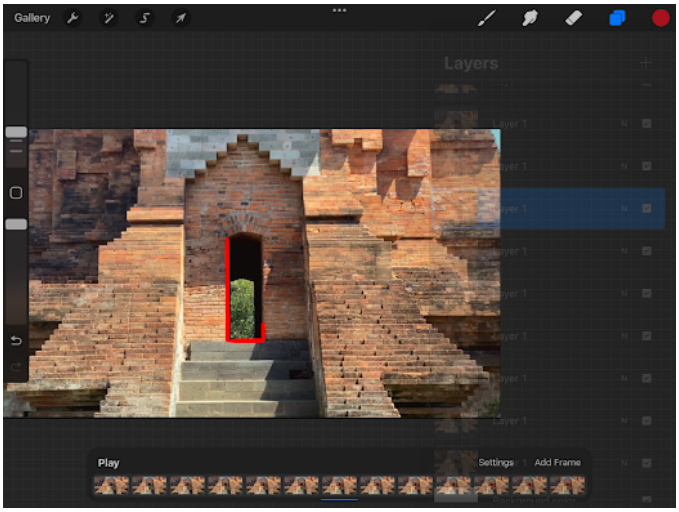

Figure 4: Visualization of red lines outlining the door of Dermo Temple.

d) Integrating Dermo Temple footage and highlighted sections videos: This stage involves the amalgamation of the footage capturing the overall view of Dermo Temple and the videos focusing on highlighted temple sections distinguished by red lines. The process is executed using the *CapCut* application. Following this, the character design of Emil is seamlessly incorporated into each section of the Dermo Temple video, aligning with the initial design.

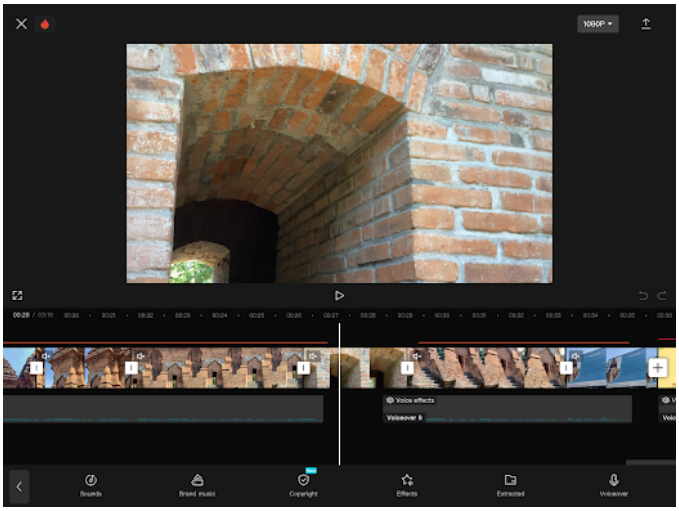

Figure 5: The process of merging the Dermo Temple footage.

e) Narrating and editing the voiceover: This phase involves narrating explanations aligned with each section and subsequently editing the voice to emulate that of a young child, utilizing the features available in the *CapCut* application. The child-like voice effect can be customized to the researcher's preference, and in this instance, a child-like voice effect of 85% was applied.

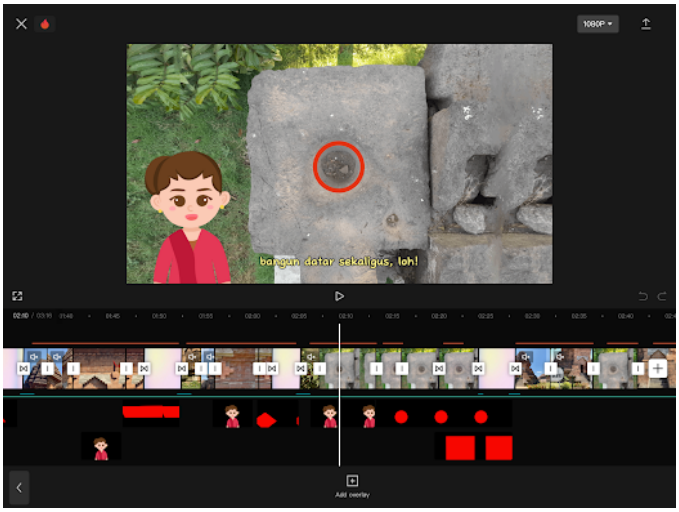

Figure 6: The process of integrating Emil's character into the video.

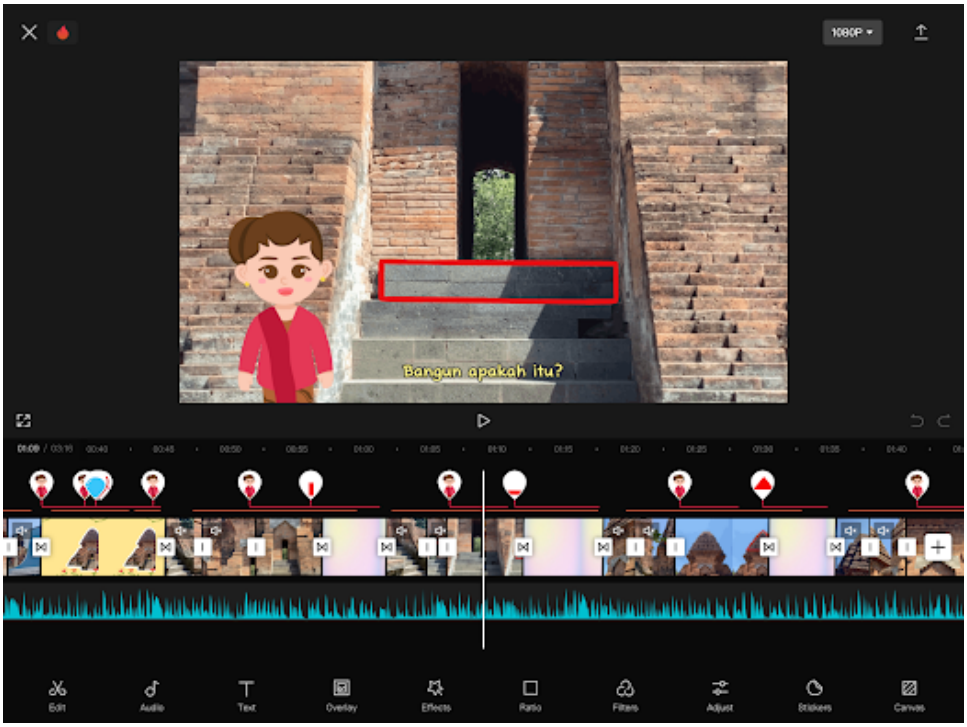

Figure 7: The process of voiceover recording and subsequent voice editing.

f) Exporting the instructional video: In the final stage, the instructional video was exported with the option to select the desired quality or resolution. For this project, the researcher chose a resolution of 720P, estimating the resultant video file size to be approximately 185.04 MB.

The ethnomathematics-based instructional video of Dermo Temple, covering the plane geometry topic, can be accessed through the following link:

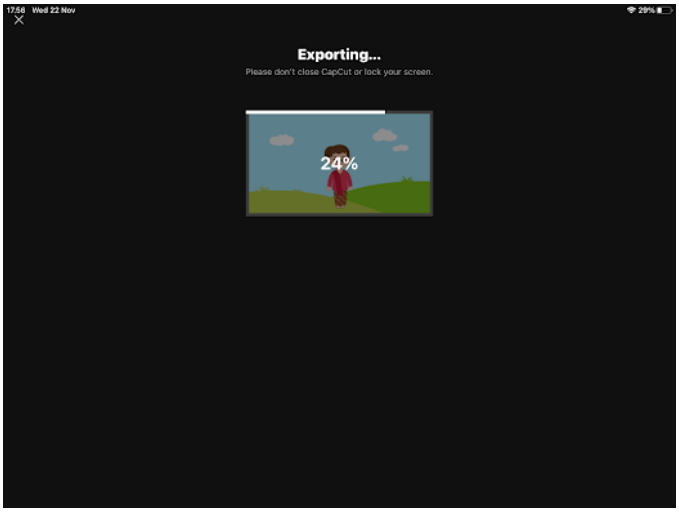

Figure 8: The exportation process of the instructional video.

https://drive.google.com/file/d/1SDTBCujPZG4RERiyUDRymkHRmAif05_D/view?usp=drivesdk

3.3. Developing

The developing phase focuses on product creation, with the researcher undertaking the following procedural steps.

a) Expert validation: The researcher undertook expert validation to affirm the appropriateness and suitability of the developed product for instructional purposes. In this development process, the instrument validation was carried out by Validator 1, Achmad Fanani, S.T., M.Pd., a faculty member at Universitas PGRI Adi Buana Surabaya, and Validator 2, Srirorik Narulita, S.Pd.SD., the homeroom teacher of Class 1-A at SDN Anggaswangi 2. Both actively contributed to the validation process.

b) Revisions: The researcher conducted revisions if the developed product was found to be less suitable or deemed inappropriate by expert validators.

c) Practicality testing of the media (student responses): It was conducted by the researcher to gather responses and comments from students regarding the practicality of the developed product. A total of 24 students provided feedback on the practicality of the product.

3.4. Disseminating

The disseminating stage was not undertaken by the researcher due to limitations in time and impractical conditions for its execution.

3.4.1. Product Feasibility Results

The results of the product feasibility for the developed product titled "*Ethnomathematics-Based Learning Video of Dermo Temple for the Plane Geometry Topic*" are presented below.

1) **Language Aspect**

TABLE 1: The Assessment of Language Aspect.

Aspect	Indicators	Validation Score	
		V1	V2
Language	a. Language clarity and accessibility for easy understanding	4.00	5.00
	b. Precision in the usage of terms and language	4.00	5.00
	c. Absence of discriminatory language	5.00	5.00
Total Score		13.00	15.00
Percentage Score		86.66%	100%
Average Percentage		93.33%	

In the presented table, the language aspect includes three assessment indicators with an average percentage of 93.33%, categorizing it as highly feasible. The assessment of the language aspect is illustrated in the following Figure 9.

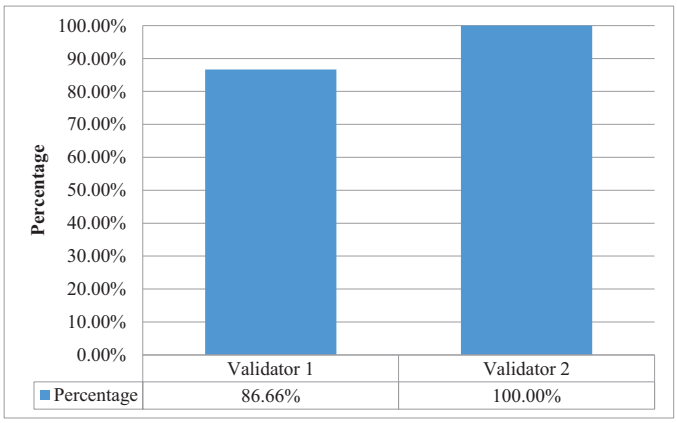

Figure 9: The Assessment of Language Aspect.

2) **Visual Layout Aspect**

TABLE 2: The Assessment of Visual Layout Aspect.

Aspect	Indicators	Validation Score	
		V1	V2
Visual Layout	a. Clarity of images and readability of text	4.00	4.00
	b. Appropriate font type and size	4.00	3.00
	c. Layout arrangement of text	4.00	4.00
	d. Suitability of background selection	4.00	4.00
	e. Composition of color choices	5.00	5.00
	f. Neatness of visual layout	4.00	5.00
	g. Appropriate use of animations in media	5.00	5.00
	h. Compatibility of visualization with students' developmental stage	5.00	4.00
	i. Clear audibility of sound	5.00	5.00
Total Score		40.00	39.00
Percentage Score		88.88%	86.66%
Average Percentage		87.77%	

In the presented table, the visual layout aspect includes nine assessment indicators with an average percentage of 87.77%, categorizing it as highly feasible. The assessment of the visual layout aspect is illustrated in the following Figure 10.

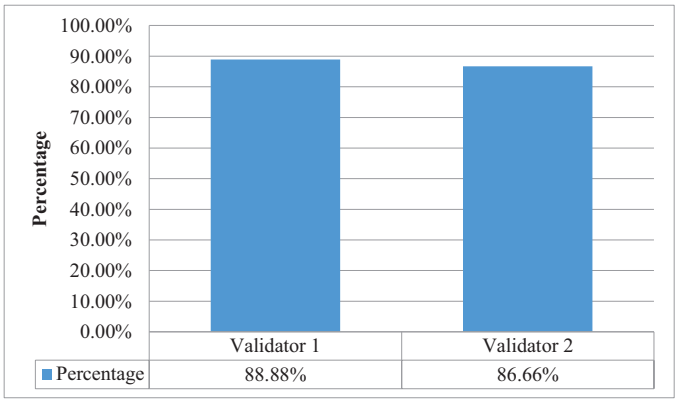

Figure 10: The Assessment of Visual Layout Aspect.

3) **Content Aspect**

In the presented table, the content aspect includes three assessment indicators with an average percentage of 86.66%, categorizing it as highly feasible. The assessment of the content aspect is illustrated in the following Figure 11.

TABLE 3: The Assessment of Content Aspect.

Aspect	Indicators	Validation Score	
		V1	V2
Content	a. Suitability of the content with learning objectives	4.00	4.00
	b. Accuracy of the content	5.00	5.00
	c. Clarity in delivering the content	4.00	4.00
Total Score		13.00	13.00
Percentage Score		86.66%	86.66%
Average Percentage		86.66%	

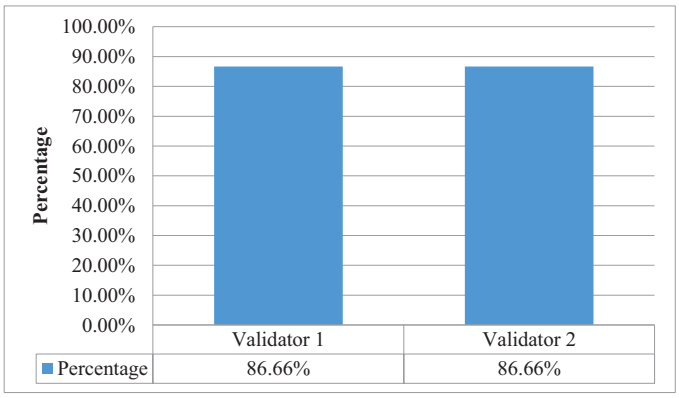

Figure 11: The Assessment of Content Aspect.

Considering the obtained percentage scores from the aspects of language, visual layout, and content, the results of the product feasibility assessment of the developed media are illustrated in the diagram below.

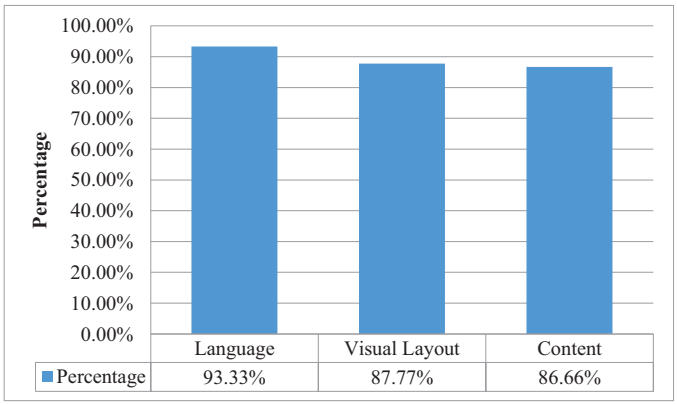

Figure 12: The Results of the Product Feasibility Assessment.

Based on the feasibility assessment results, the following are the recommendations or feedback provided by each validator.

Table 4: Recommendations/Feedback from Expert Validators.

No.	Expert Validators	Recommendations/Feedback
1	Validator 1: Achmad Fanani, S.T., M.Pd.	It is suggested to enhance the instructional video by including feedback questions for students.
2	Validator 2: Srirorik Narulita, S.Pd.SD.	It is recommended to enlarge the font size used in the video subtitles.

Following the valuable recommendations or feedback from expert validators, the researcher has revised the media based on their suggestions. The instructional video is currently ready for testing after the incorporation of these enhancements.

The practicality test involved 24 students from Class 1-A at SDN Anggaswangi 2 to evaluate the effectiveness of the developed instructional video. The calculated results indicate a practicality score of 83.57%, categorizing the media as highly practical.

The product developed in this study is an ethnomathematics-based instructional video of Dermo Temple, specifically addressing the topic of plane geometry. It is designed for the mathematics lesson targeting 1st-grade students at SDN Anggaswangi 2. The creation of this instructional video is responsive to the identified learning needs of 1st-grade students in SDN Anggaswangi 2, who perceive mathematics as monotonous and challenging. This perception is attributed to the infrequent use of instructional media by teachers and a lack of teacher proficiency in its incorporation.

The progression of creating the ethnomathematics-based instructional video centered on Dermo Temple encompassed three pivotal stages: defining, designing, and developing. In the course of this research and development, the product underwent validation testing to assess its feasibility. Additionally, a practicality evaluation was conducted, involving 24 1st-grade students at SDN Anggaswangi 2.

The instructional video (the developed product) underwent a thorough feasibility assessment covering language, visual layout, and content aspects. The validation process engaged two expert validators: Validator 1, a lecturer in the Elementary School Teacher Education Program at Universitas PGRI Adi Buana Surabaya, and Validator 2, the homeroom teacher of Class 1-A at SDN Anggaswangi 2. Validator 1 assigned a feasibility level of 4.4, indicating high feasibility, while Validator 2 conferred a level of 4.5, also deeming it highly feasible. Subsequently, a practicality test involved 24 students from Class 1-A at SDN Anggaswangi 2, yielding a response percentage of 83.57%, meeting the criteria for high practicality.

Mashuri (2019) defines instructional media as any tool used in teaching to convey messages or information. It aims to cultivate students' interest in learning and stimulate their minds, attention, and emotions, thereby facilitating the learning process. Instructional media takes on various forms, and one notably effective type is instructional videos. Falling under the category of audio-visual instructional media, instructional videos combine auditory (sound) and visual (images) elements, creating a cohesive experience that engages both sight and hearing. This allows students to both see and hear the presented material or concepts Invalid source specified.. The use of instructional videos is particularly fitting for student learning, given the students' familiarity with contemporary technological advancements (Faridah *et al*., 2021). This perspective aligns with observational findings, which indicate that 1st-grade students exhibit a heightened interest in digital learning media.

The media developed in this research takes the form of an ethnomathematics-based instructional video. Ethnomathematics establishes a connection between the local culture surrounding students and the learning of mathematics. This approach is considered more effective as it helps students understand a subject matter directly linked to their cultural context and daily activities tangibly and practically (Masrura, 2020). Furthermore, this perspective is in line with Piaget's theory, which suggests that elementary school students operate primarily through concrete operational thinking, relying on phenomena and tangible objects in their immediate environment for learning.

The aforementioned statements are relevant to the rationale behind the development of instructional media, specifically an ethnomathematics-based video centered around Dermo Temple. The objective is to craft teaching tools that cater to the specific needs of 1st-grade students at SDN Anggaswangi 2. Limitations encountered during the development of the ethnomathematics-based instructional video of Dermo Temple are outlined as follows: The plane geometry shapes present in Dermo Temple are limited to only six forms: triangle, square, rectangle, rhombus, trapezoid, and circle. Creating instructional videos requires a relatively largestorage/memory space.

4. Conclusion

Based on the research result; (1) this learning videos of ethnomathematics was developedusing 4D models until the develop stage; (2) the media validation/feasibility test result on the language aspect were 93,33% with very feasible criteria, the media appearance aspect was 87,77% with very feasiable criteria, and the material aspect was 86,66% with

very feasible criteria; and (3) the practiciality of the Dermo Temple ethnomathematics based learning video was 83,57% which showed very interesting criteria.

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