Jurnal PG-PAUD TRUNOJOYO
Volume 13, Nomor 2, Tahun 2026, pp. 206-230
P-ISSN: 2528-3553, E-ISSN: 2613-9650
Open Access: https://doi.org/10.21107/pgpaudtrunojoyo.v13i2.34148



The Development of Digital Wayang-Based Learning Media to Enhance Cultural Literacy among Early Childhood Learners

Nur Fajrie[1]✉, **Rangga Alif Faresta**[2]
[1]Postgraduate Program in Elementary Education, Universitas Muria Kudus, Kudus, Indonesia
[2]Department of Digital Learning, Monash University, Melbourne, Australia

ARTICLE INFO

Article history:
Received April 21, 2026
Revised June 03, 2026
Accepted June 29, 2026
Available online October 31, 2026

Kata Kunci:
Anak Usia Dini, Literasi Budaya, Pandawa, Wayang Digital

Keywords:
Early Childhood, Cultural Literacy, Pandawa, Digital Wayang

This work is licensed under a Creative Commons Attribution 4.0 International License.

Copyright © 2026 by Author. Published by Universitas Trunodjoyo Madura.

ABSTRAK

Masa anak usia dini awal merupakan tahap perkembangan kritis, yang sering disebut sebagai masa keemasan yang mengalami pertumbuhan kognitif, sosial, emosional, dan budaya yang pesat. Pengembangan literasi budaya pada tahap ini sangat penting karena memperkuat pemahaman anak-anak tentang identitas lokal dan nilai-nilai budaya. Namun, memperkenalkan budaya tradisional Indonesia, khususnya Wayang menjadi semakin menantang karena daya tarik dan relevansi media pembelajaran konvensional yang terbatas dalam lingkungan pendidikan kontemporer. Oleh karena itu, mengintegrasikan warisan budaya dengan teknologi digital diperlukan untuk menciptakan pengalaman belajar yang menarik bagi anak-anak usia dini. Studi ini bertujuan untuk merancang dan mengembangkan media pembelajaran berbasis Wayang digital untuk meningkatkan literasi budaya di kalangan anak usia dini dan untuk menguji efektivitasnya sebagai media pembelajaran. Studi ini menggunakan pendekatan Penelitian dan Pengembangan (R&D) dengan desain eksploratif. Proses penelitian melibatkan tahapan pengumpulan informasi, perencanaan, desain produk, validasi, revisi, uji coba terbatas, pengujian lapangan, penyempurnaan produk, dan diseminasi. Partisipan meliputi guru dan siswa dari lima taman kanak-kanak selama tahun ajaran 2025/2026 yang dipilih melalui pengambilan sampel penelitian. Data dikumpulkan menggunakan observasi, wawancara, kuesioner, dan tes literasi, dan dianalisis melalui teknik kualitatif dan kuantitatif deskriptif. Hasil penelitian menunjukkan bahwa media wayang digital efektif meningkatkan literasi budaya anak-anak, yang ditunjukkan oleh nilai rata-rata kelas eksperimen sebesar 91,6 dan indeks peningkatan sebesar 74,4%, yang dikategorikan efektif. Temuan ini menunjukkan bahwa mengintegrasikan teknologi digital dengan konten budaya lokal dapat memberikan strategi pembelajaran inovatif yang mendukung pengembangan literasi budaya sekaligus melestarikan warisan budaya dalam pendidikan anak-anaki usia dini.

ABSTRACT

Early childhood represents a critical developmental stage, often referred to as the golden age, during which children experience rapid cognitive, social, emotional, and cultural growth. Developing cultural literacy at this stage is essential because it strengthens children's understanding of local identity and cultural values. However, introducing traditional Indonesian culture, particularly puppet (wayang), has become increasingly challenging due to the limited attractiveness and relevance of conventional learning media in contemporary educational settings. Therefore, integrating cultural heritage with digital technology is necessary to create engaging learning experiences for young learners. This study aimed to design and develop digital wayang-based learning media to enhance cultural literacy among early childhood learners and to examine its effectiveness as an instructional medium. The study employed a Research and Development (R&D) approach using exploratory design. The research process involved stages of information gathering, planning, product design, validation, revision, limited trials, field testing, product refinement, and dissemination. Participants included teachers and students from five kindergartens during the 2025/2026 academic year selected through purposive sampling. Data were collected using observations, interviews, questionnaires, and literacy tests, and were analyzed through descriptive qualitative and quantitative techniques. The findings revealed that digital wayang media effectively improved children's cultural literacy, demonstrated by an average experimental class score of 91.6 and a gain index of 74.4%, categorized as effective. These findings suggest that integrating digital technology with local cultural content can provide an innovative instructional strategy that supports cultural literacy development while preserving cultural heritage in early childhood education.

✉Corresponding author:
E-mail addresses: nur.fajrie@umk.ac.id

To cite: Fajrie, N., & Faresta, R. A. (2026). The Development of Digital Wayang-Based Learning Media to Enhance Cultural Literacy among Early Childhood Learners. *Jurnal PG-PAUD Trunojoyo: Jurnal Pendidikan dan Pembelajaran Anak Usia Dini, 13*(2), 206-230. https://doi.org/10.21107/pgpaudtrunojoyo.v13i2.34148

1. INTRODUCTION

Early childhood education plays a crucial role in shaping children's cognitive, social, and cultural development. During early childhood, often referred to as the "golden age," children experience rapid growth in cognitive, linguistic, and socio-emotional domains, making this stage highly strategic for introducing fundamental values and cultural knowledge (Shonkoff & Phillips, 2000). One essential aspect that needs to be developed during this period is cultural literacy, which refers to the ability to understand cultural symbols, traditions, and values that shape social identity and collective memory (Banks, 2001; Hirsch, 1987). Cultural literacy enables children to develop a sense of belonging to their community while fostering respect for diversity and cultural heritage.

The current issue of cultural literacy in early childhood education has become increasingly significant in the era of rapid digital transformation and globalization. Young children are increasingly exposed to globalized digital content through various media platforms, while opportunities to engage with local cultural values and traditional heritage are gradually diminishing. Consequently, many early childhood learning environments tend to prioritize cognitive and academic achievement over the development of cultural understanding and identity formation. This condition may contribute to limited awareness of local traditions, decreased appreciation of cultural diversity, and weaker connections between children and their cultural heritage (Binns 2026; Rahmawati and Pamungkas 2026). Within the Indonesian context, strengthening cultural literacy is particularly important because it is closely associated with preserving local cultural heritage and fostering cultural identity from an early age.

In Indonesia, cultural literacy is closely linked to the preservation of local cultural heritage. One of the most prominent forms of traditional culture is *Wayang*, a traditional puppet art that conveys philosophical teachings, moral values, and historical narratives. Historically, Wayang performances have functioned not only as entertainment but also as a medium for transmitting ethical values such as honesty, courage, responsibility, and social harmony (Brandon, 2003). Therefore, introducing Wayang narratives within educational settings has the potential to strengthen children's cultural awareness and support their character development. However, in the contemporary digital era, introducing traditional cultural media to early childhood presents significant challenges. The rapid advancement of information technology has transformed children's learning environments and preferences. Today's children are often described as digital natives, meaning they grow up surrounded by digital devices and multimedia technologies that shape the way they learn and interact with information (Prensky, 2001). Consequently, conventional learning approaches that rely on static materials or traditional storytelling often struggle to maintain children's engagement.

Recent studies highlight the growing importance of digital learning media in early childhood education. Multimedia-based learning environments can integrate visual, auditory, and interactive elements that enhance children's engagement and learning motivation (Clark & Mayer, 2016; Mayer, 2009). Interactive digital storytelling also offers opportunities to integrate narratives with immersive learning experiences, which can strengthen children's understanding and emotional engagement in the learning process (Robin, 2016). This suggests that digital technology can play a significant role in improving the effectiveness of cultural education.

Several previous studies emphasize the importance of integrating cultural elements into early childhood education. For instance, research indicates that audiovisual media introducing Indonesian cultural heritage can stimulate language development and cultural awareness among

young learners (Sari, 2021). Similarly, culture-based learning activities, such as traditional dance and arts, have been found to foster creativity and cultural literacy in early childhood education (Hartono *et al.*, 2022). These findings suggest that cultural learning can be effectively implemented through creative and engaging instructional media.

Research focusing on Wayang as an educational medium has also demonstrated promising results. Studies indicate that Wayang-based learning media can improve children's listening skills, language development, and learning motivation (Kurniasih *et al.*, 2022; Nursalim *et al.*, 2023). Furthermore, the digital transformation of traditional arts such as Wayang has begun to attract increasing academic attention. Recent studies show that digital Wayang media can enhance children's interest in local culture and help foster a sense of cultural identity from an early age (Najib *et al*., 2023). In addition, the development of digital cultural media, such as digital comics adapted from Wayang characters, has proven effective in capturing the attention of digital-native learners and strengthening cultural education (Suryani *et al.*, 2026).

Previous studies have identified several limitations. First, many studies on digital learning media in early childhood education primarily focus on academic subjects such as literacy, numeracy, and science learning. In addition, research specifically addressing digital media for the development of cultural literacy remains limited. Second, studies exploring the use of Wayang in education often rely on traditional media, such as paper puppets or storytelling activities, rather than integrating interactive digital technologies. Third, empirical investigations evaluating the effectiveness of digital cultural learning media in enhancing children's cultural literacy are still relatively scarce (Gahrizsangi and Kewalramani 2026; Rentzou, Tsiara, and Barranco 2026).

These gaps indicate the need for an innovative educational approach that integrates traditional cultural heritage with modern digital learning technologies. Transforming traditional cultural narratives into interactive digital learning media can offer a promising solution to make cultural education more engaging and relevant for contemporary learners. Digital cultural media not only provide interactive learning experiences but also contribute to the preservation and transmission of cultural heritage in the digital era. Based on the preceding discussion, this study aims to develop and implement digital Wayang-based learning media designed to enhance cultural literacy among early childhood learners. This media integrates traditional Wayang narratives with multimedia elements such as animation, narration, and interactive features to create an engaging and developmentally appropriate learning experience.

The findings of this study are expected to contribute both theoretically and practically. From a theoretical perspective, this research enriches the literature on cultural literacy and digital learning in early childhood education. From a practical perspective, the developed digital Wayang media can serve as an innovative educational tool that assists educators in introducing Indonesian cultural heritage in a manner that is engaging, meaningful, and aligned with the learning characteristics of today's digital generation.

2. METHODS

This study employed a Research and Development (R&D) approach to develop digital Wayang-based learning media and examine its effectiveness in enhancing cultural literacy among early childhood learners. This research approach was selected because the study focused not only on investigating educational phenomena but also on developing and validating an educational product through a systematic and iterative process. In addition, a mixed-method exploratory design was adopted to integrate qualitative and quantitative approaches, thereby providing a more comprehensive understanding of both the product development process and its educational effectiveness (Borg & Gall, 1983; Creswell, 2019; Sugiyono, 2016).

The research study utilized two types of data: qualitative and quantitative data. Qualitative data were obtained through observations, interviews, expert feedback, and user responses to explore learning needs, perceptions, and implementation processes. Meanwhile, quantitative data were collected through questionnaires and cultural literacy tests to evaluate the feasibility of the developed product and its effectiveness in improving children's cultural literacy outcomes.



Figure 1. Research and Development Procedure

The research procedure consisted of several stages, including preliminary information gathering, planning, initial product design, expert validation, first revision, limited trials, second revision, field testing, final product refinement, and dissemination. To examine the effectiveness of the developed product, a quasi-experimental approach using a Non-Equivalent Control Group Design was implemented, involving both experimental and control groups. The participants consisted of children aged 4–6 years and teachers from five kindergartens during the 2025/2026 academic year, selected using purposive sampling techniques.

Data collection was conducted using observations, interviews, questionnaires, and tests. Observations were carried out to examine students' engagement and learning activities during the implementation process. Interviews were used to explore teachers' and students' needs and perceptions regarding the learning media. Questionnaires were administered to evaluate the feasibility of the media based on expert assessments and user responses, while cultural literacy tests were used to measure students' learning outcomes before and after the intervention(Piaget, 2021). The research instruments were developed according to specific indicators, as presented in Table 1.

Data collection techniques included observation, interviews, questionnaires, and tests. Observation was conducted to assess students' engagement during the implementation of the digital Wayang media, while interviews were used to explore the needs and perceptions of both teachers and students. Questionnaires were administered to evaluate the feasibility of the media based on expert judgments and user responses, and tests were used to measure students' cultural literacy before and after the intervention. The use of multiple data collection techniques reflects the principle of triangulation to ensure the validity and reliability of the data (OECD, 2022; Rikunto, 2018).

Table 1. Instrument Indicators

Intrument	Indicators	Data Collection Method
Observation Sheet	Student engagement, participation, and interaction with digital media	Observation
Interview Guidelines	Learning needs, perceptions toward media use, and implementation challenges	Interview
Expert Validation Sheet	Media design, content appropriateness, and language quality	Questionnaire
Teacher Response Questionnaire	Usability, practicality, and instructional effectiveness	Questionnaire
Student Response Questionnaire	Interest, attractiveness, and ease of use	Questionnaire
Cultural Literacy Test	Understanding of cultural values, character recognition, and comprehension of Wayang content	Test

The research instruments were developed based on specific indicators, including expert validation sheets (covering media, content, and language aspects), teacher and student response questionnaires, interview guidelines, observation sheets, and a cultural literacy test. These instruments were examined through validity and reliability analyses, as well as item difficulty and discrimination index testing, to ensure accurate measurement of the research variables. Instrument testing is essential to ensure the accuracy and consistency of data in educational research (Ghozali, 2018).

The developed product is a web-based digital Wayang application designed to be accessible through browsers such as Google Chrome and Safari. The application is responsive and compatible with various devices, including computers, laptops, and smartphones with a minimum screen size of five inches. It supports operating systems such as Windows, macOS, Linux, Android, and iOS. The content includes an introduction to the Pandawa characters, cultural values (e.g., honesty and cooperation), and interactive activities such as puzzles, quizzes, numeracy exercises, character identification, and songs. The materials are designed based on early childhood developmental characteristics and principles of digital learning that emphasize interactivity and engagement (Plowman *et al.*, 2012; Prasetyo, 2021).

Data analysis was conducted using both qualitative and quantitative approaches. Qualitative data obtained from observations, interviews, and expert feedback were analyzed through data reduction, data display, and conclusion drawing. Quantitative data were analyzed using descriptive statistics, prerequisite tests such as normality testing, and non-parametric statistical tests including the Wilcoxon test and the Mann–Whitney U test. In addition, N-Gain analysis was employed to measure the improvement in students' cultural literacy following the implementation of the media. The use of non-parametric statistical analysis is appropriate for small sample sizes and data that are not normally distributed (Siegel & Castellan, 1988). This study was conducted in kindergartens located in Kedung District, Jepara Regency, involving early childhood students and teachers as participants. The duration of the study covered all stages of development and field testing throughout the 2025/2026 academic year.

In this study, the researcher acted as the primary instrument, serving as the developer, data collector, and observer throughout the implementation process. To ensure data validity, several strategies were employed, including technique triangulation (observation, interviews,

questionnaires, and tests), source triangulation (students, teachers, and experts), expert validation, and instrument testing. These procedures ensure that the research findings are credible, reliable, and scientifically accountable.

3. RESULT AND DISCUSSION

3.1 Result

Research and Information Gathering

This study was conducted in Kedung District, Jepara Regency, Central Java, Indonesia, located in the western coastal area known for its maritime characteristics. Kedung District has significant coastal potential, dominated by fisheries and salt production. Geographically, Jepara Regency consists of 15 districts, including the Karimunjawa archipelago. Kedung holds a strategic position as a coastal area and the southern gateway of Jepara Regency.

Socioculturally, the community of Kedung District is known for its strong work ethic, particularly in the fisheries sector and small-scale salt production. Local wisdom values such as mutual cooperation (gotong royong), tolerance (tepa selira), and Islamic religiosity acculturated with coastal Javanese culture are preserved and passed down from generation to generation. Traditions such as the commemoration of the Prophet's birthday (Maulid Nabi) and the sea alms ritual (sedekah laut) serve as media for the internalization of moral and social values among the younger generation, including early childhood. In the field of education, Kedung District has shown significant development, particularly at the Early Childhood Education (ECE) and Kindergarten (TK) levels. Based on available data, there were 1,485 students and 123 educators distributed across various educational institutions in the 2025/2026 academic year. From this population, this study selected a sample of 60 students from five institutions, namely TK Islam Mangun Sejati, TK Yoga Bivak Indonesia, TK Sekar Jepara, TK Bahari Bulak Baru, and TK Rajawali.

The data analysis in this study employed a qualitative approach to examine in depth the learning process, the use of instructional media, and the implementation of cultural literacy among early childhood learners in each institution. The research sample consisted of students and teachers selected randomly, with a composition of three students and one teacher from each institution. Overall, the findings related to learning materials, media usage, and the development of cultural literacy among early childhood learners in the five institutions are presented systematically in the following sections.

3.1.1.1 Research on Curriculum, Characteristics, Learning Materials, and Instructional Media for Developing Cultural Literacy in Early Childhood

Based on the Decree of the Head of the Agency for Standards, Curriculum, and Educational Assessment of the Ministry of Education, Culture, Research, and Technology Number 46/H/KR/2025 concerning Learning Outcomes in Early Childhood Education, primary education, and secondary education, cultural literacy in early childhood is included in the Self-Identity element. This element emphasizes the development of children's identity as individuals, family members, and part of society, encompassing self-awareness, emotional regulation, social interaction, and a sense of belonging to the environment and local culture. The sub-elements of self-identity include children's ability to recognize and manage emotions, build healthy social relationships, demonstrate positive behavior toward themselves and their environment, adapt to norms and rules, and utilize motor functions to explore their surroundings as part of their personal development.

Based on the analysis of the curriculum and syllabus in the research institutions, it was found that the learning process has referred to the Merdeka Curriculum, particularly the self-identity element, with an emphasis on sub-elements such as the introduction of positive behavior toward oneself and the environment, as well as fostering a sense of pride as Indonesian children grounded in Pancasila. The learning indicators include the ability to recognize

emotions, understand local culture, demonstrate self-confidence, cooperate, maintain discipline, and show care and tolerance toward others. The learning materials focus on the introduction of local culture through storytelling methods, utilizing storybooks as instructional media, while the learning model remains predominantly teacher-centered.

Although substantively aligned with curriculum requirements, the analysis indicates that the implementation of learning has not fully accommodated the characteristics of early childhood learners. The instructional media used tend to be less engaging and have not effectively facilitated active child participation. The predominantly teacher-centered approach limits children's optimal involvement, resulting in the development of cultural literacy not being achieved to its fullest potential.

1) Information Gathering Related to Cultural Literacy in Early Childhood

   Information was collected through observations and interviews with students and teachers across five kindergarten institutions.

2) Learning Activity Observation Results

   The results of observations of learning activities involving 60 students indicate that children tend to show low interest in the instructional media used, such as storybooks and conventional puppet media. This finding is consistent with international studies suggesting that conventional learning media are less effective in maintaining young children's attention compared to interactive digital media that are more visually and auditorily engaging (Bautista *et al.*, 2024; Hirsh-Pasek *et al.*, 2015). Children are easily distracted, have limited focus, and can only sustain attention for a short period. Although teachers have attempted to manage the classroom effectively, the limited attractiveness of the media results in some children remaining less actively engaged in the learning process.

3) Interview Results

   The results of interviews with students across the five institutions indicate that most children are not familiar with traditional puppet performances (*wayang*) and show limited interest in playing them. Children tend to prefer digital-based entertainment such as mobile devices, electronic games, and other forms of digital media. This condition is consistent with research findings indicating that contemporary early childhood learners have a strong preference for digital media due to its interactive nature and its ability to provide more engaging learning experiences compared to traditional media (Li *et al.*, 2024; Neumann, 2018). This suggests a shift in children's interests from traditional media toward digital media.

   Meanwhile, the results of interviews with educators indicate that all teachers share a common perspective on the importance of cultural literacy from an early age. Cultural literacy is considered to play a significant role in shaping children's identity, fostering a sense of pride in local culture, and developing tolerance and social skills. However, teachers face several challenges, including children's low interest in traditional culture, limited availability of engaging instructional media, and time constraints within the learning process.

   The instructional media used so far include folktale storybooks, learning videos, and culture-based activities such as wearing traditional attire. The use of digital media in the classroom remains limited, generally implemented only once or twice a week.

   Interestingly, all educators expressed positive responses toward the development of digital *wayang* media. This medium is considered to have significant potential in enhancing cultural literacy, as it integrates cultural elements with technology in a way that aligns with the characteristics of early childhood learners. Teachers also emphasized that such media should be equipped with engaging visuals, animations, simple narratives,

easily understandable characters, and audio using language appropriate to children's developmental levels.

In addition, the ideal duration for the use of digital media in learning ranges from 10 to 30 minutes, adjusted to the conditions and characteristics of the children. Teachers also expect support in the form of user guidelines, training, and assistance in the implementation of the media.

Overall, the results of the needs analysis indicate that children's interest in traditional culture, particularly *wayang*, remains low, as it is perceived as less engaging and less relevant to contemporary developments. Children show a stronger preference for digital media that are interactive and visually appealing. On the other hand, teachers require innovative instructional media that can bridge the gap between the preservation of local culture and technological advancement.

Therefore, the development of digital *wayang* media becomes a relevant and contextual solution for enhancing cultural literacy in early childhood, as it is able to accommodate children's needs, interests, and learning characteristics in the digital era.

Planning and Data Collection

Based on the analysis of the Self-Identity element and its sub-elements, particularly the indicator of recognizing local culture in early childhood education across five kindergartens in Kedung District, Jepara Regency, and supported by interview data with school principals and teachers regarding children's social-emotional development, the researcher subsequently designed the planning and data collection stage as part of the instructional media development process.

Learning Needs Planning

The instructional media development planning was based on the results of observations and interviews conducted with teachers and students. The initial findings indicate the need for more engaging, interactive, and developmentally appropriate media to support cultural literacy in early childhood education. Therefore, the researcher designed the development of digital wayang media as a learning solution that is adaptive to contemporary developments.

The developed media was subsequently named digital wayang for enhancing cultural literacy in early childhood. The design of this media development was based on a needs analysis that included the curriculum, learners' characteristics, and learning materials relevant to cultural literacy, particularly the introduction of wayang (traditional puppetry).

Operationally, the development process of the digital wayang media consists of three main stages, namely:

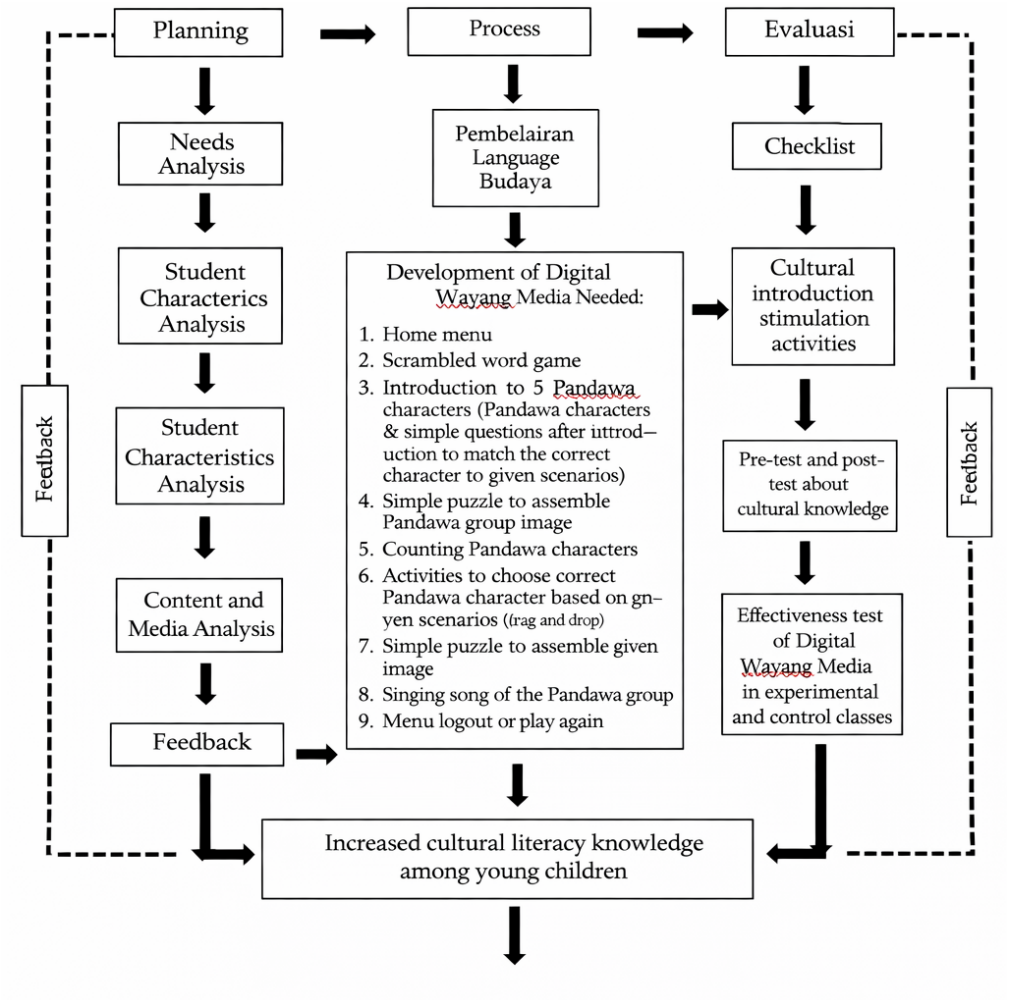


Figure 2. Development Design Diagram of Digital Wayang Media

1) Planning Stage

In this stage, the researcher conducted a needs analysis for media development through curriculum analysis, analysis of early childhood characteristics, and analysis of learning materials and instructional media. The main focus of the analysis was on children's level of understanding of cultural literacy, particularly their knowledge of wayang.

2) Process Stage

This stage is a continuation of the planning results, in which the researcher conducted observations of the implementation of cultural literacy learning in the classroom. This activity aimed to identify the actual learning conditions, including methods, instructional media, and students' responses to the materials delivered.

3) Evaluation Stage

This stage is a continuation of the planning results, in which the researcher conducted observations of the implementation of cultural literacy learning in the classroom. This activity aimed to identify the actual learning conditions, including methods, instructional media, and students' responses to the materials delivered.

3.1.2.2 Data Development Results

The data development results were obtained through interviews with teachers and students. Based on interviews with teachers, it was found that the introduction of wayang culture had been implemented, but its frequency remained limited. In addition, some teachers acknowledged having limited mastery of wayang content and tended to use monotonous

instructional media such as books and pictures, which were less effective in attracting children's interest.

Teachers responded very positively to the development of digital wayang media. This medium was considered relevant to technological advancements and aligned with children's interests, as they tend to be more attracted to digital media than traditional games. Moreover, the simple and interactive design of the media, along with the use of easily understandable language, was seen as supportive of the learning process and contributing to the preservation of national culture.

Meanwhile, interviews with students revealed that some children were not familiar with wayang, while others had limited experiences, such as watching performances or creating simple paper puppets. The introduction of wayang through conventional media such as books, pictures, and videos was considered less engaging, resulting in low enthusiasm and passive participation in learning activities.

However, when students were introduced to digital wayang media, there was a significant increase in their interest and engagement. Children showed high enthusiasm and were even able to operate the media repeatedly after only a single instruction. The use of devices such as Interactive Flat Panels (IFP) in schools and mobile phones at home also supported the flexibility of media use in various learning contexts.

Based on interviews with both teachers and students, it can be concluded that innovative and engaging learning media are highly needed to enhance cultural literacy in early childhood education. Therefore, the development of digital wayang media is a relevant solution to address this need, as well as a strategic effort to introduce and preserve local culture from an early age.

3.1.3 Initial Product Design

The development of digital wayang media for enhancing cultural literacy in early childhood is designed systematically and interactively, taking into account children's learning characteristics, which favor engaging visuals, audio, and play-based activities. This media contains several main menus integrated into an exploratory and experiential learning flow (learning by playing). The media interface and usage procedures are described as follows:

1) Main Menu

The main menu serves as the opening (home) page, presenting an introductory narration delivered by the "young puppeteer" character. In this section, users are welcomed with a communicative and engaging greeting, such as: *"Halo sahabat cilik, selamat datang, yuk kita bermain dan mengenal wayang Pandawa, tekan tombol mulai ya."* This menu functions to capture children's initial attention while providing orientation for using the media.

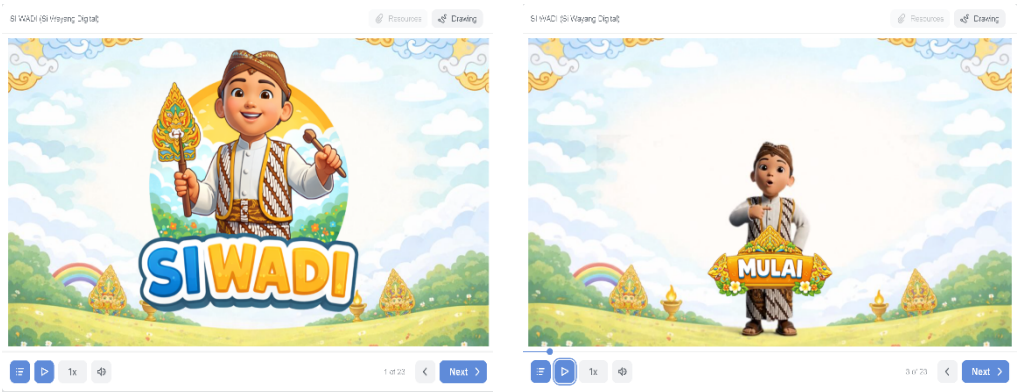


Figure 3. Main Menu and Start Menu Interface

2) Material Menu

After pressing the "Mulai" button, users are directed to the material menu, which contains an introductory explanation of Wayang. The narration is delivered in a simple manner, stating that Wayang is a traditional Indonesian storytelling puppet that embodies moral values. Subsequently, children are introduced to the Pandawa characters through interactive visual displays. Each character icon can be tapped, allowing the image to enlarge and triggering audio pronunciation of the character's name, aiming to strengthen recognition through audiovisual stimulation.

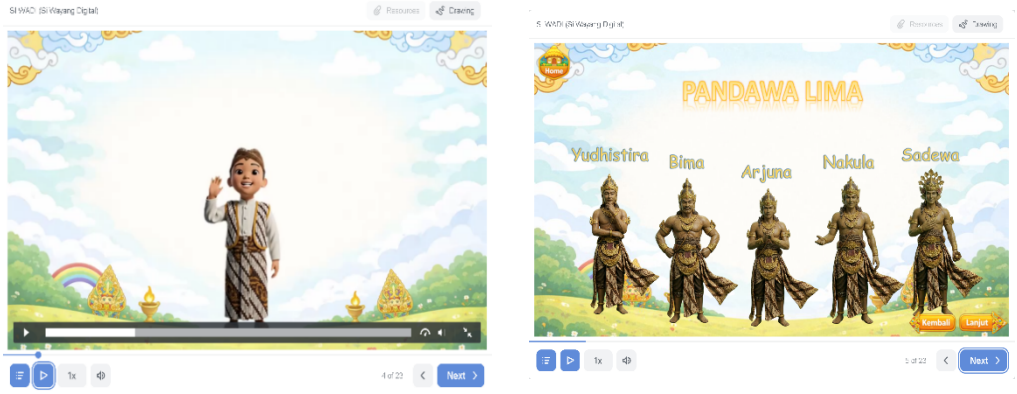


Figure 4. "Dalang Cilik" Display and Pandawa Menu Interfere

3) Character Introduction and Characteristics Menu

In this menu, children are introduced to the characteristics of each Pandawa character, namely Yudistira (honest and wise), Bima (strong and brave), Arjuna (intelligent and focused), Nakula (friendly and intelligent), and Sadewa (kind and honest). Each character is accompanied by a short video explaining their characteristics.

In addition, there is an interactive activity in which children are asked to select expressions or situations that reflect these character values in daily life. The media provides immediate feedback in the form of positive audio responses ("Wah, kamu hebat") for correct answers, as well as motivational encouragement to try again for incorrect responses. This aims to strengthen children's understanding of character values while increasing their engagement.

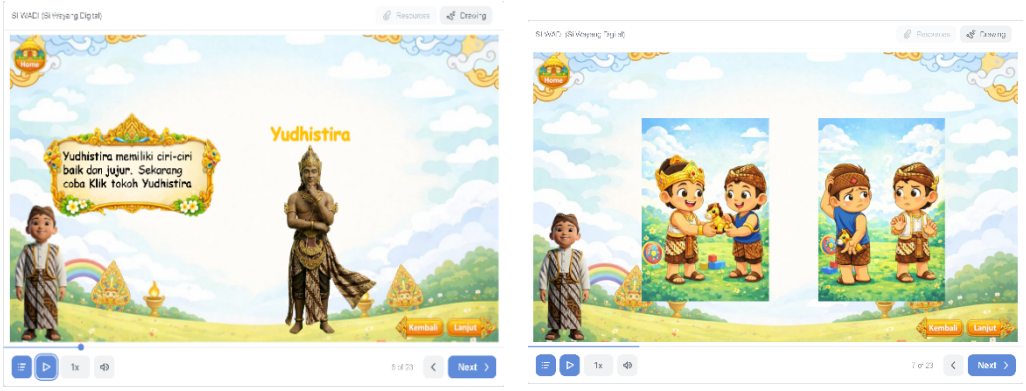


Figure 5. Pandawa Characters and Their Characteristics Display, and Game Menu Showing the Honesty Characteristic

4) Counting the Number of Wayang Menu

This menu integrates cognitive skills with cultural literacy through an activity in which children are asked to count the number of Pandawa characters. Children are



Figure 6. Counting the Number of Pandawa Wayang Display

required to select the number that corresponds to the total images displayed. Immediate feedback is provided to reinforce the learning process.

5) Guess the Character Based on Traits Menu

In this menu, children are asked to guess the Pandawa character based on the characteristics described. This activity trains memory, conceptual understanding, and the ability to associate character traits with the correct figure.

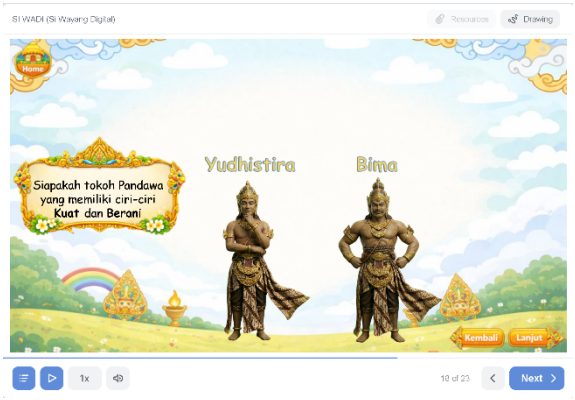


Figure 7. Guess the Character Based on Its Characteristics Display

6) Wayang Image Puzzle Menu

The puzzle menu is designed to develop children's visual-spatial skills and fine motor coordination. Children are asked to arrange image pieces to form a complete *wayang* character. This activity also enhances concentration and attention to detail.

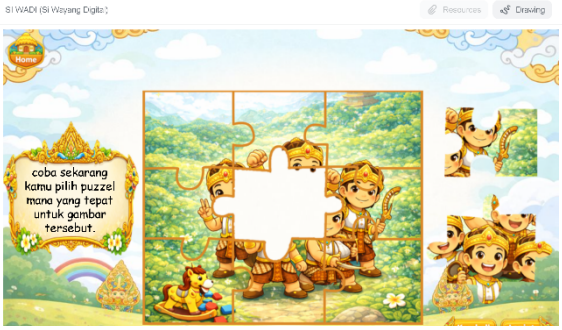


Figure 8. Wayang Image Puzzle Display

7) Pandawa Lima Singing Menu

In this menu, children are invited to sing a simple song about the Pandawa Five, which contains reinforcement of character values such as honesty and helping others. This activity aims to strengthen memory through rhythm and repetition.

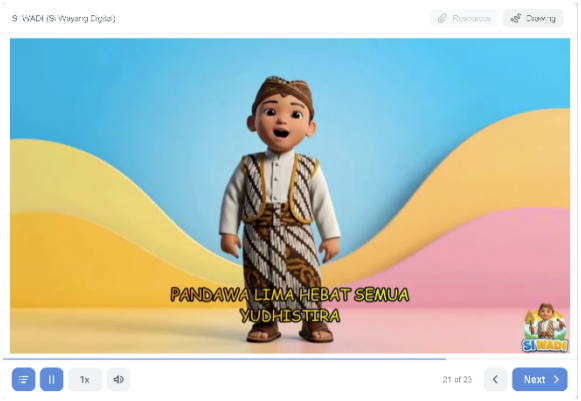


Figure 9. Pandawa Song Singing Display

8) Final Menu (Play Again or Quit)

This menu provides children with the option to repeat the game or end the activity. This flexibility offers a pleasant and non-coercive learning experience, in line with early childhood learning principles.

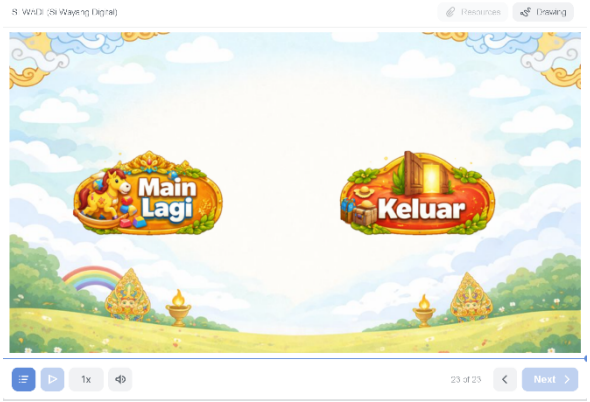


Figure 10. Play Again or Exit Menu Display

Overall, the design of the Digital *Wayang* media integrates cognitive, affective, and psychomotor domains into a unified set of interactive and enjoyable activities. This media not only serves as a means of introducing cultural content but also functions as a tool to stimulate holistic child development, particularly in cultural literacy and character building.

3.1.4 Product Validation

Expert validation conducted by media, content, and language specialists yielded average scores of 3.20–3.69 (*very good*), 3.52–3.88 (*very good* to *very appropriate*), and 3.80 (*very good*) respectively, confirming that the Digital *Wayang* media is feasible for use as an early childhood cultural literacy learning tool. Minor recommendations from validators regarding audio volume, language simplification, and platform accessibility were subsequently addressed during product revision.

Table 2. Expert Validation Score per Each Aspect

Aspect	Scale Interval		Category
Media	Expert 1	3.20	Very Good
	Expert 2	3.69	Very Good
Content	Expert 3	3.88	Very Good
	Expert 4	3.52	Very Good
Language	Expert 5	3.80	Very Good

Note. Categorization 3,21 – 4,00 (Very Good); 2,51 – 3,20 (Good); 1,76 – 2,50 (Fair); and 1,00 – 1,75 (Poor)

First-Stage Product Revision / Product Revision Phase I

After undergoing media validation, content validation, and language validation, the product was revised. The revision focused on the audio aspect, which was initially considered insufficiently clear due to low volume. Therefore, the audio was adjusted to be louder to improve clarity and user experience.

3.1.6 Limited Trial

The limited trial was conducted on Monday, February 2, 2026, involving 6 students from Group B1 at TK Islam Mangun Sejati. This activity aimed to identify the initial responses of students as well as the effectiveness of the Digital *Wayang* media in enhancing early childhood cultural literacy.

Based on observations of students' activities during the use of the media, a score of 84.6 was obtained, which falls into the *very enthusiastic* category. This indicates that the Digital *Wayang* media is capable of attracting children's attention and increasing their active engagement in the learning process. Furthermore, students' performance results were analyzed through a comparison of pre-test and post-test scores, as presented in Table 2.

Table 3. Recapitulation of Performance Results in the Limited Trial

	Average Post-test	Maximum Score	N-Gain
51,8	78,7	100	0,56

The analysis results indicate that the average post-test score reached 78.7 out of a maximum scale of 100, with an N-Gain value of 0.56, which falls into the *moderate* category. This improvement indicates an enhancement in students' cultural literacy abilities after using the Digital *Wayang* media. These findings are consistent with studies showing that the use of digital media in early childhood education can significantly improve learning outcomes through a multimodal approach that integrates visual, audio, and interactive activities (Papadakis *et al.*, 2018).

Overall, the results of the limited trial demonstrate that the Digital *Wayang* media is effective for use in learning to enhance cultural literacy in early childhood. This media not only improves learning outcomes but also creates a more interactive and enjoyable learning environment. Nevertheless, there were several suggestions from teachers regarding its implementation, particularly the need to further develop the media into a downloadable application that can be used across various devices. This is expected to enhance accessibility and flexibility in using the media in different learning contexts.

3.1.7 Second-Stage Product Revision / Product Revision Phase II

After the implementation of the limited trial, the researcher received several suggestions from teachers regarding the use of the Digital *Wayang* media. One of the main recommendations was to further develop the media into a downloadable application, making it more accessible and usable across various devices. In response to this suggestion, the researcher conducted revisions and refinements of the Digital *Wayang* media, particularly in the technical

aspects, to enable its development into a more practical and flexible application for learning purposes.

In addition, the results of the limited trial showed that students demonstrated a high level of enthusiasm when using the Digital *Wayang* media. This indicates that the developed media is capable of attracting children's interest in learning and increasing their engagement in the learning process.

From the educators' perspective, the use of Digital *Wayang* media is considered effective in facilitating the delivery of cultural literacy materials, particularly in introducing *wayang* characters and their associated values. Teachers also stated that this media helps create a more engaging, interactive, and developmentally appropriate learning environment for early childhood learners.

Therefore, the product revision carried out in this phase not only focused on technical aspects but also considered user needs (teachers and students), making the Digital *Wayang* media more effective and applicable in supporting cultural literacy learning.

3.1.8 Field Trial

The field trial was conducted using a quasi-experimental design by forming an experimental class and a control class. The experimental class consisted of a group that received treatment in the form of learning using Digital *Wayang* media to enhance early childhood cultural literacy, particularly knowledge of the Pandawa *wayang*. This activity was carried out at TK Islam Mangun Sejati, TK Yoga Bivak Indonesia, and TK Sekar Jepara, with 15, 10, and 15 students respectively. Meanwhile, the control class consisted of a group that participated in cultural literacy learning without using Digital *Wayang* media. This was conducted at TK Bahari Bulak Baru and TK Rajawali Jepara, each with 15 students.

The results of the trial showed that the average pre-test score in the experimental class was 68.5 (*Developing as Expected*), which increased to 91.6 (*Very Well Developed*) in the post-test. In contrast, the control class showed an average pre-test score of 54.6 (*Beginning to Develop*), which increased to 67.3 (*Developing as Expected*) in the post-test, as presented in the graph in Figure 12.



Figure 11. Field Trial Results Graph

These findings indicate that the improvement in cultural literacy abilities in the experimental class was higher than that of the control class. Empirically, this suggests that the use of learning technology leads to greater improvements in learning outcomes compared to conventional methods, particularly in terms of literacy and engagement among early childhood learners (Bautista *et al*., 2024; Maulinda *et al.*, 2024).

3.1.8.1 Cultural Literacy Development in the Experimental Class

The implementation of learning in the experimental class was conducted over five sessions, which included pre-test activities, treatment using Digital *Wayang* media, and post-test. The results of descriptive statistical analysis showed a significant increase between the pre-test and post-test scores. The average score increased from 68.48 to 91.56, indicating a substantial improvement in students' cultural literacy abilities, as presented in Table 3.

Table 4. Recapitulation of Early Childhood Cultural Literacy (Experimental Group)

Indicator	***Pretest***		***Posttest***	
	Mean	**Criteria**	**Mean**	**Criteria**
Recognizing culture (mentioning the five Pandawa characters)	67.0	BSH	88.9	BSB
Recognizing *wayang* as Indonesian cultural heritage	64.7	BSH	85.3	BSB
Demonstrating enthusiasm when observing and using Digital *Wayang*	60.8	MB	94.7	BSB
Expressing enjoyment of *wayang* stories	71.8	BSH	91.9	BSB
Identifying positive traits of the Pandawa characters	69.3	BSH	89.9	BSB
Demonstrating honest, brave, and polite behavior	74.8	BSH	93.2	BSB
Average	**68.1**	**BSH**	**90.7**	**BSB**

For each cultural literacy indicator, all aspects showed improvement from the *Developing as Expected* (BSH) category to the *Very Well Developed* (BSB) category. The highest improvement was observed in the indicator of students' enthusiasm in using the media, indicating that the Digital *Wayang* media is effective in enhancing children's engagement and learning motivation. This high level of enthusiasm is consistent with research findings showing that interactive digital media can increase children's motivation and engagement through enjoyable and participatory learning experiences (Flewitt *et al.*, 2015).

Overall, these results indicate that the use of Digital *Wayang* media is effective in improving early childhood cultural literacy, particularly in recognizing Pandawa characters, understanding character values, and fostering positive attitudes toward local culture.

3.1.8.2 Cultural Literacy Development in the Control Class

In the control class, learning was conducted conventionally without the use of Digital *Wayang* media. The learning activities included tasks such as coloring, writing, and completing worksheets related to the Pandawa characters.

The analysis results showed an increase in the average score from 54.64 in the pre-test to 67.28 in the post-test. Although there was an improvement, the results remained within the *Developing as Expected* (BSH) category and had not consistently reached the *Very Well Developed* (BSB) category, as presented in Table 4 below.

Table 5. Recapitulation of Early Childhood Cultural Literacy in the Control Class

Indicator	**Pretest**		**Posttest**	
	Mean	**Criteria**	**Mean**	**Criteria**
Recognizing culture (mentioning the five Pandawa characters)	58.3	MB	75.8	BSH
Recognizing *wayang* as Indonesian cultural heritage	68.6	BSH	77.5	BSH
Demonstrating enthusiasm when observing and using Digital *Wayang*	50.0	MB	60.7	BSH
Expressing enjoyment of *wayang* stories	64.6	BSH	76.9	BSH
Identifying positive traits of the Pandawa characters	61.3	BSH	81.1	BSH
Demonstrating honest, brave, and polite behavior	74.0	BSH	90.2	BSB
Average	**62.8**	**BSH**	**77.0**	**BSH**

Observations also indicated that some students were less enthusiastic and tended to lose focus during the learning process. This suggests that conventional learning methods are less effective in optimally engaging children's interest.

The results of cultural literacy development in both the experimental and control classes are presented in Table 5 as follows.

Table 6. Recapitulation of Cultural Literacy Development in Early Childhood (Post-test)

Indicator	Experimental		Control	
	Score	Description	Score	Description
Recognizing culture (mentioning the five Pandawa characters)	88.9	BSB	75.8	BSH
Recognizing *wayang* as Indonesian cultural heritage	85.3	BSB	77.5	BSH
Demonstrating enthusiasm when observing and using Digital *Wayang*	94.7	BSB	60.7	MB
Expressing enjoyment of *wayang* stories	91.9	BSB	76.9	BSH
Identifying positive traits of the Pandawa characters	89.9	BSB	81.1	BSB
Demonstrating honest, brave, and polite behavior	93.2	BSB	90.2	BSB
Average	**90.7**	**BSB**	**77.0**	**BSH**

Based on Table 5, the average post-test score in the experimental class was 90.7, while the average post-test score in the control class was 77.0. To facilitate clearer interpretation, the data are presented in the form of a histogram as shown below.

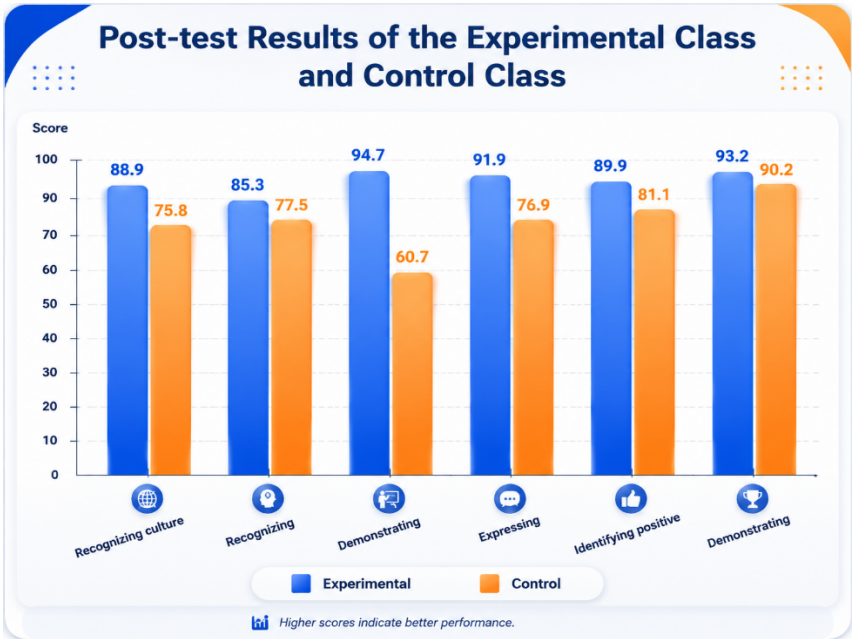


Figure 12. Post-test Results Diagram of the Experimental and Control Classes

Effectiveness of Digital Wayang Media

To determine the effectiveness of the Digital *Wayang* media development in kindergartens in Kedung District, Jepara Regency, this study employed a paired sample *t*-test and gain index calculation. However, prior to conducting these tests, prerequisite tests were performed, namely normality and homogeneity tests.

1) Normality Test

The results of the normality test using the *Kolmogorov–Smirnov* formula and the *Shapiro–Wilk* test indicated that most of the data were not normally distributed ($p < 0.05$). Therefore, the analysis was continued using non-parametric tests.

2) Wilcoxon Test

Theoretically, the Wilcoxon Signed-Rank test is a non-parametric alternative to the paired sample *t*-test, used to analyze two related samples with non-normally distributed data. Meanwhile, the Mann–Whitney *U* test is a non-parametric alternative to the independent sample *t*-test, used to compare two independent groups (Siegel & Castellan, 1988).

The results of the Wilcoxon test showed a significance value of < 0.001, indicating a significant difference between the pre-test and post-test scores in both groups. All respondents experienced an increase in scores after the treatment.

3) Mann-Whitney U Test

The result of the *Mann–Whitney U* test showed a significance value of < 0.001, indicating a significant difference in improvement between the experimental and control classes. The mean rank value in the experimental class was higher than that of the control class, indicating that the use of Digital *Wayang* media had a greater effect on improving learning outcomes.

4) Gain Index

The results of the gain index calculation showed that the average N-Gain in the experimental class was 0.726 (effective category), while in the control class it was 0.287 (low category). Most students in the experimental class were in the effective category (74.4%), whereas the control class was dominated by moderately effective and less effective categories, as shown in Table 5.

Table 7. Criteria for N-Gain Index Calculation

Interval	Criteria
0,7≤ N- Gain ≤ 1	Effective
0,3 ≤ N- Gain , 0,7	Moderately Effective
N-Gain <0,3	Less Effective

Based on Table 6, the data can be presented in the form of a bar chart as follows.

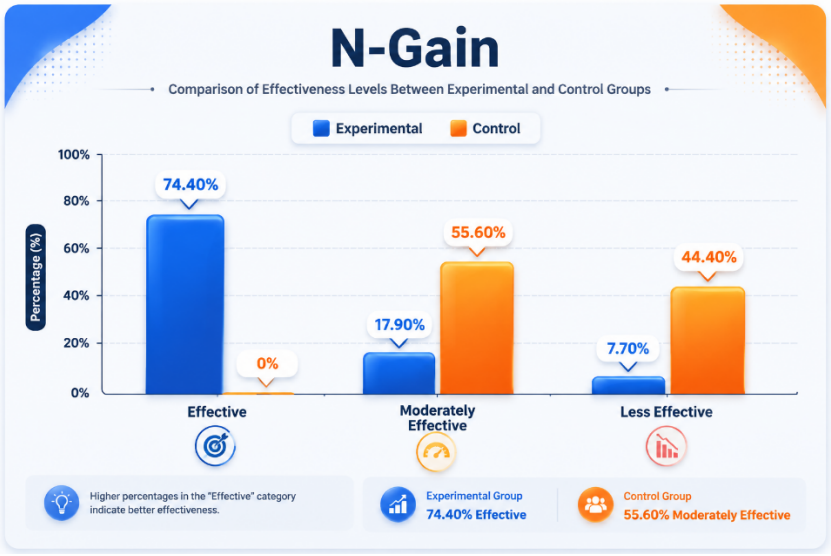


Figure 14. N-Gain Index Calculation Results for the Experimental and Control Groups

Based on the research findings, the Digital *Wayang* media has been proven effective in enhancing early childhood cultural literacy. This effectiveness reinforces international research findings indicating that digital-based learning technologies have a significant positive impact on improving early childhood literacy skills, particularly when designed in accordance with children's developmental characteristics (Li *et al.*,

2024). This is reflected in the significant improvement across all indicators, especially in cultural recognition, understanding of character values, and learning enthusiasm.

The use of interactive digital media is able to increase students' engagement in the learning process. Children do not merely receive information passively but are actively involved in exploring the material. This finding is consistent with constructivist learning theory, which emphasizes the importance of direct experience in knowledge construction.

In contrast, conventional learning in the control class showed relatively lower improvement, particularly in terms of students' enthusiasm and engagement. This indicates that instructional media play a crucial role in enhancing both the quality of the learning process and learning outcomes.

Therefore, it can be concluded that the development of Digital *Wayang* media is both feasible and effective as an innovative learning tool to enhance early childhood cultural literacy, particularly in introducing characters and values in Pandawa *wayang* stories.

Final Product Refinement

Based on the results of both the limited and large-scale trials, the development of the Digital *Wayang* media in kindergartens in Kedung District, Jepara Regency, has been declared feasible for use in learning. This is supported by the analysis results from both the experimental and control classes, which indicate an improvement in students' learning outcomes after the learning process.

Based on the statistical analysis output (SPSS), in the control group consisting of 27 students, the mean rank score increased from 17.72 in the pre-test to 37.28 in the post-test. This improvement indicates a positive change in learning outcomes, although it falls within the moderate category. Meanwhile, in the experimental group consisting of 39 students, the mean rank score increased significantly from 22.74 in the pre-test to 56.26 in the post-test.

Comparatively, the improvement in the experimental group was higher than that in the control group. In addition, the post-test mean rank score of the experimental group (56.26) was higher than that of the control group (37.28). These findings descriptively indicate that the use of Digital *Wayang* media has a more optimal impact on improving learning outcomes compared to conventional learning methods.

The results of the gain index analysis further support these findings. In the experimental group, 74.4% of students were in the effective category, 17.9% in the moderately effective category, and 7.7% in the less effective category. In contrast, the control group had no students in the effective category, with 55.6% in the moderately effective category and 44.4% in the less effective category.

Thus, it can be concluded that the use of Digital *Wayang* media is more effective in improving early childhood cultural literacy compared to learning without such media. These findings indicate that the Digital *Wayang* media not only improves learning outcomes quantitatively but also strengthens children's understanding of local culture, particularly the Pandawa *wayang* characters.

Discussion of Research Findings

1) Analysis of Media Development Needs

The development of Digital *Wayang* media was based on the need to enhance cultural literacy in early childhood, particularly in introducing Pandawa *wayang* characters. The results of observations and interviews indicated that interactive, visual, and audio-based learning media are highly needed to attract children's interest in learning.

This media was designed by integrating visual, audio, and interactive elements, enabling children to recognize *wayang* characters more concretely. Interactive features such as touch-based animations and audio narration have proven effective in increasing children's engagement in the learning process. In addition, the media integrates the character values of the Pandawa figures into children's daily life contexts, making it not only a tool for cultural introduction but also a medium for character development.

From a developmental perspective, this media is able to stimulate various domains of child development, including language, cognitive, motor, and socio-emotional aspects. This is in line with early childhood education principles that emphasize a holistic and integrated approach to learning.

2) Planning and Design of Media Development

The planning of media development was carried out through an analysis of learning needs, curriculum analysis, and the formulation of indicators for children's developmental achievements. The media was designed by referring to learning elements that emphasize the introduction of local culture and the strengthening of character values.

The media design includes several main components, namely the introduction of Pandawa characters, understanding of character traits, counting activities, interactive games (puzzles), and educational songs. All components were organized into a systematic learning flow through a storyboard.

The media was developed using Adobe Captivate, which enables the integration of various multimedia elements such as text, images, animations, and audio into an interactive HTML5-based format. The selection of this software supports flexibility in using the media across various devices, such as laptops, tablets, and interactive flat panels.

The media interface design was adapted to the characteristics of early childhood learners, namely simplicity, attractiveness, and ease of use. The visual principles applied include the use of bright colors, clear icons, and intuitive navigation. In addition, each activity is equipped with feedback to reinforce children's understanding.

3) Effectiveness of Digital Wayang Media

The results of the effectiveness test indicate that the Digital *Wayang* media significantly improves early childhood cultural literacy. The post-test score in the experimental group (91.6) was higher than that of the control group (67.3), demonstrating a significant difference in learning outcomes between the two groups. These findings are consistent with previous studies by Nikmah *et al*., (2020), which state that interactive digital media can enhance children's motivation and learning comprehension through multisensory stimulation. Media that integrate visual, audio, and interactive elements have been proven to be more effective in creating meaningful and enjoyable learning experiences (Suryani, E., & Sari, 2022).

The use of interactive digital media has been proven to enhance students' engagement in the learning process. Children do not merely receive information passively but are actively involved in exploring the material through various multimodal activities. This finding is supported by studies indicating that educational technology has a positive impact on early childhood literacy development through the integration of visual, audio, and interactive elements that strengthen learning experiences (Bautista *et al.*, 2024; Hirsh-Pasek *et al.*, 2015; Li *et al.*, 2024; Neumann, 2018).

These findings are also consistent with constructivist learning theory, which emphasizes the importance of direct experience in knowledge construction. Empirically, digital interaction-based learning enables children to construct understanding through active exploration and direct participation, making learning more meaningful (Papadakis *et al.*, 2018). Multimodal digital learning environments allow children to

access various forms of information representation simultaneously, which has been shown to enhance conceptual understanding and memory retention (Flewitt *et al.*, 2015; Marie *et al.*, 2025).

In addition, the findings indicate that the Digital *Wayang* media is effective in enhancing early childhood cultural literacy, which encompasses not only cognitive aspects but also an understanding of cultural values, symbols, and practices. This media serves as a bridge between traditional culture and modern technology, making learning more contextual and relevant to contemporary developments. This is consistent with findings that digital media can transmit cultural values through multimodal and contextual approaches that strengthen cultural identity from an early age (Kim, 2022; Kumpulainen, 2020; Kumpulainen & Gillen, 2017; Thompson, 2021).

Cultural literacy in early childhood encompasses not only cognitive abilities but also an understanding of cultural values, symbols, and practices. The Digital *Wayang* media serves as a bridge between traditional culture and modern technology, making learning more contextual and relevant to contemporary developments (Jackie Marsh, 2005; Kim, 2022; Rina *et al.*, 2025; Thompson, 2021). From a broader perspective, digital media functions as a multimodal space that enables the integration of various forms of cultural representation (Gonzalez, 2020; Johnson, 2018; Lee, 2019). This supports more holistic literacy development, including critical thinking skills, empathy, character formation, and the development of children's cultural identity from an early age (Annisa *et al.*, 2025).

Furthermore, children's digital literacy practices develop through active interaction with media in both school and home learning environments, enriching language and communication experiences from an early age (Marie *et al.*, 2025). The use of multimedia-based digital media has also been shown to significantly improve children's literacy skills, including language ability and symbolic understanding (Maulinda *et al.*, 2024). These findings indicate that the integration of technology in early childhood education needs to be carefully designed to effectively stimulate multiple developmental domains simultaneously, including cognitive, language, social, and emotional aspects (Li *et al.*, 2024). However, the successful implementation of this media is highly influenced by the role of teachers and parents in guiding its use. Appropriate guidance strengthens the connection between children's digital experiences and their cultural reality, thereby making learning more optimal. Effective facilitation enables children to relate digital learning experiences to real-life contexts, resulting in more meaningful learning (Barr & Nichols, 2017).

Overall, the development of Digital Wayang media has proven to be an effective and innovative learning tool that not only enhances learning outcomes but also fosters cultural literacy and character development in early childhood. Consequently, the promotion and continued development of similar media that integrate local culture with digital technology are essential to support relevant and engaging learning in the digital era.

Dissemination

The dissemination of digital product development is a strategic process aimed at distributing information, innovation outcomes, and product feature updates to target users and stakeholders. This activity is not only oriented toward promotion but also includes education, increasing adoption, and optimizing product utilization within the learning context.

The dissemination was carried out through two main approaches, namely direct (offline) and indirect (online) methods. Direct dissemination was implemented through professional forums such as IGTKI activities, Teacher Working Groups (*Kelompok Kerja Guru/KKG*), and

Principal Working Groups (*Kelompok Kerja Kepala Sekolah/KKKS*) in Kedung District. These activities facilitated direct interaction, discussion, and demonstration of media usage to educators.

Meanwhile, online dissemination was conducted by sharing the application with fellow teachers working in kindergartens or early childhood education institutions (PAUD) through digital platforms. This approach enabled broader distribution, not limited to Kedung District but also reaching other regions.

Through a well-planned and systematic dissemination approach, product visibility increased and the adoption process by users became more rapid. In addition, dissemination contributed to the wider utilization of learning media across various early childhood education institutions, allowing the developed innovation to generate broader and more sustainable impacts.

4. CONCLUSION

This study demonstrates that the development of web-based Digital Wayang learning media through a Research and Development (R&D) approach provides a meaningful contribution to enhancing cultural literacy among early childhood learners. The findings indicate that the developed media is not only feasible and valid based on expert evaluations but also effective in improving children's understanding of cultural values, as reflected in the increase in learning outcomes after implementation. The integration of interactive features, such as games, storytelling, and character introduction, has been proven to support active engagement and meaningful learning experiences for young children.

At this stage, the study confirms that digital cultural media, when designed in accordance with children's developmental characteristics, can serve as an innovative solution to address the decline in cultural awareness in early childhood education. The main argument emphasizes that technology-based learning media can act as a bridge between traditional cultural heritage and modern educational practices, making cultural learning more accessible, engaging, and relevant for today's digital generation.

Based on these findings, several key recommendations can be proposed. First, teachers are encouraged to integrate digital cultural media, such as Digital Wayang, into daily learning activities to support both cognitive and character development. Second, schools and educational institutions should facilitate the use of interactive digital media by providing adequate technological infrastructure and teacher training. Third, policymakers should consider incorporating digital culture-based learning media into early childhood education curricula to strengthen cultural identity from an early age.

In practical terms, the developed Digital Wayang media can be directly implemented in classroom settings as a complementary learning tool, particularly in thematic and character education. It can also be adapted for independent learning at home, enabling parents to participate in introducing cultural values to children. Furthermore, the framework used in this study can serve as a model for developing other culture-based digital learning media across different regions and cultural contexts. Despite its contributions, this study has several limitations, particularly in terms of sample scope and implementation duration. Therefore, future research is recommended to involve larger and more diverse samples, as well as to examine the long-term impact of digital cultural media on children's cognitive, social, and emotional development.

Further studies may also explore the integration of more advanced technologies, such as augmented reality or artificial intelligence, to enhance interactivity and personalization in cultural learning. In conclusion, this study highlights the importance of integrating culture and technology in early childhood education and provides a practical and measurable framework for developing engaging and culturally relevant digital learning media.

5. REFERENCES

Annisa, F., Wulandari, R., & Prayitno, P. (2025). Survei Pengetahuan dan Kebutuhan Guru Terhadap Penerapan Pembelajaran Literasi Budaya Anak Usia Dini. *Aulad: Journal on Early Childhood*, *8*(3), 1335–1341. https://doi.org/10.31004/aulad.v8i3.1397

Banks, J. A. (2001). *Cultural Diversity and Education: Foundations, Curriculum, and Teaching*. Routledge. https://doi.org/10.4324/9781315622255

Barr, R., & Nichols, D. (2017). Media Exposure During Infancy and Early Childhood: The Effects of Content and Context on Learning and Development. In *Media Exposure During Infancy and Early Childhood: The Effects of Content and Context on Learning and Development*. https://doi.org/10.1007/978-3-319-45102-2

Bautista, G. F., Ghesquière, P., & Torbeyns, J. (2024). Stimulating preschoolers' early literacy development using educational technology: A systematic literature review. *Int. J. Child-Comp. Interact.*, *39*(C). https://doi.org/10.1016/j.ijcci.2023.100620

Binns, Amanda. 2026. "Parents ' Utilisation of the Literacy-Based Text Message Program Kindytxt." Journal of Early Childhood Literacy 26(2):612–32. doi:10.1177/14687984251370974.

Borg, W. R., & Gall, M. D. (1983). *Educational research: An introduction* (Edisi ke-4). Longman.

Brandon, J. R. (2003). On thrones of gold: Three Javanese shadow plays. In *Harvard University Press*. https://doi.org/10.1353/atj.2011.0029

Clark, R. E., & Mayer, R. E. (2016). *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*. Wiley. https://doi.org/https://doi.org/10.1002/9781119239086

Creswell, J. W. (2019). *Research design: Qualitative, quantitative, and mixed methods approaches* (Edisi ke-5). SAGE Publications.

Flewitt, R., Messer, D., & Kucirkova, N. (2015). New directions for early literacy in a digital age: The iPad. *Journal of Early Childhood Literacy*, *15*(3), 289–310. https://doi.org/https://doi.org/10.1177/1468798414533560

Gahrizsangi, Hadis Salehi, and Sarika Kewalramani. 2026. "Multimodal Technology-Integrated Approaches for Teaching Early Childhood and Early Primary Science : A Scoping Review." Education Sciences. doi:https://doi.org/10.3390/educsci16040586.

Ghozali, I. (2018). *Aplikasi Analisis Multivariate dengan Program SPSS*. Universitas Diponegoro.

Gonzalez, M. (2020). Interactive media and multicultural awareness in young children. *Early Childhood Technology Review*, *14*(3), 78–92. https://doi.org/10.2345/ectr.2020.34567

Hartono, Kusumastuti, E., Pratiwinindya, R. A., & Lestari, A. W. (2022). Strategi Penanaman Literasi Budaya dan Kreativitas bagi Anak Usia Dini melalui Pembelajaran Tari. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *6*(6), 5476–5485. https://doi.org/10.31004/obsesi.v6i6.2894

Hirsch, E. D. (1987). *Cultural literacy: What every American needs to know*. Houghton Mifflin.

Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in "educational" apps: lessons from the science of learning. *Psychological Science in the Public Interest : A Journal of the American Psychological Society*, *16*(1), 3–34. https://doi.org/10.1177/1529100615569721

Jackie Marsh. (2005). *Popular Culture, New Media and Digital Literacy in Early Childhood*.

Johnson, E. (2018). Digital tools for cultural literacy in early childhood education. *Journal of Digital Learning*, *11*(2), 45–59. https://doi.org/10.1234/jdl.2018.56789

Kim, R. (2022). Digital storytelling: Enhancing cultural literacy in young learners. *Digital Education Perspectives*, *13*(2), 33–47. https://doi.org/10.5678/dep.2022.54321

Kumpulainen, K. (2020). Young children ' s digital literacy practices in the sociocultural contexts of their homes. *Journal of Early Childhood Literacy*, *0*(0), 1–28. https://doi.org/10.1177/1468798420925116

Kumpulainen, K., & Gillen, J. (2017). *Young Children ' s Digital Literacy Practices in the Home: A Review of the Literature*. University of Sheffield.

Kurniasih, E., Abidin, R., & Sa'ida, N. (2022). Pengaruh Pembelajaran Menggunakan Media Wayang Kreasi Bahan Alam terhadap Perkembangan Bahasa Anak Usia 6–7 Tahun SDN 15 Segedong Kabupaten Bengkayang. *PEDAGOGI: Jurnal Anak Usia Dini Dan Pendidikan Anak Usia Dini*, *8*(2), 144–159.

Lee, D. (2019). Using digital platforms to foster cultural identity in preschoolers. *International Journal of Early Childhood Education*, *12*(1), 112–126. https://doi.org/10.3456/ijece.2019.78901

Li, H., He, H., Luo, W., & Li, H. (2024). Early Childhood Digital Pedagogy : A Scoping Review of Its Practices , Profiles , and Predictors. *Early Childhood Education Journal*, *54*, 263–284. https://doi.org/10.1007/s10643-024-01804-8

Marie, S., Gemayel, E., Flewitt, R., & Goodall, J. (2025). 0-3-Year-old children ' s digital language and literacy practices at home : A scoping review of the literature. *Journal of Early Childhood Literacy*, *0*(0), 1–26. https://doi.org/10.1177/14687984251388333

Maulinda, R., Subhan, R., Yuliah, & Abdullah, D. (2024). The Influence of Learning Technology on Early Childhood Literacy Development in Indonesia. *International Journal of Language and Ubiquitous Learning*, *1*(4), 260–274. https://doi.org/https://doi.org/10.70177/ijlul.v1i4.688

Mayer, R. E. (2009). *Multimedia Learning* (2nd ed.). Cambridge University Press. https://doi.org/DOI: 10.1017/CBO9780511811678

Najib, F. A., Dhieni, N., & Nurjannah. (2023). Digital Wayang Kulit Develops A Love For Local Culture In Children Aged 5-6 Years. *Jurnal Pendidikan Anak Usia Dini Undiksha*, *11*(1), 89–96.

Neumann, M. M. (2018). Using tablets and apps to enhance emergent literacy skills in young children. *Early Childhood Research Quarterly*, *42*(1), 239–246. https://doi.org/https://doi.org/10.1016/j.ecresq.2017.10.006

Nikmah, N., Rahayu, R., & Fajrie, N. (2020). Pengembangan Media Pembelajaran Berbasis Multimedia untuk Meningkatkan Minat dan Pemahaman Belajar Siswa. *Jurnal Pendidikan*.

Nursalim, A., Nurillah, D., Zuhro, N. S., & Susanti, M. (2023). Pengaruh Media Wayang Kertas terhadap Kemampuan Mendengar pada Anak Usia Dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *7*(6), 7019–7029. https://doi.org/10.31004/obsesi.v7i6.5672

OECD, O. for E. C. and D. (2022). *Starting Strong VI: Supporting Successful Transitions to School*. OECD Publishing.

Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2018). Educational apps from the Android Google Play for Greek preschoolers: A systematic review. *Computers & Education*, *116*, 139–160. https://doi.org/https://doi.org/10.1016/j.compedu.2017.09.007

Piaget, J. (2021). *The Psychology of the Child (Edisi ulang)*. Basic Books.

Plowman, L., McPake, J., & Stephen, C. (2012). Young children's learning with technology at home. *Computers & Education*, *59*(1), 112–115. https://doi.org/10.1016/j.compedu.2011.09.013

Prasetyo. (2021). Inklusivitas dalam Pengembangan Media Pendidikan Budaya. *Jurnal Pendidikan Inklusif*, 134.

Prensky, M. (2001). Digital Natives, Digital Immigrants. *On the Horizon*, 1–6.

Rahmawati, Fitri Puji, and Onok Yayang Pamungkas. 2026. "Folklore as Pedagogy: Moral and Cultural Values in Southeast Asian Children's Literature." *International Journal of Society Culture &*

Language.

Rentzou, Konstantina, Efthymia Tsiara Tsiara, and Daniel Barranco. 2026. "Greek Preschool Children's Disaffection and Its Relation to the Quality of Early Childhood Education and Care." Early Childhood Education Journal 54(4):2619–30. doi:10.1007/s10643-025-02033-3.

Rikunto, S. (2018). *Prosedur penelitian: Suatu pendekatan praktik* (Edisi ke-2). Rineka Cipta.

Rina, N., Nugroho, C., Wulandari, A., Sugandi, M. S., & Anggraini, C. N. (2025). Integrating Digital Media in Early Childhood Literacy: An Educational Communication Approach from Bandung, Indonesia. *Forum for Linguistic Studies*, *7*(7), 670–685. https://doi.org/10.30564/fls.v7i7.9851

Robin, B. R. (2016). The Power of Digital Storytelling to Support Teaching and Learning. *Digital Education Review*, *30*, 17–29.

Sari, N. M. I. K. (2021). Media Pembelajaran Berbasis Audio Visual Ayo Belajar Budaya Nusantara untuk Menstimulasi Perkembangan Bahasa Anak Usia Dini. *Jurnal Pendidikan Anak Usia Dini Undiksha*, *9*(3), 391–399.

Shonkoff, J. P., & Phillips, D. A. (2000). *From Neurons to Neighborhoods: The Science of Early Childhood Development*. National Academy Press.

Siegel, S., & Castellan, N. J. J. (1988). *Nonparametric Statistics for the Behavioral Sciences*. McGraw-Hill.

Sugiyono. (2016). *Metode Penelitian Pendidikan*. CV. Alfabeta.

Suryani, E., & Sari, R. (2022). Pemanfaatan Media Digital dalam Pembelajaran Anak Usia Dini. *Jurnal Golden Age*, *6*(1), 14–22.

Suryani, L., Prayitno, E. H., & Pahala, A. A. (2026). Pengembangan Komik Digital sebagai Media Edukasi Digital Native Hasil Transformasi Karakter Wayang Beber. *Besaung: Jurnal Seni, Desain Dan Budaya*, *10*(11), 237–256. https://doi.org/10.36982/JSDB.V11I1.6248

Thompson, S. (2021). Multimedia resources for cultural education in early years. *Childhood Education Journal*, *15*(4), 201–215. https://doi.org/10.4567/cej.2021.11223