International Journal on Education Insight
Vol. 5, No. 1, April 2024, pp. 27-34
p-ISSN: 2722-2683, e-ISSN: 2722-2691, DOI: 10.12928/ijei.v5i1.13678

Developing interactive storytelling-based learning video to enhance students' numerical literacy in geometry

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Abstract

Literacy is the ability to understand, use, and interpret written information. One of the fundamental forms of literacy that is embedded in everyday life is numerical literacy, which refers to an individual's ability to apply numerical and arithmetic concepts in daily life and interpret quantitative information in their surroundings. This research aims to develop a valid, practical, and effective interactive storytelling-based learning video to enhance students' numerical literacy in geometry. To this end, Plomp's research and development method was applied. The result showed that, firstly, the developed product was valid, with an average total validity score of 0.910 for content validation and 0.860 for media validation. Secondly, the product was deemed practical, with an average score of 91.67% based on teacher evaluation and 80.31% based on student evaluation. Thirdly, the product was considered effective in improving students' numerical literacy, with calculated values $tobs$=11.5084 and critical region=$\{t \mid t>1.721\}$, as well as an average N-Gain score of 0.668, indicating a moderate level of improvement. These results indicate that the developed interactive storytelling-based learning video is valid, practical, and effective in enhancing students' numerical literacy in geometry.

Keywords: interactive learning video, learning geometry, numerical literacy, storytelling

How to cite: Susanti, V. A., Nurhasanah, F., & Chrisnawati, H. E. (2024). Developing interactive storytelling-based learning video to enhance students' numerical literacy in geometry. *International Journal on Education Insight, 5*(1), 27-34. DOI: 10.12928/ijei.v5i1.13678

Article history: Received July 20, 2023; Revised Feb 3, 2024; Accepted March 30, 2024

INTRODUCTION

Literacy refers to the ability to understand, use, and interpret written information (Lechner et al., 2021). It plays a crucial role in the success of students' learning processes and influences the reception and processing of information related to everyday life. There are six basic literacies that the Indonesian people need to master, namely reading and writing literacy, numerical literacy, science literacy, digital literacy, financial literacy, and cultural and citizenship literacy (Kementerian Pendidikan dan Kebudayaan, 2017). One fundamental form of literacy that is embedded in everyday life is numerical literacy, considering that many issues in the surrounding environment involve calculations, measurements, shapes, data processing, and other mathematical-related aspects. Numerical literacy is highly necessary to address these issues. Numerical literacy is an individual's ability to apply numerical concepts and arithmetic in daily life and the ability to interpret quantitative information in their surroundings (Sutama et al., 2020). In other words, numerical literacy is a person's ability to obtain, interpret, and use various kinds of numbers and mathematical symbols to solve problems, analyze quantitative information in various forms, and use the interpretation of the

results of the analysis to predict and make decisions in the context of everyday life. Numerical literacy is closely related to mathematical literacy in terms of the scope of context, competencies, and content (Poernomo et al., 2021).

Several indicators are usually used to measure numerical literacy. These indicators vary for each developmental stage of children. For children aged 7–11 years, the indicators used to measure their numerical literacy abilities are presented in Table 1.

Table 1. Numerical literacy indicators of 1st-grade students

Numerical Literacy Skill	Indicator
Representation skill	Using various representations like images or concrete object to solve problems
Reasoning and argumentative skill	Giving reasons or arguments when drawing conclusion or solving problems.
Using symbolic, formal, and technicallanguage or operation	Using mathematical language and symbolic operation to solve problems.

Since 2016, the government has been actively promoting the National Literacy Movement (Gerakan Literasi Nasional) in an effort to cultivate a culture of literacy in Indonesian society. However, the numerical literacy rates among students in Indonesia are still relatively low, as indicated by PISA (2019) and TIMSS (2015) results, which ranked Indonesia as the 7th and 6th lowest among all member countries, respectively. The low numerical literacy can be attributed to the inadequate selection of learning models and media (Ambarwati & Kurniasih, 2021). This has led to an increasing number of researchers developing learning media to enhance students' numerical literacy. According to data from APJII in 2022, in the 2021-2022 period, the internet penetration rate, or the ratio of internet users to the population in the age group of 5–12 years, reached 62.43%. This has prompted many researchers to develop technology-based media that utilize the internet.

One of the media that has been deemed effective in enhancing students' numerical literacy is learning videos. Learning videos are multimedia resources that combine audio and visual elements used in the learning process. They can stimulate attitudes, improve knowledge, develop skills, and aid in cognitive, affective, and psychomotor learning (Hasiru et al., 2021). A previous study found that 77.6% of students need learning videos, while 65.6% of students prefer learning videos with engaging backgrounds and animations (Nasikhah et al., 2021). However, the learning videos currently circulating on the internet are not particularly engaging for students. Yet, children would be more interested in watching videos if they had captivating narratives and animations.

Children between the ages of 7 and 11 are in the stage of concrete operational thinking, where they can solve problems based on concrete objects they observe (Nabila, 2021). More specifically, Van Hiele (Unaenah et al., 2020) asserts that during the study of geometry, children in this age range are at a stage of recognizing shapes based on the visual similarities they perceive. In this regard, providing stimuli using appropriate media would be helpful in delivering learning materials through enjoyable and challenging learning activities.

Storytelling is considered capable of enhancing students' interest, concentration, and motivation while also developing their understanding of

learning content (Lestari, 2017). Storytelling serves as a means to deliver a narrative to children, not only to impart certain morals or values but also to present learning materials in a concise and engaging manner. Videos with captivating storylines and adventurous plots are undoubtedly more appealing than videos with simple animations and audio. However, the learning videos currently available on the internet are not particularly captivating for students.

Based on the observations, the researchers found that the majority of mathematics learning videos on YouTube primarily consist of material explanations and problem-solving tutorials. From a sample of 20 YouTube channels with over 1030 uploaded videos, 50% of the videos presented problem-solving tutorials using simple tools and animations, 49.5% of the videos provided concept explanations through presentation-like activities similar to those in a classroom setting, and only 0.5% of the videos consisted of animations that conveyed concept explanations through short stories. Based on this background, the researchers intend to develop a valid, practical, and effective interactive learning video based on storytelling to enhance students' numerical literacy in geometry.

RESEARCH METHOD

This study utilized Plomp's development model. The development stages consist of the initial investigation, design, construction (realization), trial (test, evaluation, and revision), and implementation stages (Budiyono, 2017). During the initial investigation phase, preliminary research, student needs analysis, content analysis, and a literature review were conducted. Subsequently, in the design stage, a research implementation was planned and a product design was made, which was then transformed into a prototype during the construction stage. During the construction phase, the process began with developing the product prototype and preparing various instruments needed for the trial stage (test, evaluation, and revision). In the testing phase, activities such as content validation, media validation, practicality test, and effectiveness were conducted. Once the media was deemed valid, practical, and effective, the next stage was implementation involving the product dissemination.

The study was conducted at SD Muhammadiyah 16 Surakarta in the second semester of the academic year 2022-2023. The cluster random sampling technique was used to recruit participants to test the practicality and effectiveness of the product. From three classes, one was randomly selected. A questionnaire was employed to collect data regarding the validity and practicality of the product, and a pre-test and a post-test were performed to collect data of the product effectiveness.

The product validation process used the Aiken validity method. The validation questionnaire utilized a Likert scale for scoring purposes. The result was then converted based on the categorization criteria presented in Table 2.

Table 2. Validity category

Interval	Validity Category
$0.00 \leq \bar{X} < 0.20$	Very Low
$0.20 \leq \bar{X} < 0.40$	Low
$0.40 \leq \bar{X} < 0.60$	Moderate
$0.60 \leq \bar{X} < 0.80$	High
$0.80 \leq \bar{X} < 1.00$	Very high

The product practicality test is carried out by teachers and students. While the practicality test by teachers used the Likert scale, the students' practicality test was performed using the Guttman scale. The scoring result was then converted based on the categorization criteria as shown in Table 3.

Table 3. Practicality category

Interval (%)	Practicality Category
$0.0 \leq \bar{X} < 20.0$	Impractical
$20.0 \leq \bar{X} < 40.0$	Less practical
$40.0 \leq \bar{X} < 60.0$	Fairly Practical
$60.0 \leq \bar{X} < 80.0$	Practical
$80.0 \leq \bar{X} < 100.0$	Highly practical

The product's effectiveness was evaluated through the N-Gain test and the hypothesis test. The hypothesis test that was used was the paired-sample t-test method. Table 4 presents the interpretation of N-Gain.

Table 4. N-Gain interpretation

Interval	Categorization
$0.70 \leq N - Gain < 1.00$	High
$0.30 \leq N - Gain < 0.70$	Moderate
$0.00 \leq N - Gain < 0.30$	Low

RESULTS AND DISCUSSION

Initial investigation

The initial investigation is conducted to discover data regarding the underlying causes of issues in the field that form the basis of the research and development study. The preliminary research activities were carried out by observing videos on YouTube. It was found that out of 20 YouTube channels, only 0.5% of animated videos presented explanations of mathematical concepts through short stories, which are highly favored by children. This indicates the lack of appeal of the currently available learning videos on the internet for students. This is in line with research conducted by Wulandari and Nugroho (2020), who found that learning videos currently circulating on the internet are not very interesting for students.

Based on the student need analysis through literature studies and observations, children aged 7–11 are in the stage of concrete operational thinking. More specifically, when learning geometry, children at this age are in the stage of recognizing shapes based on the visual similarities they perceive. Therefore, providing appropriate stimuli using suitable media can facilitate the delivery of learning materials through enjoyable and challenging learning activities, one of which is learning videos. The development of animated videos with fairy tales is considered practical and can attract children's interest (Ariani et al., 2021). Meanwhile, the content analysis through literature review activities concluded that there are eight learning objectives in the domain of geometry for first-grade students. However, the researcher found that there is a need for several adjustments in its implementation to encompass all the intended learning objectives.

Design

The product design was developed in the form of a manuscript or storyboard and students' worksheets, which were then materialized into prototypes during the construction stage. The storyboard was created by considering the main elements of a story, namely the theme, characters, traits, setting, plot, perspective, and moral message. The researchers chose an adventure theme with animal characters set in a fascinating fantasy world for Grade 1 students. In developing the story, a "story arc" is employed to establish the plot or narrative structure, consisting of five stages: exposition, complication, crisis, climax, and resolution.

On the other hand, students' worksheets were organized into three activities, taking into account the learning materials aligned with the learning objectives of the geometry domain for Grade 1. The challenges faced by the characters were translated into questions on the worksheets, which were then solved by the students. Each question or activity was provided to be completed at the end of each episode.

Construction

The process of developing the prototype started with preparing the necessary tools, creating assets or properties, recording video and audio, and concluding with editing and rendering. Some tools were prepared, such as hand puppets, cameras, tripods, sound recorders, audio mixers, computers, and various editing applications such as Adobe Audition, Adobe After Effects, Adobe Premiere Pro, Adobe Illustrator, and Adobe Photoshop. After the tools were prepared, the researchers proceeded to create assets, including characters in the story, illustrations for worksheet content and material explanations, backgrounds, foregrounds, and other necessary properties for the recording process. Once the assets were completed, the next step involved recording the video and audio. The results obtained from the recording process were then edited using the aforementioned applications. The editing phase began by transforming the illustrations and video recordings into simple animations with added motion or movement effects. The edited results were then combined with the recorded audio during the rendering process. Besides, the researchers also prepared various instruments required for assessing the validity, practicality, and effectiveness of the product.

Testing, evaluation, and revision

Material validation was performed by two material experts and three media experts. The validation results conclude that the developed interactive storytelling-based learning video has a very high level of validity. The results of material and media experts' validation are presented in Table 5 and Table 6.

Table 5. Content validation result

Assessment aspect	Mean score	Validity criteria
Material presentation	0.854	Very high
Language use	0.917	Very high
Media Effect	0.958	Very high
Total mean score	0.910	Very high

Table 6. Media validation result

Assessment aspect	Mean score	Validity criteria
Language	0.875	Very high
Integrity	0.854	Very high
Appearance	0.900	Very high
Direct or indirect use	0.813	Very high
Total mean score	0.860	Very high

After the product is deemed valid and revised according to the validators' suggestions, the next step is to conduct practicality and effectiveness tests. The practicality test was carried out by a teacher and all students in Class 1.2 at SD Muhammadiyah 16 Surakarta. The practicality test showed that the developed interactive storytelling-based learning video was highly practical for educational purposes. The results of the practicality testing conducted by the teachers and students are presented in Table 7 and Table 8, respectively.

Table 7. Teacher's practicality test result

Assessment aspect	Score (%)	Practicality criteria
Flexibility	80	Highly practical
Direct or indirect use	95	Highly practical
Practicality	100	Highly practical
Mean Score	91.67	Highly practical

Table 8. Students's practicality test result

Assessment aspect	Score (%)	Practicality criteria
Flexibility	66.67	Practical
Direct or indirect use	85.87	Highly practical
Practicality	88.41	Highly practical
Mean Score	80.31	Highly practical

In the next step, the media effectiveness was evaluated through the N-Gain test and hypothesis test using the paired-sample t-test method. Based on the results of the N-Gain and hypothesis tests, it can be inferred that the developed interactive storytelling-based learning video is effective in improving students' numerical literacy. These results were also supported by the research conducted by Karmila et al. (2021), who found that using interactive learning videos can improve the understanding of students' concepts, learning motivation, and learning outcomes.

The mean N-Gain was 0.668, which fell into the category of moderate improvement. This indicates that the developed interactive storytelling-based learning video could enhance students' numerical literacy. Furthermore, this result was reinforced by a hypothesis test using the paired-sample t-test method. The calculated *tobs* was 11.4084 with the critical region of ={t│t>1,721}. Since it was *tobs* > 1,721, it can be concluded that the average post-test score is better than the average pretest score.

From these results, it appears that the storytelling-based interactive learning videos developed are valid for use in learning. The video is also considered practical for use in learning geometry. This learning video is considered effective for use in learning and can improve students' numeracy literacy skills in geometry material. These results are in line with the research results of Afifah et al. (2023) with the title "The Development of Adobe Flash CS6- Based Interactive Media to Improve Numerical Literacy Skills for Madrasah Ibtidaiyah Students," which shows that the media developed is declared very valid with an average percentage of 87%, very practical with an average percentage of 100%, and effective in improving students' numeracy literacy skills with an N-Gain result of 0.49.

Implementation

The next step was the implementation stage. The implementation stage is a follow-up stage after the media developed has been tested. In this research, after the media was declared valid, practical, and efficient, the developed media was disseminated to teachers in SD Muhammadiyah 16 Surakarta, especially first-grade teachers.

CONCLUSION

Based on the research findings and discussions related to the development of interactive storytelling-based learning videos to enhance students' numerical literacy in geometry, some conclusions can be drawn that the development of interactive storytelling-based learning videos was conducted using Plomp's development model that consists the initial investigation, design, construction (realization), trial (evaluation, and revision), and implementation stages. The product was deemed valid, with an average total validity score of 0.910 for material validation and 0.860 for media validation. Besides, the product was considered practical, with average scores of 91.67% for teachers and 80.31% for students. On the other hand, the product was found to be effective in enhancing students' numerical literacys based on the results of the hypothesis test using the paired-sample t-test method, with a calculated value of $tobs$ = 11.4084 and critical region ={t|t>1.721}. Additionally, the average N-Gain was 0.668, indicating a moderate level of improvement. The future studies are expected to focus on the development of other interactive video or learning media for students in higher grades. Furthermore, future studies are also expected to develop other learning media that can enhance students' numerical literacy.

ACKNOWLEDGEMENT

This article has been presented orally at the 4th International Conference on Science, Mathematics, Environment, and Education; and exclusively published at the International Journal on Education Insight.

The authors would like to thank the Sebangku Games as partners for the development proccess in this research. The authors are also very grateful to Muhammadiyah 16 Surakarta Elementary School for their willingness to help with this research. Without their help, this research would not have run smoothly.

REFERENCES

Afifah, D. S. N., Nafi'an, M. I., & Manggar, D. A. (2023). The development of Adobe Flash CS6-based interactive media to improve numerical literacy

skills for Madrasah Ibtidaiyah students. *Jurnal Matematika Kreatif-Inovatif, 14*(1), 75–85.

Ambarwati, D., & Kurniasih, M. D. (2021). Pengaruh problem based learning berbantuan media youtube terhadap kemampuan literasi numerasi siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 5*(3), 2857–2868. https://doi.org/10.31004/cendekia.v5i3.829

Ariani, N. K., Widiana, I. W., & Ujianti, P. R. (2021). Media video animasi untuk meningkatkan listening skill anak usia dini. *Jurnal Pendidikan Anak Usia Dini Undiksha, 9*(1), 43–52.

Budiyono. (2017). Statistika untuk Penelitian. UNS Press.

Hasiru, D., Badu, S. Q., & Uno, H. B. (2021). Media-media pembelajaran efektif dalam membantu pembelajaran matematika jarak jauh. *Jambura Journal of Mathematics Education, 2*(2), 59–69. https://doi.org/10.34312/jmathedu.v2i2.10587

Karmila, D., Putri, D. M., Berlian, M., Pratama, D. O., & Fatrima. (2021). The role of interactive videos in mathematics learning activities during the Covid-19 pandemic. *Proceedings of the International Conference on Educational Sciences and Teacher Profession (ICETeP 2020)*, 141–144. https://doi.org/10.23917/varidika.v31i2.10

Kementerian Pendidikan dan Kebudayaan. (2017). *Panduan Gerakan Literasi Nasional*. Kementerian Pendidikan dan Kebudayaan.

Lechner, C. M., Gauly, B., Miyamoto, A., & Wicht, A. (2021). Stability and change in adults' literacy and numeracy skills: Evidence from two large-scale panel studies. *Personality and Individual Differences, 180*. https://doi.org/10.1016/j.paid.2021.110990

Lestari, D. A. (2017). Pengembangan media digital storytelling berbasis website untuk meningkatkan hasil belajar ekonomi siswa di SMA Negeri 5 Tanjung Jabung Timur. *Bachelor thesis*. Universitas Sebelas Maret. https://digilib.uns.ac.id/dokumen/detail/71479

Nabila, N. (2021). Konsep pembelajaran matematika SD berdasarkan teori kognitif Jean Piaget. *JKPD: Jurnal Kajian Pendidikan Dasar, 6(*1), 69–79.

Nasikhah, A. D., Yuliyani, M., Khikmah, N., & Safitri, W. D. (2021). Analisis kebutuhan terhadap video pembelajaran matematika dalam meningkatkan pemahaman konsep siswa pada masa pandemi Covid-19 di SMK N 1 Batang. *Konferensi Ilmiah Pendidikan Universitas Pekalongan 2021*, 121–126. https://proceeding.unikal.ac.id/index.php/kip

Poernomo, E., Kurniawati, L., & Atiqoh, K. S. N. (2021). Studi literasi matematis. *Algoritma Journal of Mathematics Education (AJME), 3(*1), 83–100. https://doi.org/10.15408/ajme.v3i1.20479

Sutama, Novitasari, M., & Narimo, D. S. (2020). Numerical literacy ability in learning mathematics based on 21st century skills in primary school. *Ilkogretim Online, 19*(4), 194–201. https://doi.org/10.17051/ilkonline.2020.04.121

Unaenah, E., Anggraini, I. A., Aprianti, I., Aini, W. N., Utami, D. C., Khoiriah, S., & Refando, A. (2020). Teori Van Hiele dalam pembelajaran bangun datar. *Jurnal Pendidikan dan Ilmu Sosial, 2*(2), 365–374.

Wulandari, E., & Nugroho, W. (2020). Sikap siswa terhadap video pembelajaran jarak jauh materi statistika pada media sosial Youtube. *Edumatica: Jurnal Pendidikan Matematika, 10*(2), 1–9.