



Development of Interactive Educational Videos to Improve Children's Math Skills in Kindergarten

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Abstract: This study aimed to develop and analyze the validity, practicality, and effectiveness of Canva-based Interactive Educational Videos to improve the mathematical abilities of children aged 5–6 years in kindergarten learning. The novelty of this research lies in the integration of animated visualization, audio narration, interactive quizzes, and self-assessment features into a Canva-based numeracy learning media specifically designed for early childhood education using the ADDIE development model. This research employed the Research and Development (R&D) method with the ADDIE model consisting of Analysis, Design, Development, Implementation, and Evaluation stages. The research subjects consisted of 20 children aged 5–6 years in Group B at Humhaz Kindergarten, West Pasaman, Indonesia. Data were collected through observation, interviews, questionnaires, documentation, and pretest-posttest tests, then analyzed using descriptive statistics and N-Gain analysis. The results showed that the developed media obtained a validity score of 93.3% from material experts and 95.8% from media experts, both categorized as very valid. The practicality test results reached 95% in the small-group trial and 100% in the large-group trial, indicating that the media were very practical and easy to implement in classroom learning. Furthermore, the average score increased from 19.15 in the pretest to 25.1 in the posttest, with an N-Gain value of 0.5350 categorized as moderate improvement, indicating that the media were sufficiently effective in improving children's mathematical abilities. However, this study was limited to one kindergarten with a relatively small sample size and short implementation duration. Practically, the developed media can be applied by PAUD/TK teachers as an interactive digital learning medium to support numeracy instruction through projector- or device-assisted classroom activities that are more engaging and developmentally appropriate for early childhood learners.

Keywords: ADDIE model; Early Childhood Education; Interactive Educational Videos; Mathematical Ability; Numeracy Learning.

Introduction

Education has a fundamental role in shaping human resources that are able to adapt to the demands of the 21st century. In the context of Early Childhood Education (PAUD), the educational process is directed to optimize all aspects of child development, including cognitive development as the basis for logical thinking and problem-solving skills at the next stage of education.

One of the important cognitive competencies that need to be stimulated early on is math skills or numeracy literacy. Numeracy skills in early childhood are not only related to numeracy, but also include the ability to recognize patterns, classify objects, understand number symbols, compare quantities, and build logical reasoning through meaningful learning experiences. This competence is very important because children aged 5-6 years are in the golden age, which is a period of

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brain development that takes place very quickly and affects children's academic readiness at the next level of education (Azzahra & Nurhafizah, 2024; Husna & Nurhafizah, 2022). In line with the implementation of the Independent Curriculum, numeracy literacy is one of the important components in strengthening children's cognitive competence through contextual, student-centered, and technology-integrated learning (Hidayat et al., 2024; Nuraeni et al., 2025). In addition, interactive digital learning media is able to increase student engagement, learning motivation, and concept understanding through a more meaningful multisensory learning experience (Susanti et al., 2022; S. Susilawati et al., 2022).

Conceptually, mathematics learning in early childhood needs to be designed according to the characteristics of children's cognitive development (Novrianti & Nurhafizah, 2024). Based on the theory of cognitive development put forward by Jean Piaget, children aged 5-6 years are in the preoperational stage, which is the stage when the ability to think symbolically begins to develop but still needs concrete representations to understand abstract concepts (Piaget & Inhelder, n.d.; Saul, 2024). Therefore, learning mathematics in early childhood should emphasize a visual, interactive, and exploratory learning experience rather than memorization-oriented learning. In this context, interactive educational videos are a relevant medium because they are able to integrate visual animation, narrative, sound, color, and movement to facilitate the multisensory learning process. The Cognitive Theory of Multimedia Learning also explains that children will understand information more effectively when verbal and visual information are presented simultaneously through multimedia integration (Chen et al., 2020; Mukarromah & Agustina, 2021). Interactive digital media also supports active participation and self-assessment processes that can increase children's engagement and understanding of concepts (Lukita et al., 2017; Sachan, 2023). Canva-assisted multimedia-based learning and interactive media can improve students' learning outcomes, learning independence, and mathematical literacy skills by providing engaging visualizations and active learning opportunities (Adhana & Andriani, 2024; Nuri et al., 2023). In addition, Canva-based media is increasingly being used because it is practical, flexible, easy to operate, and accessible to teachers despite having limited digital design skills (Musdalifah et al., 2024).

Although the use of technology-based learning media continues to grow, various empirical findings show that early childhood mathematics skills in various kindergartens in Indonesia are still relatively low. A similar condition was found in Humhaz West Pasaman Kindergarten, where the results of initial observations

showed that the development of children's mathematical skills had not reached the expected indicators optimally with an average developmental achievement of only 33.3%. Most children are still in the "Undeveloped" category, especially in the ability to recognize number symbols, sort numbers, recognize patterns, and compare object sizes (Fitri et al., 2020). This condition is closely related to the use of monotonous and teacher-centered learning strategies through lecture methods, worksheets, and static visual media so that children do not have the opportunity to actively explore (Chakra Setiawan et al., 2022; Tran & Phan, 2022). In addition, teachers pedagogic and technological competence in integrating Information and Communication Technology (ICT) into learning is also limited (Maden, 2023; Mahmood et al., 2022). As a result, learning activities have not been able to accommodate children's multisensory learning characteristics optimally. The low use of digital learning media has an impact on low learning motivation, student participation, and understanding of basic mathematics concepts (Caella & Yulianto, 2024; Suryana, 2025).

Although previous studies have developed multimedia learning and digital educational media, most studies still focus on general animated videos, electronic worksheets, or educational game applications without integrating interactive self-assessment features specifically designed to stimulate early childhood math skills. In addition, research on the development of Canva-based interactive educational videos using the ADDIE development model in the context of early childhood numeracy learning is still limited. Therefore, the novelty of this research lies in the development of Canva-based Interactive Educational Videos that integrate animated visualizations, audio narration, interactive quizzes, and self-assessment activities into structured math learning specifically for children aged 5-6 years. In contrast to previous research, this study not only tests the validity and practicality of media, but also analyzes the effectiveness of media empirically through pretest-posttest analysis and N-Gain calculation on improving children's mathematical skills. This research is important because it provides innovative solutions to the limitations of conventional mathematics learning while supporting the transformation of digital pedagogy of PAUD teachers in the implementation of the Independent Curriculum. In addition to making a theoretical contribution to strengthening the implementation of multimedia learning in early childhood education, this study also provides practical contributions in the form of learning media that are easy to use, effective, and in accordance with the characteristics of children's development to improve numeracy skills from an early age. Thus, the purpose of this study is to develop, test the validity, practicality,

and effectiveness of Canva-based Interactive Educational Videos in improving early childhood math skills in the context of kindergarten learning.

Method

Research Design

This study employed the Research and Development (R&D) method aimed at developing a learning product in the form of Canva-based Interactive Educational Videos to improve early childhood mathematical abilities. The R&D approach was selected because this research not only examined educational phenomena but also systematically developed, validated, and tested the effectiveness of a learning media product. The development model used in this study was the ADDIE model, consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was chosen because it provides a structured, systematic, and flexible framework suitable for developing technology-based learning media in early childhood education contexts (Cresswell, n.d.; Sugiyono, 2013)

Time and Location of the Research

This research was conducted during the 2025 academic year at Humhaz Kindergarten, West Pasaman Regency, West Sumatra, Indonesia. The research implementation was carried out from February to April 2025, covering the stages of preliminary observation, media development, validation, product trials, implementation, and evaluation.

Research Subjects

The subjects involved in this study consisted of expert validators, teachers, and children aged 5-6 years in Group B at Humhaz Kindergarten. The expert validators included one material expert and one media expert responsible for assessing the feasibility, quality, and suitability of the developed media. The practicality test involved classroom teachers as practitioners who evaluated the usability and implementation efficiency of the media in classroom learning activities. Furthermore, the effectiveness test involved 20 children in Group B as research participants selected using purposive sampling techniques because they matched the criteria and developmental characteristics required in this study.

Research Procedure

The research procedure referred to the ADDIE development model, which consisted of five systematic stages as shown in figure 1 below:

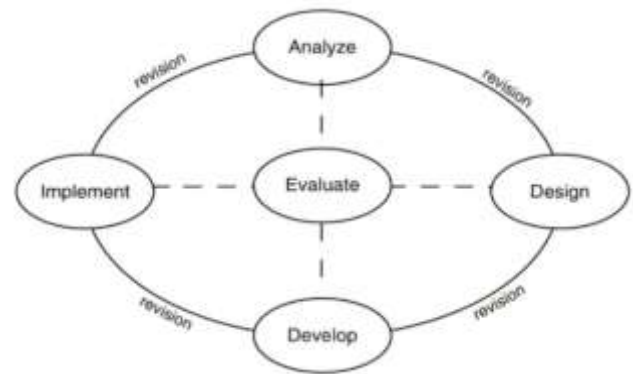


Figure 1. Research Procedure

Analysis Stage

researchers identified learning needs, classroom conditions, teacher competencies, and children’s mathematical development characteristics through observation and interviews. The results of preliminary observations indicated that children’s mathematical abilities were still relatively low, particularly in recognizing number symbols, sequencing numbers, identifying patterns, and comparing object sizes.

Design Stage

Focused on planning the structure and content of the interactive educational video. Researchers prepared learning scenarios, storyboards, learning indicators, visual designs, interactive quizzes, and narration scripts aligned with early childhood developmental characteristics and mathematics learning objectives.

Development Stage

The interactive educational videos were produced using the Canva platform by integrating animation, audio narration, colorful illustrations, and interactive evaluation features. The developed product was subsequently validated by material experts and media experts to assess content appropriateness, instructional quality, visual appearance, functionality, and language suitability.

Implementation Stage

Involved limited and large-group trials conducted in classroom learning activities. Teachers utilized the developed media during mathematics learning sessions, while researchers observed children’s participation and learning responses throughout the instructional process.

Evaluation Stage

The evaluation stage aimed to determine the practicality and effectiveness of the developed product through questionnaires, observations, interviews, and pretest-posttest comparisons. Product revisions were

also conducted based on expert suggestions and trial results to improve media quality comprehensively.

Data Collection Techniques

Data collection techniques used in this study included: 1) Observation was conducted to identify classroom learning conditions, children's participation, and initial mathematical abilities before treatment implementation; 2) Interviews were conducted with classroom teachers to obtain information regarding learning difficulties, media utilization, and classroom instructional needs; 3) Validation Questionnaires were administered to material experts and media experts to assess the feasibility and quality of the developed media product; 4) Practicality Questionnaires were distributed to teachers to evaluate ease of use, efficiency, attractiveness, and implementation practicality of the media; 5) Pretest and Posttest instruments were used to measure improvements in children's mathematical abilities after using the interactive educational videos; 6) Documentation techniques were employed to collect supporting data in the form of photographs, field notes, lesson activities, and product development records.

Data Analysis

Data analysis techniques in this study consisted of descriptive and inferential statistical analyses. Validity obtained from expert validators were analyzed using percentage descriptive analysis. Practicality questionnaire data from teachers were analyzed descriptively using percentage calculations to determine the practicality level of the developed media in classroom implementation. The effectiveness of the developed media was analyzed through pretest and posttest comparisons using the Paired Sample t-Test to determine significant differences before and after treatment implementation. The N-Gain Score analysis was conducted to determine the improvement level of children's mathematical abilities after treatment using the following formula:

$$N - gain = \frac{\text{Mean posttest} - \text{mean pretest}}{\text{Max Skor} - \text{mean pretest}} \quad (1)$$

The N-Gain results were categorized into low, medium, and high improvement criteria to determine the effectiveness level of the developed interactive educational videos.

Result and Discussion

Results of the Analysis Stage

The analysis stage was carried out to identify learning conditions, teacher competence, media availability, and children's early mathematics skills at

Humhaz West Pasaman Kindergarten. The results of initial observations show that children's mathematical skills have not developed optimally. The average child development achievement only reaches 33.3%, while most children (66.7%) are still in the Not Emerging category, especially in the ability to recognize number symbols, sort numbers, recognize patterns, and compare object sizes. The findings show that children's numeracy skills still require more intensive stimulation through innovative and interactive learning strategies.








Children's low math ability is influenced by several learning factors. Learning activities are still dominated by conventional approaches that are centered on teachers through lecture methods, the use of worksheets, and static visual media. As a result, children are less actively involved in the learning process and have difficulty understanding abstract mathematical concepts. These findings are in line with previous research that states that monotonous learning methods cause low learning engagement and understanding of children's concepts because they are not able to accommodate the characteristics of multisensory learning (Chakra Setiawan et al., 2022; P. Quilapio & C. Callo, 2022)

In addition, the limited competence of teachers in integrating Information and Communication Technology (ICT) into learning also affects the effectiveness of the teaching and learning process (Maden, 2023; Mahmood et al., 2022). The use of interactive multimedia and technology-based learning media has a significant effect on student participation, learning motivation, and concept understanding (Susanti et al., 2022). Therefore, there is a need for learning media innovations that are able to visualize abstract mathematical concepts into concrete and fun learning experiences for early childhood.

Canva-Based Interactive Educational Video Development

Based on the results of the analysis stage, the researcher designed and developed a Canva-based Interactive Educational Video that was tailored to the characteristics of early childhood development. The product was developed using the Canva platform because it has practical, flexible, and easy-to-use features that make it easier for teachers to create engaging multimedia learning content without the need for advanced digital design skills. The developed media integrates animated visualization, audio narration, color illustrations, background music, interactive quizzes, and self-assessment activities into structured math learning modules.

Table 1. Interactive Educational Video Media Storyboard

Slides	Visual	Audio	Remarks
Opening		Cheerful music (instrumental) & Narrator: "Hello friends! Welcome to a fun math adventure!"	Gaining attention: Grabbing the child's attention at the beginning of the video.
Purpose & guide		Narration: "Today we will learn to recognize numbers, group objects, and measure objects around us!"	Informing learners of objectives: Communicating what will be learned.
Module 1: Number symbols		Narration: "This is number one... one apple. Try to calculate how many apples there are?"	Presenting content: Introduce number symbols and one-to-one correspondence.
Module 2: Classification		Narration: "Let's group! Put the red object in the red basket, and the yellow object in the yellow basket."	Learning guidance: Provides guidance for classifying objects.
Module 3: Sequencing		Narrative: "Look at the pattern: one, two, three. After three, what number?"	Pattern recognition: Stimulates the ability to recognize patterns and sequences.
Module 4: Measurement		Narrative: "Which is heavier? Which is longer? Let's compare!"	Concept of measurement: Introducing non-standard size comparison (weight/length).
Closing		Narration: "Wow, you guys are great at completing your adventure today. See you in the next lesson!"	Enhance retention: Summarize material so that children's memories last longer.

The interactive educational video consists of four main modules, namely number symbol recognition, object classification, number sequencing, and simple measurement concepts. Each module is systematically designed according to the child's stage of cognitive development and the principles of multisensory learning. Interactive quizzes and audio narration are integrated to encourage active participation as well as a child's independent learning experience.

The development of this media is in line with the Cognitive Theory of Multimedia Learning which explains that children understand concepts more effectively when information is presented through simultaneous verbal and visual representations (Chen et al., 2020). In addition, the integration of animation, audio narration, and interactive activities supports the Dual Coding Theory proposed by Allan Paivio, where verbal and nonverbal information is processed through

different cognitive channels so as to strengthen memory retention and understanding of children's concepts (Clark & Paivio, 1991).

Canva-based multimedia learning effectively improves learners' learning engagement, concept understanding, and learning outcomes because it combines engaging visual design with interactive learning activities (Adhana & Andriani, 2024; Musdalifah et al., 2024). Thus, the interactive educational videos developed are considered relevant to support meaningful numeracy learning in early childhood education.

Product Validity

The developed product is validated by material experts and media experts to determine the feasibility level before being implemented in learning activities.

Table 2. Develop Assesment Instrument

Validity	Percentage (%)	Feasibility Criteria
Media	95.8	Very valid
Material	93.3	Very valid

The validation results showed that Canva-based Interactive Educational Videos obtained a validity score of 93.3% from subject matter experts and 95.8% from media experts in the "Highly Valid" category.

The high material validation score shows that the developed media is in accordance with the PAUD curriculum standards, learning objectives, and characteristics of early childhood cognitive development. The preparation of materials, language use, mathematical ability indicators, and learning activities are considered appropriate to stimulate the mathematical ability of children aged 5–6 years. Meanwhile, a high media validation score indicates that the developed videos have excellent visual quality, layout, animation integration, audio clarity, color composition, and interactivity. This aspect contributes to creating an interesting and child-friendly learning media so that it is able to maintain children's attention during the learning process.

These validity results support previous research that states that interactive multimedia-based learning media is able to provide effective visualization and improve the quality of learning in early childhood education (Ilyas et al., 2023; Jabborova & Olimov, 2020). Canva's assisted interactive learning media has a high level of validity because it is able to effectively integrate pedagogical content, multimedia visuals, and interactive learning experiences (Musdalifah et al., 2024). In addition, the validation results showed that the developed media successfully transformed abstract mathematical concepts into concrete visual experiences that corresponded to the characteristics of early

childhood learning. These findings are in line with Piaget's theory of cognitive development which emphasizes the importance of concrete representations and active experiences in the preoperational stages.

Practicality of Interactive Educational Videos

Table 3. Small group practicality

No	Statement of Practicality Instrument	Value
1	Interactive educational videos are easy to play and integrate into daily classroom activities.	4
2	The time needed to prepare this media is relatively short compared to making conventional media.	4
3	Media can be run well using devices available in schools without any specification constraints.	3
4	This media is effective in attracting attention and increasing children's concentration during math sessions.	4
5	Interactive features (quizzes) help children test their understanding independently (self-assessment).	4
Quantity		19
Average		3.8
Percentage		95%

Table 4. Practicality of Large Groups

No	Statement of Practicality Instrument	Value
1	Interactive educational videos are easy to play and integrate into daily classroom activities.	4
2	The time needed to prepare this media is relatively short compared to making conventional media.	4
3	Media can be run well using devices available in schools without any specification constraints.	4
4	This media is effective in attracting attention and increasing children's concentration during math sessions.	4
5	Interactive features (quizzes) help children test their understanding independently (self-assessment).	4
Quantity		20
Average		4
Percentage		100%

The results of the practicality test showed that the interactive educational videos developed were included in the "Very Practical" category. The small-group test obtained a practicality percentage of 95%, while the large-group test reached 100%. Teachers stated that the media is easy to operate, efficient to use, attractive to children, and can be run using the devices available in the school without requiring complicated technical preparation.

The teacher also said that the integration of audio narration, color animations, and interactive quizzes was able to increase children's concentration and enthusiasm during mathematics learning. Compared to conventional learning methods, the media developed is able to create a more fun and interactive learning atmosphere so that children are encouraged to be more active in learning activities.

These practical results support previous research that states that technology-based interactive media can improve the efficiency of classroom management and teachers' confidence in implementing innovative learning (Bakhri et al., 2021; Ngadni & Cing, 2025). Interactive features also facilitate an independent learning experience through self-assessment activities

that are important for developing children's learning independence and engagement.

Multimedia learning media is effective in increasing learning motivation, class participation, and learning interaction because students become more active during learning activities (Caella & Yulianto, 2024; Susanti et al., 2022). Thus, the media developed not only functions as a learning tool, but is also able to create a more meaningful and student-centered learning environment.

The Effectiveness of Interactive Educational Videos on Children's Mathematics Skills

The effectiveness of the developed media was analyzed through pretest-posttest comparison and N-Gain calculation.

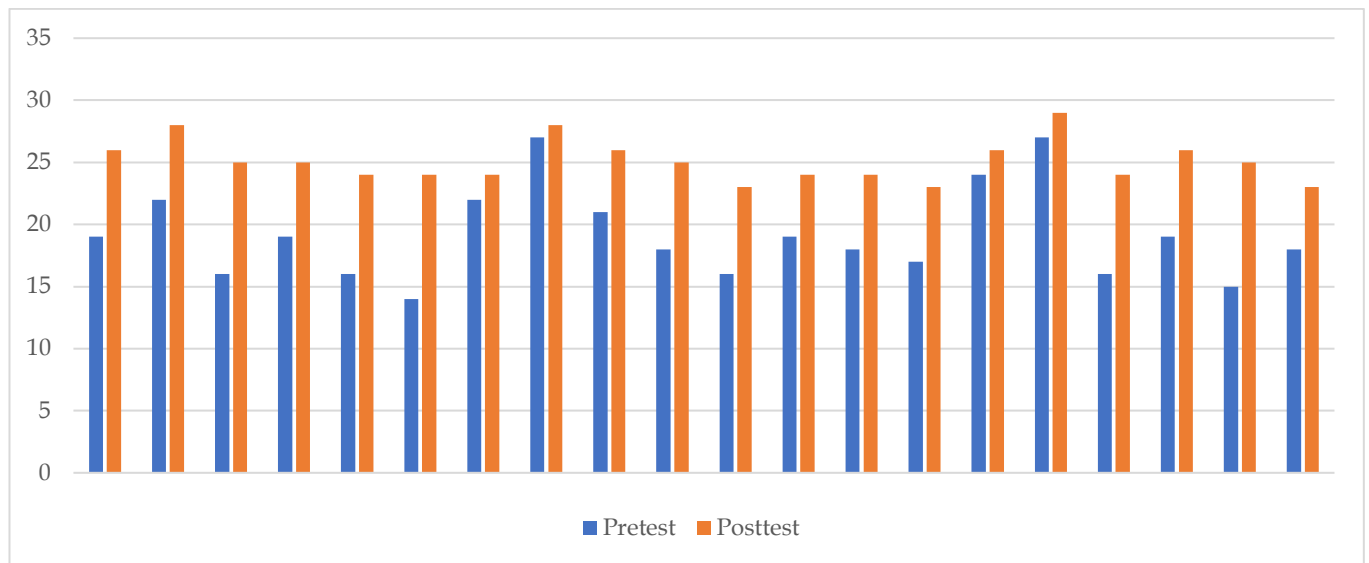


Figure 2. Large Scale Test Pre-test Post-test Comparison

The results showed a significant improvement in children's math skills after using Canva-based Interactive Educational Videos. The average pretest score increased from 19.15 to 25.1 on the posttest results.

Table 5. N-gain Score

	N	Min	Max	Mean	Hours of deviation
Ngain_Score	20	.25	.75	.5350	.12929
Ngain_Presses	20	25.00	75.00	53.5027	12.92871
Valid N (listwise)	20				

The calculation results show an N-Gain value of 0.5350 in the category of "Moderate" or "Quite Effective". The findings show that the interactive educational videos developed are effective in improving children's ability to recognize number symbols, sort numbers,

group objects, recognize patterns, and understand simple measurement concepts.

The effectiveness of this media can be explained through the integration of multisensory learning experiences that combine visual, auditory, and interactive stimulation simultaneously. Based on Generative Learning Theory, meaningful learning occurs when learners actively build knowledge through interactive cognitive processes (A. Susilawati et al., 2022). In this study, interactive quizzes and self-assessment activities encourage children to become active participants, not just passive recipients of information (Yulia et al., 2021).

The findings of this study are in line with previous research that stated that interactive video-based learning is able to improve students' concept understanding, critical thinking skills, and learning engagement because it provides a more concrete and meaningful learning experience (Chen et al., 2020; Sachan, 2023). Multimedia-

assisted learning has a positive influence on mathematical literacy skills, learning motivation, and problem-solving skills through dynamic visualization and interactive learning activities (Az-Zahra et al., 2025; Nuri et al., 2023; Rahman et al., 2021).

Compared to previous research, this study makes a more specific contribution to the context of early childhood numeracy learning through the integration of Canva-based animated videos, audio narrations, interactive quizzes, and self-assessment features into learning media that was systematically developed using the ADDIE model. Thus, this study strengthens the empirical evidence that technology-based multimedia learning is effective in improving early childhood mathematics skills while supporting the implementation of the Independent Curriculum through meaningful and student-centered learning experiences.

Overall, the results show that Canva-based Interactive Educational Videos are valid, practical, and effective in improving early childhood math skills. The media developed also makes a practical contribution to teachers through the provision of digital learning media that is easy to use, innovative, interactive, and in accordance with the characteristics of children's development in kindergarten learning.

Conclusion

This study concluded that Canva-based Interactive Educational Videos developed through the ADDIE model were declared valid, practical, and effective in improving early childhood math skills, especially in the aspects of recognizing numbers, patterns, object grouping, and simple measurements. The improvement of children's abilities is shown through pretest-posttest results and N-Gain values in the medium category. The novelty of this research lies in the integration of visual animation, audio narration, interactive quizzes, and self-assessment in Canva-based numeracy learning media that are in accordance with the characteristics of early childhood multisensory learning. This research is still limited to one PAUD institution with a limited number of subjects and implementation time. Practically, this media can be used by PAUD teachers as an alternative to digital numeracy learning that is more interactive and interesting in the classroom. Therefore, further research is recommended to involve a wider sample and develop interactive media on other aspects of child development in order to obtain more comprehensive results.

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Author Contributions

WDY: Research concept, media design, data collection, analysis, article writing. NH: Theory development, methodology, data analysis, article revision. RKM: Initial media design, product trial, data collection, analysis. DS: Field testing, data processing, media evaluation, writing trial results.

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Conflicts of Interest

The authors declare no conflict of interest.

References

- Adhana, H. M., & Andriani, A. E. (2024). Development of Interactive Multimedia based on Problem-Based Learning to Improve IPAS Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 10(9), 6737–6745. <https://doi.org/10.29303/jppipa.v10i9.7588>
- Az-Zahra, R. T., Suryana, D., Yaswinda, & Eliza, D. (2025). Development of Smart Box Media Based on QR Code Technology to Improve Early Childhood Numerical Literacy Skills. *Jurnal Penelitian Pendidikan IPA*, 11(3), 80–86. <https://doi.org/10.29303/jppipa.v11i3.10538>
- Azzahra, R. T., & Nurhafizah, N. (2024). Manajemen Pengembangan Sumber Daya Guru Dalam Meningkatkan Profesionalisme Pendidik Paud. *Thufuli: Jurnal Ilmiah Pendidikan Islam Anak Usia Dini*, 6(2), 37–48. <https://doi.org/10.33474/thufuli.v6i2.22078>
- Bakhri, S., Dede, D., Rahmawati, E., & ... (2021). Peningkatan Kompetensi Guru PAUD melalui Pelatihan Teknologi Informasi di Kecamatan Way Jepara Kabupaten Lampung Timur. *NEAR: Jurnal ...*, 1(1).
- Caella, L. A., & Yulianto, S. (2024). Keefektifan Media Video Animasi untuk Meningkatkan Minat Dan Hasil Belajar Mata Pelajaran IPAS Kelas IV SD Negeri Klumprit 01 Nusawungu Kabupaten Cilacap. *Jurnal Penelitian Pendidikan IPA*, 10(9), 6621–6630. <https://doi.org/10.29303/jppipa.v10i9.8445>
- Chakra Setiawan, H., Nugroho, W., & Abdur Rofi, H. (2022). The Importance Of Video As Learning Media According To Principle Of Media Production "Visuals." *Interdisciplinary Journal and Hummanity (INJURITY)*, 1(3), 92–97. <https://doi.org/10.58631/injury.v1i3.24>
- Chen, G., Chan, C. K. K., Chan, K. K. H., Clarke, S. N., & Resnick, L. B. (2020). Efficacy of video-based

- teacher professional development for increasing classroom discourse and student learning. *Journal of the Learning Sciences*, 29(4-5), 642-680. <https://doi.org/10.1080/10508406.2020.1783269>
- Clark, J., & Paivio, A. (1991). Dual Coding Theory and Education. *Educational Psychology Review*, 3, 149-210. <https://doi.org/10.1007/BF01320076>
- Cresswell, J. W. (n.d.). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*.
- Fitri, A., Nurhafizah, & Yaswinda. (2020). Pengaruh media puzzle angka modifikasi terhadap kemampuan berhitung anak taman kanak-kanak. *Jurnal Pendidikan Tambusai*, 4(1), 7-12.
- Hidayat, A. S., Saiful Mutaqin, G., & Hermawati, M. (2024). Penguatan Kompetensi Pedagogik Guru dalam Penggunaan Media Informasi dan Komunikasi (TIK) pada Proses Pembelajaran. *Edu Cendikia: Jurnal Ilmiah Kependidikan*, 4(01), 51-65. <https://doi.org/10.47709/educendikia.v4i01.3794>
- Husna, A., & Nurhafizah. (2022). Strategi pembelajaran matematika mengenal nilai dan angka melalui bermain dan benda-benda konkret pada anak usia dini. *Pedagogi: Jurnal Ilmu Pendidikan*, 22(1), 24-33.
- Ilyas, A., Akbar, S. S., Hamza Wajid, S., Joghee, S., Fatima, A., & Mago, B. (2023). The Growing Importance of Modern Technology in Education. *2023 International Conference on Business Analytics for Technology and Security (ICBATS)*, 1-4. <https://doi.org/10.1109/ICBATS57792.2023.10111128>
- Jaborrova, D. F., & Olimov, S. S. (2020). Interactive Learning Technology. *The American Journal of Social Science and Education Innovations*, 02(12), 122-126. <https://doi.org/10.37547/tajssei/Volume02Issue12-21>
- Lukita, H., Sujana, Y., & Budiyanto, C. (2017). Can Interactive Learning Improve Learning Experience? A Systematic Review of the Literature. *Proceedings of the International Conference on Teacher Training and Education 2017 (ICTTE 2017)*. <https://doi.org/10.2991/ictte-17.2017.56>
- Maden, C. (2023). Improving Teachers' Skills for Pedagogic Use of Educational Technologies: Turkish Perspective. In *Research, Policymaking, and Innovation* (pp. 285-302). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-4349-2_14
- Mahmood, S., Butt, M., & Manzoor, A. (2022). The Impact of In-service Training on Teachers' Teaching and Students' Learning. *Global Educational Studies Review*, VII(I), 322-335. [https://doi.org/10.31703/gesr.2022\(VII-I\).32](https://doi.org/10.31703/gesr.2022(VII-I).32)
- Mukarromah, T. T., & Agustina, P. (2021). Gamifikasi Berbasis Aplikasi dan Pembelajaran Anak Usia Dini. *Edukids: Jurnal Pertumbuhan, Perkembangan, Dan Pendidikan Anak Usia Dini*, 18(1), 18-27. <https://doi.org/10.17509/edukids.v18i1.33338>
- Musdalifah, M., Lumowa, S. V. T., & Rambitan, V. M. M. (2024). Development of Canva-Based Electronic Student Worksheet (E-LKPD) to Improve Student Biology Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 10(3), 1093-1104. <https://doi.org/10.29303/jppipa.v10i3.6929>
- Ngadni, I. N., & Cing, Y. Z. (2025). The Impact of Training on Professional Development to Integrate Technology into the Classroom among Preschool Teachers. *International Journal of Research and Innovation in Social Science*, IX(VI), 5523-5533. <https://doi.org/10.47772/IJRISS.2025.906000421>
- Novrianti, W., & Nurhafizah. (2024). Implementasi Media Papan Pintar Angka Modifikasi dalam Mengembangkan Kemampuan Berhitung Anak di Taman Kanak-Kanak Islam Shabrina. *Bunayya: Jurnal Pendidikan Anak*, 10(2), 263-272.
- Nuraeni, C., Anjani, R., & Nabila, S. W. M. (2025). Tingkat Kompetensi TIK Guru PAUD di Era Abad 21. *Kumarottama: Jurnal Pendidikan Anak Usia Dini*, 4(2), 43-55. <https://doi.org/10.53977/kumarottama.v4i2.1625>
- Nuri, B., Zikriana, L., & Iqbal, I. (2023). Effectiveness of Desmos Application Integrated with PjBL in Multimedia Mathematics Learning in Terms of Mathematical Literacy Skills. *Jurnal Penelitian Pendidikan IPA*, 9(11), 10457-10465. <https://doi.org/10.29303/jppipa.v9i11.5497>
- P. Quilapio, M., & C. Callo, E. (2022). The Effect of In-Service Training Programs on the Professional Development of Public Elementary School Teachers. *International Journal of Research Publications*, 107(1). <https://doi.org/10.47119/IJRP1001071820223799>
- Piaget, J., & Inhelder, B. (n.d.). *The Psychology of The Child*.
- Rahman, M. M., Doyan, A., & Sutrio, S. (2021). Efektifitas Perangkat Pembelajaran Pendekatan Multi Representasi Berbantuan Video Untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Penelitian Pendidikan IPA*, 7(SpecialIssue), 56-60. <https://doi.org/10.29303/jppipa.v7ispecialissue.1063>
- Sachan, M. (2023). Interactive Teaching Methodologies. *World Journal of Education and Humanities*, 5(1), p9. <https://doi.org/10.22158/wjeh.v5n1p9>
- Saul, M. (2024). Piaget's Theory and Stages of Cognitive Development. *Simply Psychology*, October, 1-34.
- Sugiyono, D. (2013). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*.
- Suryana, D. (2025). QR Code-Based Animated Videos to Improve Early Childhood Numeracy Literacy Skills.

- Icece*, 252–257.
<https://doi.org/10.5220/0014069800004935>
- Susanti, D., Sari, L. Y., & Fitriani, V. (2022). Increasing Student Learning Motivation through the Use of Interactive Digital Books Based on Project Based Learning (PjBL). *Jurnal Penelitian Pendidikan IPA*, 8(4), 2022–2028.
<https://doi.org/10.29303/jppipa.v8i4.1669>
- Susilawati, A., Yusrizal, Y., Halim, A., Syukri, M., Khaldun, I., & Susanna, S. (2022). Effect of Using Physics Education Technology (PhET) Simulation Media to Enhance Students' Motivation and Problem-Solving Skills in Learning Physics. *Jurnal Penelitian Pendidikan IPA*, 8(3), 1157–1167.
<https://doi.org/10.29303/jppipa.v8i3.1571>
- Susilawati, S., Doyan, A., Putri, I., & Taufik, M. (2022). Practicality of Physics Learning Tools using Blended Learning Model with Video Assistance on Momentum and Impulse Materials to Improve Problem Solving Ability of Students. *Journal of Science and Science Education*, 3(2), 91–95.
<https://doi.org/10.29303/jossed.v3i2.2575>
- Tran, T. B., & Phan, T. H. (2022). Development of CDIO-Based Programs from the Teacher Training Perspective. *International Journal of Learning, Teaching and Educational Research*, 21(5), 204–219.
<https://doi.org/10.26803/ijlter.21.5.11>
- Yulia, R., Mahyuddin, N., Nurhafizah, & Sulong, K. (2021). Exploring Children's Science and Mathematics Ability with Leaf Diary: A Case Study. *Al-Athfal: Jurnal Pendidikan Anak*, 7(2), 145–156.