

Application of Digital Storytelling Technology to Improve Problem-Solving Skills in Early Childhood

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Abstract

Problem solving is a foundational competency in early childhood, yet few studies have examined how digital storytelling can be designed to develop it. This study analyzed the use of digital storytelling, delivered as e-comics in Cycle 1 and as podcasts in Cycle 2, to support problem-solving skills among children aged 5 to 6 years. Classroom Action Research based on the Kemmis and McTaggart model was conducted in two cycles of two meetings each at Lab Model UMP Kindergarten (11 children) and Aisyiyah 6 Kindergarten (16 to 18 children). Data were collected through observation, documentation, and interviews, and three indicators were scored, namely matching objects based on their function, identifying moral messages in stories, and applying basic logic through puzzle activities. At Lab Model UMP Kindergarten, completion for matching objects rose from 79% and 91% in Cycle 1 to 100% in Cycle 2, and completion for basic logic rose from 82% to between 88% and 100%, while identifying moral messages stayed between 89% and 94%. At Aisyiyah 6 Kindergarten, basic logic improved from 85% and 78% to 88% and 85%, matching objects varied between 67% and 83%, and identifying moral messages fell from 69% and 54% to 50% and 48%, below the good criterion. E-comics appeared to attract attention and engagement, whereas podcasts appeared to support imaginative thinking and logic, although children lost focus when stories were long. Digital storytelling shows promise for early problem solving when story length, guiding questions, and visual support are adjusted to children's developmental characteristics. The absence of a control group and the overlap between media and cycles limit causal claims.

Keywords: digital storytelling; problem solving; early childhood education; e-comic; podcast

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1. Introduction

The integration of digital technology in early childhood settings has become increasingly essential because it supports children's motivation, interest, and engagement in learning activities (Sarjani et al., 2023). Digital storytelling blends traditional narratives with multimedia elements, which increases engagement and promotes understanding in early childhood (Purnama, 2021). It merges conventional storytelling techniques with contemporary technology and creates a more engaging and meaningful learning experience for young children (Rahiem, 2021). This approach is especially significant in early childhood, where learning must be developmentally appropriate, sensory-rich, and engaging to support children's holistic growth.

A substantial body of research highlights the benefits of digital storytelling, including improved communication skills, creativity, and children's capacity to construct meaning from multimedia representations (Catalano & Catalano, 2022; Papadimitriou et al., 2013). The integration of multimedia tools helps strengthen children's understanding of narrative structure and their ability to relate stories to real-life contexts (Indriani & Suteja, 2023; Manousi & Prentzas, 2021). When children create digital stories, they express their creative ideas and use their full potential to produce engaging digital narratives. Storytelling also serves as an effective educational tool for sharing knowledge and transmitting socio-cultural heritage to a wider audience and to future generations (Smeda et al., 2014). These findings underscore the pedagogical significance of storytelling as a foundation for children's cognitive, linguistic, and social development.

Beyond these advantages, digital storytelling is increasingly acknowledged for its potential to support higher-order thinking skills. When engaging with multimedia stories, children analyze visual

sequences, interpret auditory cues, predict narrative outcomes, and evaluate characters' actions, all of which are closely linked to reasoning and inference. However, despite these cognitive benefits, limited research has specifically examined how digital storytelling develops children's problem-solving skills. Much of the existing literature focuses on creativity, engagement, or language outcomes, which leaves an important gap regarding the strategic use of digital storytelling to foster problem-solving processes.

Most digital stories are relatively short, typically two to ten minutes long, and are saved in a digital format that can be viewed on a computer or another device capable of playing video files. Digital stories are also often uploaded to the internet, where they can be accessed through any popular web browser (Robin, 2016). This format aligns naturally with children's limited attention spans, because its brief duration corresponds with the time children can usually sustain focus on a single activity, including listening to digital narratives or podcasts. Understanding this alignment between attention span and media duration is essential, as it helps explain why digital storytelling is a suitable tool for early childhood learning.

Despite the evidence supporting digital storytelling as a meaningful learning medium, research has not yet fully explored how the method can be intentionally designed to enhance children's problem-solving skills. Existing studies tend to describe general cognitive outcomes without detailing how children use narrative elements to identify problems, generate solutions, compare alternatives, or make decisions. There is therefore a clear research gap regarding the mechanisms through which digital storytelling can strengthen early problem-solving abilities, an essential competency in early learning and future academic success.

In response to this gap, the present study aims to analyze implementation strategies of digital storytelling that can enhance problem-solving skills among young children. The study investigates how multimedia tools, narrative components, and child-centered storytelling activities can be integrated into classroom practice to support children's ability to think critically, develop solutions, and understand cause and effect relationships. By considering children's developmental characteristics such as attention span, cognitive readiness, and engagement preferences, this research seeks to provide a comprehensive perspective on how digital storytelling can function as an effective pedagogical approach.

Ultimately, the findings of this study are expected to offer practical guidance for early childhood educators regarding the design and implementation of digital storytelling activities. These insights may help teachers develop learning experiences that not only engage children but also strengthen their foundational problem-solving abilities, filling the gap identified in the current literature and advancing the application of digital storytelling in early childhood education.

2. Methodology

The research used a Classroom Action Research (CAR) design based on the model of Kemmis and McTaggart (Kemmis et al., 2019). CAR aims to solve practical problems while seeking scientific support. Participants, including teachers and lecturers, deliberately formulate interventions designed to improve the situation and carefully observe their implementation to assess their effectiveness (Susilo et al., 2022).

The study was conducted in two kindergartens, Aisyiyah 6 Kindergarten (TK ABA 6) and the Lab Model Kindergarten of Universitas Muhammadiyah Pontianak (Lab Model UMP Kindergarten). The participants were children aged 5 to 6 years. The number of children observed was 11 at Lab Model UMP Kindergarten and between 16 and 18 at Aisyiyah 6 Kindergarten, depending on the meeting. Each of the two cycles consisted of two meetings.

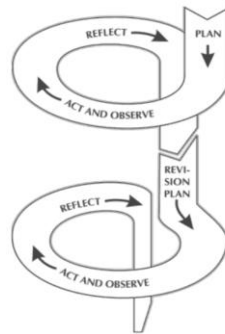


Figure 1

Classroom action research cycle of Kemmis and McTaggart (adapted from Kemmis et al., 2019)

Diagrammatically, the steps of CAR based on the Kemmis and McTaggart model consist of four interrelated components, namely planning, action, observation, and reflection. These components form a continuous cycle. Action and observation are shown together in Figure 1 because they take place at the same time.

In the planning stage, all necessary preparations for implementing the action are arranged carefully, including teaching materials, lesson plans that incorporate teaching methods and techniques, and observation and evaluation techniques and instruments.

The action stage involves executing all planned activities. The teacher assumes a dual role as both the facilitator of learning and the researcher. Observation is conducted simultaneously with the implementation of the action. Data on the execution of the planned action and its impact on the learning process and outcomes are collected using pre-developed observation instruments. In collaborative CAR, teachers are assisted by lecturers to ensure a comprehensive analysis. The reflection stage involves processing and analyzing the data collected during observation. The data are interpreted, explanations are explored, and findings are analyzed to assess the effectiveness of the action.

The data collection techniques in this study included observation, documentation, and interviews. Data were analyzed with a comparative technique that compared the results of the first and second research cycles. These comparisons were used to determine indicators of success and failure in each cycle, and unmet indicators were addressed in the subsequent cycle. Indicators serve as implicit measures of the success of improvements, which facilitates verification and conclusion-drawing for corrective actions through CAR and helps reduce conceptual errors. A child was considered to have achieved mastery when reaching a score of 80%.

For each indicator, every child was scored on a three-level scale, with 3 for emerged, 2 for beginning to emerge, and 1 for not yet emerged. To determine the percentage of children's achievement on each indicator, the following formula was used. $P = \frac{F}{N} \times 100\%$. In this formula, P is the percentage, F is the total score obtained by the children, and N is the maximum possible score, which equals three points multiplied by the number of children observed (Pahleviannur et al., 2022). The percentages were interpreted with the Likert scale criteria in Table 1.

Table 1

Likert Scale Criteria for Interpreting Percentage Scores	
Percentage	Criteria
0% to 25%	Very Poor
26% to 45%	Poor
46% to 69%	Fair
70% to 85%	Good
86% to 100%	Very Good

An indicator was considered achieved when the percentage fell in at least the Good category on the Likert scale. If any indicator did not meet this criterion, an additional cycle would be required until the criterion was satisfied.

The research indicators were (1) matching objects based on their function, (2) identifying moral messages or lessons in a story, and (3) applying basic logic through puzzle activities. The first indicator measures children's ability to associate various objects with their respective uses, and a high level of performance suggests sound recognition of object and function relationships. The second indicator concerns children's ability to interpret and extract moral values or life lessons conveyed through storytelling, which reflects ethical reasoning and comprehension. The third indicator evaluates logical thinking through activities such as solving puzzles or riddles, and it is closely related to problem solving and early critical thinking.

3. Results

The ability to solve problems is a crucial skill that needs to be developed from an early age. Observations conducted in two early childhood education institutions, Aisyiyah 6 Kindergarten and Lab Model UMP Kindergarten, revealed that children aged 5 to 6 years still required assistance in determining and selecting objects for specific activities. This finding highlights the need for learning strategies that engage children actively and interactively to enhance their critical thinking and problem-solving skills.

Digital storytelling was delivered through e-comic media in Cycle 1 and through podcasts in Cycle 2, both tailored to the characteristics of early childhood. The research used the CAR method and was implemented in two cycles, each consisting of two meetings. In each cycle, the stages of planning, action, observation, and reflection were carried out.

3.1. Cycle 1, Meetings 1 and 2

In the planning stage, the classroom was arranged so that children sat in rows on floor mats, facing the projector. The teacher set learning objectives aimed at enhancing children's problem-solving abilities through interactive activities.

The learning medium was an e-comic titled *Yuk Cuci Tangan* (Let's Wash Our Hands), presented via a laptop, speaker, and projector to support children's understanding both visually and auditorily. The teacher also prepared a Children's Worksheet (LKA) aligned with the research indicators. The LKA included maze games, spot-the-difference tasks, matching identical pictures, and sequencing handwashing steps in alphabetical order from A to Z.

These preparations were designed to create an engaging learning environment and to foster active participation among children. In the action and observation stage, children began the activity by reciting a prayer and taking attendance with the teacher. The teacher then introduced the learning theme on maintaining body hygiene, with a focus on washing hands before and after eating.

Next, the teacher presented the digital story through the e-comic *Yuk Cuci Tangan*. After listening to the story, children engaged in a discussion through simple questions relevant to the narrative. This activity was followed by the distribution of the LKA, which contained educational tasks such as maze puzzles and other activities designed to enhance problem-solving skills.

This process was structured to help children grasp the concept of cleanliness while fostering their problem-solving abilities in a fun and interactive way.

At the end of Cycle 1, a reflection was conducted to evaluate the effectiveness of the learning process and to identify areas for improvement. Overall, the use of e-comics as a learning medium captured children's attention and increased their participation.

Children showed enthusiasm in following the story presented through the projector, and the majority were able to answer simple questions related to the cleanliness theme. Most children also completed the LKA activities, such as maze games and spot-the-difference tasks, successfully. However, some children still required intensive guidance from the teacher, particularly in activities that demanded higher problem-solving skills, such as sequencing handwashing steps alphabetically.

Although participation and engagement increased, several challenges still affected the effectiveness of the learning process. Some children tended to lose focus when the session ran too long, which indicated a need to adjust activity duration. Teacher-child interactions during discussions also needed improvement to encourage children to express their opinions more actively.

This reflection highlights the positive contribution of digital storytelling while emphasizing the need to modify the implementation strategy. Shortening the storytelling duration, providing adequate breaks, and adding more challenging activities could further support children's problem-solving abilities.

3.2. Cycle 2, Meetings 1 and 2

In the planning stage of Cycle 2, learning was designed around the Spotify application to introduce children to stories in the form of podcasts. The story themes were tailored to each school's needs, with animals (Binatang) selected for Aisyiyah 6 Kindergarten and trains (Kereta Api) for Lab Model UMP Kindergarten.

Teachers prepared devices such as laptops or smartphones connected to speakers so that the podcasts were clearly audible to all children. The LKA was also designed to align with the story themes. The worksheets included spot-the-difference tasks, sequencing pictures based on the story, thematic drawing exercises, and other activities that stimulate children's problem-solving skills. This preparation aimed to create an interactive, engaging, and thematically relevant learning experience.

In the action and observation stage of Cycle 2, learning began with an opening activity in which children recited a prayer together and took attendance. The teacher then introduced the day's learning theme and linked it to the podcast to be heard.

At Aisyiyah 6 Kindergarten the theme was animals, while at Lab Model UMP Kindergarten it was trains. After the theme was introduced, children listened to stories as podcasts on Spotify, played through speakers so that all children could hear clearly.

After listening to the podcast, the teacher asked simple questions related to the story, such as "What animal was mentioned in the story?" or "What did the train do in the story?" These questions were designed to stimulate children's responses, strengthen their memory, and encourage critical thinking.

Observations were conducted throughout the process to assess children's level of engagement, their ability to answer questions, and their performance in completing the tasks in the LKA. This process provided insights into the effectiveness of podcasts in enhancing children's problem-solving skills.

In the Cycle 2 reflection, the use of podcasts from Spotify as a learning medium was accompanied by a marked increase in children's engagement and enthusiasm. The auditory storytelling approach captured children's attention and created a more enjoyable learning atmosphere.

Children appeared more focused while listening to the story, and the majority were able to answer the teacher's simple questions afterward. The LKA results also improved compared with Cycle 1, with more children completing tasks such as sequencing story events and drawing according to the theme with minimal teacher assistance.

Although the results were quite satisfactory, some challenges remained. Some children struggled to comprehend the story fully, especially when the podcast was too long for their age. Verbal interaction between teachers and children during discussions also needed improvement to encourage children to express their ideas and opinions more actively.

Based on this reflection, future story selections should be shorter and simpler, and teachers can add more guiding questions to stimulate children's active participation. Overall, podcast-based learning showed positive results in supporting children's analytical skills in problem solving and their understanding of the presented themes.

Table 2 presents observational data on the development of children's problem-solving abilities in Cycles 1 and 2 at Lab Model UMP Kindergarten. The observations focused on three aspects, namely (1) matching objects based on their function, (2) identifying moral messages or lessons in stories, and (3) the ability to use basic logic.

Table 2
Comparison of Cycles 1 and 2 at Lab Model UMP Kindergarten

No	Observed Aspects	Cycle 1		Cycle 2	
		Meeting		Meeting	
		1	2	1	2
1	Matching objects based on their function	26	30	33	33
	Completion (%)	79%	91%	100%	100%
2	Identifying moral messages or lessons in stories	29	30	31	30
	Completion (%)	89%	91%	94%	91%
3	Ability to use basic logic (puzzle or riddle activities)	27	27	33	29
	Completion (%)	82%	82%	100%	88%

In Cycle 1, three aspects were observed, namely the ability to match objects based on their function, to identify moral messages or lessons in the story, and to use basic logic through puzzle activities.

Matching Objects Based on Their Function in Cycle 1

For matching objects based on their function, the first meeting recorded a completion rate of 79%, with 4 children (36%) in the emerged category and 7 children (64%) in the beginning to emerge category. By the second meeting, the completion rate had increased to 91%, with 8 children (73%) in the emerged category and 3 children (27%) in the beginning to emerge category. These results indicate an improvement in children's understanding of the relationship between objects and their functions from the first to the second meeting.

In the first meeting, this aspect had a completion rate of 89%, with 7 children (64%) in the emerged category and 4 children (36%) in the beginning to emerge category. By the second meeting, the completion rate had increased slightly to 91%, with 8 children (73%) in the emerged category and 3 children (27%) in the beginning to emerge category. Although the increase was small, these results indicate that children gradually improved in understanding the moral messages conveyed in the story.

For this aspect, the completion rate remained at 82% across both meetings. In the first meeting, 6 children (55%) were in the emerged category, 4 children (36%) were beginning to emerge, and 1 child (9%) had not yet emerged. The same distribution was observed in the second meeting. Some children showed progress, but almost half of the class still required additional support in developing basic logical reasoning skills.

In Cycle 2, learning was enhanced through podcast media, which was more engaging and aligned with the thematic focus of each school. At this kindergarten, completion in Cycle 2 was equal to or higher than in Cycle 1 for every observed aspect.

In both the first and second meetings, this aspect reached a 100% completion rate, with all children in the emerged category. This outcome indicates that children consistently understood object and function relationships without difficulty.

During the first meeting, the completion rate for this aspect reached 94%, with 9 children (82%) in the emerged category and 2 children (18%) in the beginning to emerge category. In the second meeting, the completion rate declined slightly to 91%, with 8 children (73%) in the emerged category and 3 children (27%) in the beginning to emerge category. This minor decrease suggests a need for further reinforcement of children's comprehension of moral messages.

In the first meeting, this aspect reached a 100% completion rate, with all children in the emerged category. In the second meeting, however, the completion rate dropped to 88%, with 7 children (64%) in the emerged category and 4 children (36%) in the beginning to emerge category. This decline may be attributed to variations in task difficulty or differences in children's problem-solving abilities during the session.

The findings from Cycles 1 and 2 show improvement in children's abilities at this kindergarten across the three aspects, namely matching objects based on their function, identifying moral messages or lessons in stories, and applying basic logic through puzzle-solving activities. In Cycle 1, e-comic media served as the learning tool and captured children's attention through engaging visual storytelling. However, some children still required guidance, particularly in tasks related to basic logic, which suggests a need for additional instructional support and reinforcement.

In Cycle 2, podcast media delivered through Spotify introduced a more dynamic learning experience. Completion improved, particularly in matching objects based on their function, which reached 100% in both meetings. However, a slight decline was observed in identifying moral messages and applying basic logic during the second meeting of Cycle 2. These findings suggest that digital media can support children's learning engagement, but the complexity of instructional materials and pedagogical approaches still need to be refined to better support cognitive development.

Overall, e-comic media in Cycle 1 and podcasts in Cycle 2 were accompanied by an engaging learning experience and by higher completion rates in the problem-solving indicators at this kindergarten. The use of diverse media shows potential for supporting children's comprehension of fundamental concepts, moral reasoning, and logical thinking. To maximize learning outcomes, varied and developmentally appropriate media should continue to be explored and adapted so that the learning environment remains interactive, relevant, and stimulating.

Table 3 presents observational data on the development of children's problem-solving abilities in Cycles 1 and 2 at Aisyiyah 6 Kindergarten. The assessment focused on three aspects, namely (1) matching objects based on their function, (2) identifying moral messages or lessons in stories, and (3) applying basic logic.

Table 3
Comparison of Cycles 1 and 2 at Aisyiyah 6 Kindergarten

No	Observed Aspects	Cycle 1		Cycle 2	
		Meeting		Meeting	
		1	2	1	2
1	Matching objects based on their function	39	36	35	40
	Completion (%)	81%	67%	73%	83%
2	Identifying moral messages or lessons in stories	33	29	24	23
	Completion (%)	69%	54%	50%	48%
3	Ability to use basic logic (puzzle or riddle activities)	41	42	42	41
	Completion (%)	85%	78%	88%	85%

In Cycle 1, the observed aspects showed varying levels of achievement across the two meetings. The learning activities were implemented to develop children's problem-solving abilities through digital storytelling.

In the first meeting, 8 children (50%) were in the emerged category, 7 children (44%) were beginning to emerge, and 1 child (6%) had not yet emerged. The overall completion percentage was 81%. In the second meeting, 5 children (28%) were in the emerged category, 8 children (44%) were beginning to emerge, and 5 children (28%) had not yet emerged, resulting in a completion percentage of 67%. These results show that achievement on this indicator varied between the two meetings.

For identifying moral messages or lessons in the story, the first meeting showed that 5 children (31%) were in the emerged category, 7 children (44%) were beginning to emerge, and 4 children (25%) had not yet emerged. The completion percentage was 69%. In the second meeting, 4 children (22%) were in the emerged category, 3 children (17%) were beginning to emerge, and 11 children (61%) had not yet emerged, resulting in a completion percentage of 54%. The results indicate that achievement on this indicator declined between the two meetings.

In the first meeting, 14 children (87%) were in the emerged category, while 2 children (13%) were beginning to emerge. The completion percentage was 85%. In the second meeting, 6 children (33%) were in the emerged category and 12 children (67%) were beginning to emerge, resulting in a completion percentage of 78%. These findings indicate that most children showed at least the beginning of basic logic in both meetings, although the completion percentage was lower in the second meeting.

The results across Cycles 1 and 2 show that children's problem-solving abilities varied across the three indicators. Matching objects based on their function reached completion rates of 81% and 67% in Cycle 1 and 73% and 83% in Cycle 2, so the second meeting of Cycle 2 was the highest of the four meetings. Identifying moral messages or lessons in the story moved in the opposite direction, from 69% and 54% in Cycle 1 to 50% and 48% in Cycle 2, which is below the good category. Basic logic through puzzle or riddle activities reached 85% and 78% in Cycle 1 and 88% and 85% in Cycle 2, which stayed in the good category or higher.

Overall, the findings indicate that the development of problem-solving skills was not uniform across indicators. Children's achievement differed by the type of problem-solving ability assessed, and the indicator of identifying moral messages did not reach the criterion at this kindergarten by the end of Cycle 2. These findings also indicate the importance of examining how digital storytelling activities relate to the specific cognitive demands of each indicator.

The use of multiple learning media, such as e-comics and podcasts, contributed to a more enjoyable learning environment and supported the development of problem-solving skills in early childhood education. This approach is an innovative alternative that can be adopted in early childhood education (Pendidikan Anak Usia Dini, PAUD) settings to support varied learning needs and enhance engagement. Figure 2 compares the mean completion rate for each indicator across the four meetings at the two kindergartens. Lab Model UMP Kindergarten had a higher mean than Aisyiyah 6 Kindergarten on all three indicators, and the largest gap was found for identifying moral messages (91% compared with 55%).

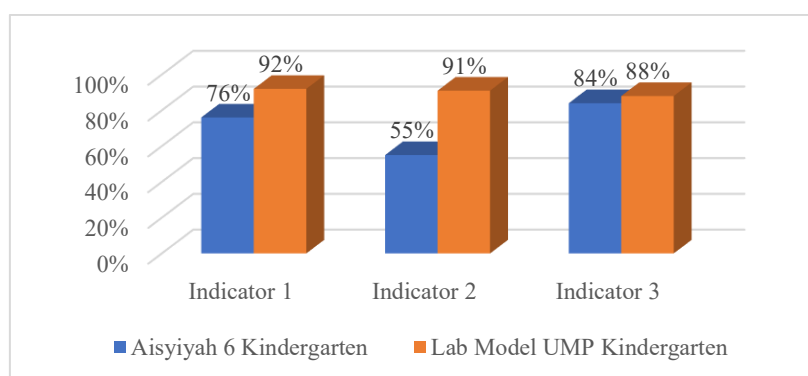


Figure 2

Mean completion rate per indicator across Cycles 1 and 2 at the two kindergartens

4. Discussion

This study shows that digital storytelling delivered through e-comics and podcasts was accompanied by better problem-solving performance among young children on two of the three indicators, namely matching objects based on their function and applying basic logic. Identifying moral messages improved only slightly at Lab Model UMP Kindergarten and declined at Aisyiyah 6 Kindergarten. Because the study used a classroom action research design without a control group, these improvements cannot be attributed to the media alone. Earlier research shows that adult scaffolding is related to how children structure problem-solving tasks with a peer (Hustedt, 2015), which is relevant to the guidance that teachers gave during discussions and worksheet activities in this study.

Digital storytelling is not only entertaining but can also stimulate critical and creative thinking in children. Through e-comics, children can visualize stories interactively, which helps them understand the context and cause-and-effect relationships within the narrative. Podcast media, in turn, can encourage active listening and imagination because children must construct the storyline without visual aids.

In Cycle 1, e-comics were used with completion rates that ranged from 79% to 91% at Lab Model UMP Kindergarten and from 54% to 85% at Aisyiyah 6 Kindergarten. Without a baseline measurement, these figures describe children's performance during the cycle rather than a change caused by the medium. The interactivity and engaging visuals of e-comics may have helped children connect the information they received with their daily experiences, which supports comprehension and analytical skills.

In Cycle 2, completion in basic logic was higher than in Cycle 1 at both kindergartens. By listening to stories without visual support, children had to imagine the storyline, identify characters, and infer the moral message, which may have strengthened their critical thinking and logical reasoning. Identifying moral messages, however, did not improve consistently, particularly at Aisyiyah 6 Kindergarten, where completion fell to 50% and 48%. This suggests that inferring a moral message from audio alone may be too demanding for some children without additional visual or verbal support.

These findings are in line with Hollenstein et al. (2022), who observed that kindergarten children identified problems in play situations and solved them with problem-solving strategies, and that the teacher's participation enabled longer and more complex problem-solving processes. Creating digital stories can also enhance children's thinking skills by fostering creativity, innovation, critical thinking, and the ability to analyze and process information during the planning stage (Merjovaara et al., 2020).

The observations suggest that e-comics were particularly effective in attracting attention and engaging children, while podcasts were accompanied by higher completion in basic logic. In Cycle 2, when podcasts were used, more children were able to complete more complex tasks, such as arranging story sequences and solving puzzles that require logic and analytical thinking. Because the two media were used in different cycles with different story themes, the differences cannot be attributed to the media alone, and practice effects and children's maturation across cycles may also have contributed.

Podcasts also have weaknesses in maintaining children's focus, especially with long stories. Some children had difficulty maintaining concentration and understanding the entire storyline without visual aids. This indicates a need for variation in the use of digital storytelling media that takes into account the characteristics and developmental needs of early childhood.

This study adopted a multimodal approach to digital storytelling by combining e-comics and podcasts as complementary learning media. The strategy involves children's visual and auditory senses and also encourages active participation and social interaction through narrative-based discussions and activities.

In Cycle 1, e-comics accompanied by group discussions encouraged children to express their opinions about the moral message in the story. In Cycle 2, podcasts followed by collaborative story-

sequencing activities appeared to help children develop social and cognitive skills such as teamwork and cooperative problem solving.

Catalano and Catalano (2022) likewise describe digital storytelling as an emerging teaching strategy that allows teachers to choose or create stories according to children's interests and that supports child-centered learning. This is consistent with the multimodal, discussion-based activities used in the present study, although the present data do not test child-centeredness directly.

The findings of this study indicate that digital storytelling technology can contribute to the development of problem-solving skills in early childhood. The practical implications of this study are described below.

Digital storytelling media, particularly e-comics, captured children's attention and increased their engagement in the learning process. The use of relatable characters and narratives from children's daily lives creates an enjoyable and meaningful learning environment. Preparing children to thrive in the 21st century has become a priority, and teachers are consequently expected to develop new competencies, such as using digital resources effectively to design learning environments that optimize student learning. This requires teachers to acquire the skills needed to operate and manage information technologies (Yilmaz & Sığirtmaç, 2023).

Narrative-based activities, such as group discussions and collaborative problem solving through the LKA, help children build communication and teamwork skills. This aligns with the findings of Ramani and Brownell (2014), who emphasize that cooperative problem solving plays an important role in children's social and cognitive development.

Activities that incorporate puzzles and riddles structured around digital storytelling help children develop basic logical reasoning and analytical skills. This approach links story narratives to fundamental logical concepts and reinforces children's cognitive development.

Researchers and educators also highlight that participation in digital storytelling is highly motivating, engaging, and liberating, and that it fosters creativity for both teachers and students. Digital storytelling supports knowledge construction, critical thinking, curiosity, inquiry, creativity, negotiation, reflection, and the sharing of ideas. It also enhances communication, confidence, content mastery, enthusiasm, collaboration, cooperation, interaction, dialogue, and commitment, and it promotes empowerment, pride, ownership, playfulness, validation, and a sense of achievement (Towndrow & Kogut, 2020).

5. Conclusion

This study shows that digital storytelling delivered through e-comics and podcasts can contribute positively to the development of problem-solving skills in early childhood. The findings indicate that both media formats supported children's ability to match objects based on their function and to apply basic logical reasoning through structured activities, whereas identifying moral messages improved only slightly at one kindergarten and declined at the other. Each medium also offered distinct advantages. E-comics appeared more effective in capturing children's visual attention and increasing participation, while podcasts appeared to play a stronger role in stimulating imagination, listening skills, and logical thinking.

The results also highlight the importance of aligning digital storytelling with children's developmental characteristics, especially their attention span and cognitive readiness. In both cycles, teachers observed that some children lost focus when sessions or stories ran too long, which supports the use of short storytelling activities, typically two to ten minutes long (Robin, 2016), combined with guided discussions and interactive tasks. The integration of multimodal elements, both visual and auditory, may further support children's cognitive processing and encourage active participation in problem-solving activities.

From a practical perspective, this study suggests that early childhood educators should adopt a multimodal digital storytelling approach by combining visual and audio-based media. Teachers are encouraged to design storytelling sessions that include problem-based narratives, guided questioning, and follow-up activities such as puzzles or sequencing tasks to strengthen children's analytical and decision-making skills. The use of accessible platforms, such as digital comics and podcast applications, can also facilitate more flexible and engaging learning environments.

Despite these contributions, this study has several limitations. The absence of a control group limits the ability to establish causal relationships between the intervention and the observed outcomes. The two media were also used in different cycles with different story themes, so the effect of the medium cannot be separated from the effects of theme, practice, and maturation. The number of participants was small, and the indicator of identifying moral messages did not reach the Good criterion at Aisyiyah 6 Kindergarten, where an additional cycle would have been needed. Variations in the implementation of storytelling sessions may also affect the consistency of results. Future research is therefore recommended to employ more rigorous designs, such as quasi-experimental or longitudinal studies, to validate the effectiveness of digital storytelling in enhancing problem-solving skills. Further studies may also explore emerging technologies, such as interactive or AI-based storytelling, to enrich children's learning experiences.

In conclusion, digital storytelling represents a promising pedagogical approach in early childhood education. When implemented thoughtfully and aligned with developmental needs, it can support the development of foundational problem-solving skills, which are essential for children's future learning and adaptability.

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