

# Enhancing early childhood education through E-story books: Promoting clean and healthy habits via digital storytelling and collaborative learning



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**Abstract** This study explores the development and implementation of E-Story Books as an innovative educational tool for promoting clean and healthy habits among kindergarten students. Utilizing a Research and Development (R&D) framework, interactive digital storybooks were designed, integrating visually engaging illustrations and relatable narratives to enhance young learners' engagement. The effectiveness of the intervention was evaluated through a Quasi-Experiment study employing a nonequivalent control group design. Findings revealed that E-Story Books successfully developed and students who exposed to E-Story Books exhibited significant behavioral improvements, including enhanced oral hygiene practices, responsible waste disposal, and healthier dietary choices. Additionally, the study identified notable enhancements in language development and literacy skills attributed to the interactive and visually stimulating nature of digital storytelling. A key aspect of the intervention was the integration of collaborative learning, wherein parents and educators actively participated in reinforcing positive habits at home and in the classroom. The collaborative approach amplified the impact of digital storytelling, fostering social-emotional growth and encouraging sustained behavioral change. Statistical analyses confirmed that students in the experimental group exhibited significantly higher gains in health-related behaviors compared to the control group, highlighting the efficacy of E-Story Books as an early childhood education tool. The study underscores the value of integrating technology into early education to promote essential life skills. E-Story Books present a scalable, engaging, and effective approach to health education, bridging gaps in traditional teaching methods. Future research should explore the long-term impacts of digital interventions and address potential challenges related to equitable access to digital resources. The study offers practical implications for educators, parents, and policymakers seeking to enhance early childhood learning experiences through digital innovation.

**Keywords:** E-Story books, clean and healthy habits, early childhood education, digital storytelling, collaborative learning, educational technology

## 1. Introduction

Encouraging clean and healthy practices in early childhood education promotes lifelong wellness and avoids health issues in the future. The literature reveals that early interventions have a lasting impact on children's behavioral and cognitive growth, laying solid groundwork for a healthier adult life. Clean and healthy living practices, including good oral hygiene, proper waste disposal, and proper nutrition, are fundamental behaviors that affect physical health, social growth, and emotional stability. The formation of such habits in early childhood is essential, as the habits developed during this formative period are most likely to continue throughout an individual's life. More specifically, oral hygiene is a significant issue in early childhood development phases (Jakobovich et al., 2023). Research by Bánfai-Csonka et al. (2022) emphasized the necessity of engaging parents and teachers in early intervention practices, including the SIMS program, which successfully enables the formation of proper oral hygiene habits in children. These findings underscore the importance of health literacy and intergenerational learning in equipping children with the motivation and skills to maintain healthy lifestyles. Similarly, research by Lim & Lee (2024) & Osera et al. (2018) demonstrated the profound impact of diet in early life on subsequent health. Kids who acquire good eating habits during their early years have better physical health and intellectual performance, making it imperative that specific education strategies are designed to instill clean and healthy living habits. Cooperative learning settings take a step further by increasing peer interaction and social skills, leading to the overall growth of young students. Research has confirmed that cooperative learning facilitates academic success and promotes the development of emotional and social skills.



As Burns et al. (2024) & Wu (2022) argued, collaborative learning experiences trigger children's involvement in meaningful problem-solving tasks, thereby fostering a sense of community in schools. Hamamoto et al. (2021) & Murphy et al. (2023) further highlight that collaborative environments offer children the possibility of learning from each other, thereby enhancing academic performance as well as behavior. The combination of academic and social learning in a collaborative model reaffirms the importance of teamwork and shared responsibility in early childhood education. Despite the significant contribution of promoting healthy and clean living habits, there are various obstacles to their effective application in early childhood education. One notable obstacle is the limited availability of healthy food choices in most schools, as noted by (Ergül et al., 2023). The school nutrition environment frequently contradicts the health messages taught in nutrition education, which results in detachment between theory and practice (Boddy et al., 2019).

Additionally, irregular integration of health education programs is regularly caused by a shortage of systematic plans aligned with the specific needs of school communities (Orava et al., 2017). These gaps underscore the need to create innovative and efficient educational materials that address these shortcomings. By providing interactive and engaging media for imparting clean and healthy practices, digital literacy emerges as a potential remedy. Evidence Purbasari et al. (2023) and Sinaga & Nandiyanto (2022) illustrates how digital technology enriches learning experiences, as it supports collaboration and active engagement. Digital media support various learning styles and promote critical thinking and problem-solving abilities, which are vital for lifelong learning (Azman et al., 2025; Bánfai-Csonka et al., 2022). The incorporation of technology in early childhood education provides an inclusive and engaging environment that supports holistic development, as evidenced by (Fajrie et al., 2024; Fidyaningrum et al., 2021; Utaminingsih et al., 2024).

The application of digital media in behavioral development is supported by strong theoretical underpinnings. For example, Gagne et al. (1992) nine events of instruction highlight the need for organized learning through activities such as digital storytelling. In line with Maureen et al. (2018), such an approach not only improves literacy but also develops digital literacy competencies. Furthermore, constructivist theories foster active learning through engagement with technology, facilitating cognitive and social development (Hoa & Minh, 2023). Such frameworks highlight the potential of digital media to influence early childhood education by rendering learning more accessible, interactive, and effective. Storytelling, particularly through digital media, has been an effective vehicle for imparting life skills to children. Narrative approaches make abstract notions, such as social-emotional learning and disaster preparedness, accessible and interesting (Haryani et al., 2023). Pulimeno et al. (2020) & Somadayo et al. (2022) stated that storytelling aids in the construction of emotional intelligence and social abilities by presenting actual life settings with which children identify. This educational trend parallels the wider moves toward more creative and interactive approaches to early childhood education (Maureen et al., 2022; Purnama et al., 2022). Digital storytelling has great potential to promote behavioral and cognitive development among young students through its integration of visual elements, interactivity, and accessible narratives.

The present research endeavors to fill the gaps in early childhood education by creating an interactive E-Story Book as an educational tool to inculcate clean and healthy living habits among kindergarten children. The present research attempts to assess how effectively the E-Story Book is in bringing about behavioral change through interactive learning environments. By incorporating digital storytelling in early learning, the project seeks to make a scalable and fun solution available to impart life skills to early learners, contributing to the general area of educational technology and early childhood development. This research is new in that it focuses on peer-to-peer learning and the use of digital media to add to health literacy and behavioral results. The results have important implications for educators, parents, and policymakers, offering a model for new directions in early childhood education. In order to accomplish this Aim, the subsequent research objectives have been formulated:

- 1- To analyze the necessity of developing an E-Story Books application aimed at promoting clean and healthy habits through digital storytelling and collaborative learning.
- 2- To design and develop an E-Story Books application that fosters clean and healthy habits through the integration of digital storytelling and collaborative learning methodologies.
- 3- To evaluate the effectiveness of the E-Story Books application in enhancing clean and healthy lifestyle practices through the use of digital storytelling and collaborative learning.

## 2. Materials and methods

This study employed a research and development (R&D) approach to design, develop, and evaluate the effectiveness of E-Story Books for promoting clean and healthy habits among kindergarten students. The methodology was grounded in design-based research principles, integrating iterative design, implementation, and evaluation cycles to ensure contextual relevance and practical applicability. Additionally, a quasiexperimental study employing a nonequivalent control group design approach was adopted to evaluate the intervention's impact comprehensively.

### 2.1. Research Design

The R&D methodology followed (Gall & Borg, 2003) ten-step framework, encompassing research, planning, product development, testing, revision, field testing, refinement, final testing, dissemination, and implementation. This structured process ensured the pedagogical effectiveness and user-friendliness of the E-Story Book media.

This research is limited to the final product testing stage. This process begins with the research and information gathering stage, which includes conducting a thorough review of literature, observing the classroom environment, and preparing a report on the current state of the art. The planning stage focuses on defining the skills and expertise needed to address the identified problem. This includes formulating objectives for each stage of the development process and determining the sequence of courses. Expert validation is carried out during preliminary product development, followed by a pilot test during initial testing. At the final product stage, a quasiexperimental study employing a nonequivalent control group design was conducted to test the final product. (Chua, 2012; Cohen et al., 2017).

X<sub>1</sub>: Experimental group treatment (E-Story Books).

X<sub>2</sub>: Control group treatment (conventional learning).

O<sub>1</sub>: Habituation of clean living behavior before experimental group treatment.

O<sub>2</sub>: Habituation of clean living behavior after experimental group treatment.

S<sub>1</sub>: Habituation of clean living behavior before the control group treatment.

S<sub>2</sub>: Habituation of clean living behavior after the control group treatment.

## 2.2. Participants and Sampling

The study population comprised kindergarten students and their parents from state kindergartens in Indonesia. Purposive sampling was employed to select two kindergartens that were designated experimental groups and control groups on the basis of their willingness to participate and the diversity of student demographics. The inclusion criteria included students aged 4–6 years who were enrolled in the selected kindergarten, parents who actively participated in their children's learning activities, and educators with at least two years of teaching experience in early childhood education. A total of 40 students, their parents, and six teachers were included to ensure a balanced representation for both the experimental and control groups.

## 2.3. Data collection instruments

To comprehensively evaluate the children's clean and healthy habits, structured observations were conducted during interactive activities such as storytelling, group discussions, and play, with a focus on social–emotional interactions, hygiene-related behaviors (e.g., brushing teeth, disposing of waste), and nutritional habits. Additionally, questionnaires were developed to determine the Clean and Healthy Habits dimensions of the students, which were formed on the basis of six indicators derived from the Indonesian curriculum syllabus 2013 (K13), such as the habit of brushing one's teeth before going to bed, the habit of brushing one's teeth after waking, throwing garbage in one's place, picking up trash in the classroom environment, eating nutritious food, and avoiding unhealthy food.

## 2.4. Data analysis

Data were collected via a quasiexperimental study method with a nonequivalent control group design (Figure 2). Data analysis was conducted via descriptive analysis, N-Gain, and inference analysis. Paired t tests were performed to compare the pretest and posttest scores between the experimental and control groups. This was done to compare the effects of using E-Story Books with those of promoting clean and healthy habits training.

## 3. Results

The development of Story Books is consistent with the research and development (R&D) framework established by (Gall & Borg, 2003). The sequence of stages that must be completed includes research and information gathering, planning, preliminary product development, initial testing, product revision, field testing, refinement, final product testing, dissemination, and implementation, as illustrated in Figure 1.

### 3.1. Research and Information Gathering

At this stage, interviews and observations of the learning process in kindergarten were conducted as part of the preliminary analysis. The issues and needs of the school regarding E-Story Books were identified during this phase. Children continue to bring provisions in the form of savory foods, snacks, and drinks containing artificial sweeteners and preservatives. Additionally, children often practice littering. From the teacher's perspective, the learning media used remains traditional. Further identification revealed that parents mostly provide snacks for their children that are purchased from stores, which may be of questionable health. Only a small number prepare their own food supplies. In this stage, an urgency emerged to develop e-story books.

### 3.2. Planning

A storyboard, interface, story narration, and instructional design or strategy are defined at this stage. This instructional media is developed on the basis of 9 events of instructions (Gagne et al., 2005), namely, to gain the students' attention, inform

students of the objectives, stimulate recall of prior learning, present the content, provide learning guidance, elicit performance (practice), provide feedback, assess performance, and enhance retention and transfer. Additionally, storytelling and collaborative learning serve as the foundation for the development of E-Story Books. The storyboard for each story can be seen in Figure 3, while the synopsis of the stories can be found in Table 1.

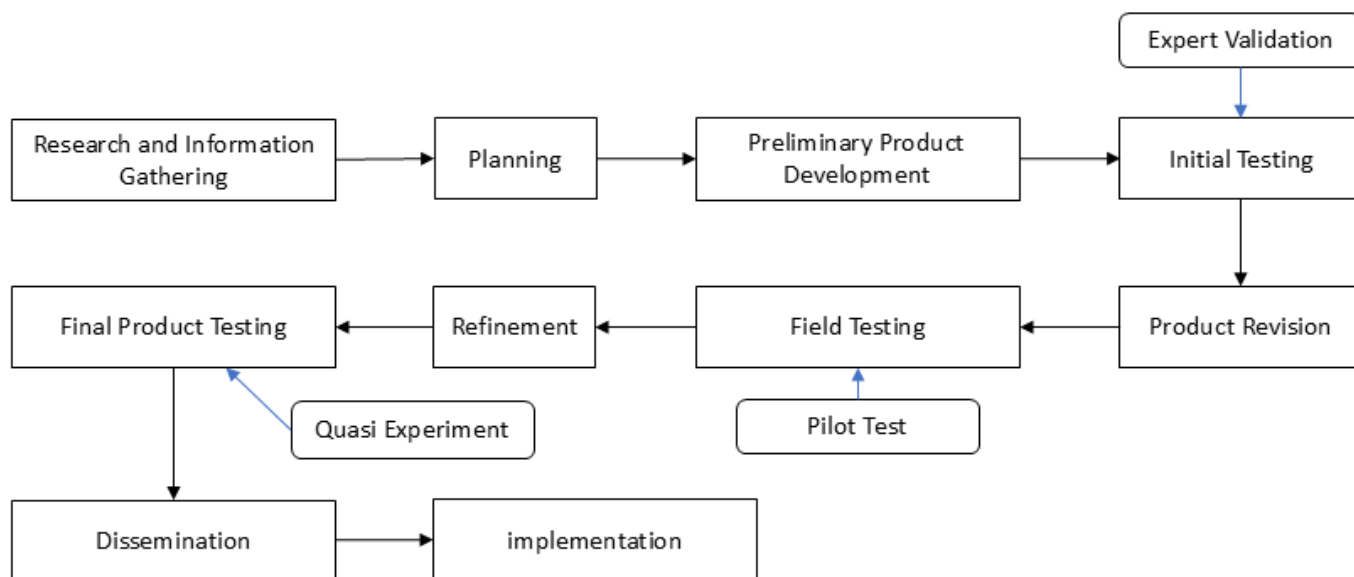


Figure 1 Gall & Borg (2003) Research and Development (R&D) Research Design.

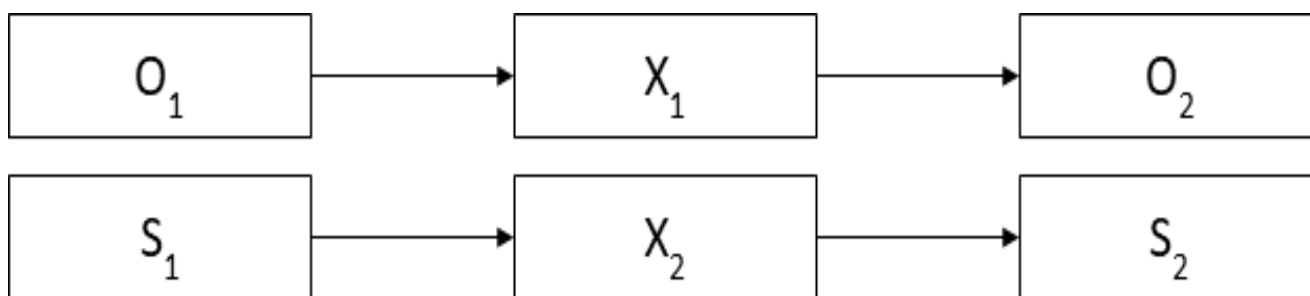


Figure 2 Quasiexperimental study using a nonequivalent control group research design.



Figure 3 Storyboard of (a) Lea's Dream; (b) Throw garbage in its place; (c) Doni like Eat Vegetables.

**Table 1** Story Synopsis of E-Story Books.

Title of The Story	Content of The Story
Lea's Dream	It tells the story of a kindergarten child named Lea who forgot to brush her teeth. As a result, she dreamed that tooth germs took her teeth. Since then, Lea has been diligent in brushing her teeth. Lea's Dream Story invites children to care for their body parts, namely, diligently brushing their teeth.
Throw garbage in its place	It tells the story of a child named Rani who has a stomach ache because she threw away her trash carelessly. The story about Throw Trash in Its Place encourages children to care about the environment and throw garbage in its place.
Doni Likes to Eat Vegetables	It tells the story of a child named Doni who has difficulty eating and wastes food. The story Doni Likes to Eat Vegetables invites children to eat nutritious food so their bodies are healthy.

**3.3. Preliminary Product Development**

The decisions made during the analysis and planning stages of the project have a substantial effect on the subsequent stage. At this stage, the application, in the form of a prototype, is constructed by leveraging pertinent media and technology components in accordance with the objective of the created media. The design of each element is achieved through the implementation of diverse software tools from the preceding stage, which are subsequently assembled on the initial platform to form a prototype. The utilization of diverse software during this phase is meticulously delineated in Table 2.

**Table 2** Software used.

Software	Purposes
Microsoft word	Story narrative development
Microsoft PowerPoint	Content development
Canva	Graphical Design
iSpring Suite	HTML 5 Compiling
Website2APK	Building apk. file

**3.4. Initial Testing**

At this stage, the application is validated by five experts specializing in learning media, early childhood education, and language and literature. Feedback and suggestions are gathered during this validation process to improve the E-Story Books application. The detailed feedback provided by the experts is presented in Table 3.

**Table 3** Validity and recommendations.

Validator	Validity*	Recommendations
Media expert	Expert 1 3,58 (Valid)	Clarify the meaning of the narrative with illustrations on the media Combine colors on the illustrations to make them more vivid and in accordance with the colors in reality so that the image becomes more real Storyboard or sketch of images on the media to avoid offending feelings, ethnicity, and religion.
	Expert 2 3,79 (Valid)	Clarity of narrative context in products to improve media quality
Content Expert	Expert 3 3,60 (Valid)	E-story book media would be better if it had sound so that children could hear the story because children are not yet able to read well and correctly.
	Expert 4 4,50 (Valid)	the delivery of messages/information has been reasonably effective
language and literature experts	Expert 5 4,30 (Valid)	The Indonesian language rules used are good and easy for children to understand.
	Expert 6 4,60 (Valid)	E-story book media has used terms that are appropriate to the concept of the subject matter.

\*Criteria for validity: Valid (>3,25–4,00), Fairly Valid (>2,50–3,25), Quite Valid, Invalid (>1,75–2,50).

**3.5. Product revision**

Following the successful completion of the language, material, and media validation tests, modifications were made to the product per expert recommendations. Subsequent to the aforementioned evaluations, the product underwent modifications in accordance with the recommendations provided by experts in the field. The alteration was implemented in the audio component. Initially, the e-story book media material on clean and healthy living behavior was exclusively a written story devoid of any auditory component. Subsequent to the successful completion of the product validation test, the audio element was incorporated to facilitate the selection of the menu option on the sound image, thereby enabling the playback of a voice reading the story on the book's page.



### 3.6. Field testing

At this stage, the revised application is tested directly on students to gain new insights that can improve the application. When the E-story book application is utilized in a classroom setting, observations of student activities are conducted. Additionally, interviews with teaching professionals are conducted to solicit feedback on aspects such as image size and sound volume.

### 3.7. Refinement

Following a field trial, the researcher received feedback from multiple teachers regarding the utilization of e-story book media products in promoting clean and healthy living behaviors. The feedback included recommendations to increase the volume and decelerate the pace of the narration. It was suggested that the narrative be articulated more slowly to enhance children's comprehension of the e-story book's storyline. In response to this recommendation, the researcher adjusted the volume of the audio recording to a higher level and reduced the reading speed, aiming to optimize the comprehension of the narrative for the young audience. The results of the small-scale trial can be seen in the children's enthusiasm for learning via e-story book media.

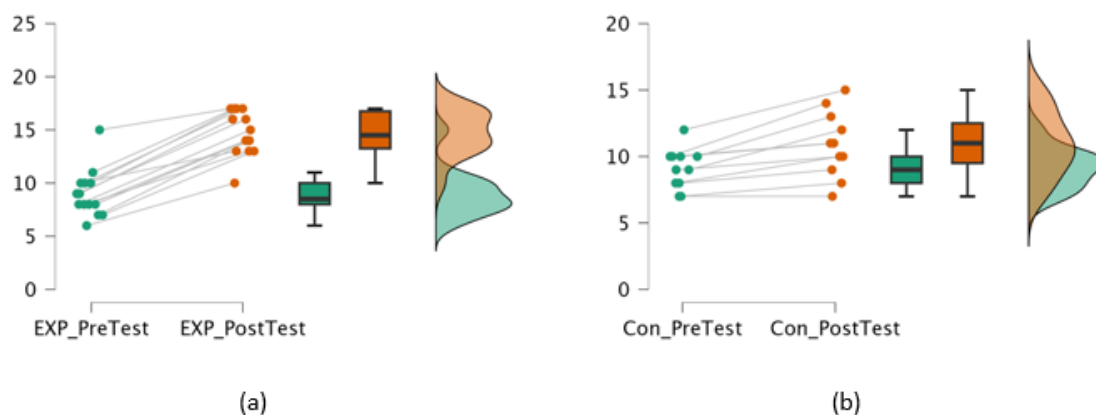
### 3.8. Final product testing

The product testing was conducted via a quasiexperimental design, creating two classes: a control class and an experimental class. Pretests and posttests were administered to these classes. The experimental class was instructed in developing e-story book media for clean and healthy living behavior. Conversely, the control class engaged in learning about clean and healthy living behaviors without the incorporation of e-storybook media. The N-Gain analysis depicted in Table 4 and the rain cloud analysis illustrated in Figure 4 demonstrated an increase in students' comprehension of clean and healthy habits.

**Table 4** N-gain analysis.

Experiment Class				Control Class			
Pretest	Posttest	N Gain	Criteria*	Pretest	Posttest	N Gain	Criteria*
55.6	72.2	0.4	Quite Effective	38.9	44.4	0.1	Less Effective
83.3	94.4	0.7	Effective	44.4	55.6	0.2	Less Effective
44.4	77.8	0.6	Quite Effective	55.6	72.2	0.4	Quite Effective
33.3	55.6	0.3	Quite Effective	50.0	66.7	0.3	Quite Effective
38.9	77.8	0.6	Quite Effective	55.6	77.8	0.5	Quite Effective
55.6	94.4	0.9	Effective	50.0	55.6	0.1	Less Effective
50.0	88.9	0.8	Effective	66.7	83.3	0.5	Quite Effective
55.6	94.4	0.9	Effective	38.9	38.9	0.0	Less Effective
44.4	77.8	0.7	Effective	55.6	61.1	0.1	Less Effective
61.1	94.4	0.9	Effective	44.4	50.0	0.1	Less Effective
44.4	83.3	0.7	Effective	55.6	61.1	0.1	Less Effective
38.9	72.2	0.5	Quite Effective				
50.0	88.9	0.8	Effective				
44.4	72.2	0.5	Quite Effective				

\*Effective ( $0,7 \leq N\text{-Gain} \leq 1$ ), Quite Effective ( $0,3 \leq N\text{-Gain} < 0,7$ ), Less Effective ( $N\text{-Gain} \leq 0,3$ ).



**Figure 4** Raincloud analysis of Gain.

As demonstrated in Table 4 and Figure 4, the experimental class has been shown to be more effective in promoting clean and healthy habits than the control class. Subsequently, an examination of the level of habituation of kindergarten



students' clean and healthy living behavior is conducted, with the utilization of indicators of clean and healthy living questions. The experimental class and the control class presented divergent outcomes.

**Table 5** Level of habituation to clean and healthy living behavior of kindergarten students.

Indicator	Experiment Class				Control Class			
	Pretest		Posttest		Pretest		Posttest	
	Mean	Criteria*	Mean	Criteria*	Mean	Criteria*	Mean	Criteria*
The habit of brushing teeth before going to bed.	57.1	SD	88.1	VWD	57.6	SD	66.7	DE
The habit of brushing teeth after waking up.	42.9	SD	76.2	DE	39.4	UD	45.5	SD
Throw garbage in its place.	38.1	UD	59.5	SD	51.5	SD	57.6	SD
Picking up trash in the classroom environment.	57.1	SD	88.1	VWD	51.5	SD	69.7	DE
Eat nutritious food	52.4	SD	90.5	VWD	51.5	SD	60.6	DE
Avoid unhealthy foods	52.4	SD	88.1	VWD	51.5	SD	63.6	DE
Average	50,0	SD	81,7	VWD	50,5	SD	60,6	DE

\*Undeveloped (UD) (0–40); Start Developing (SD) (41–60); Developing as Expected (DE) (61–80); Very Well Developed (VWD) (81–100).

The findings of the analysis presented in Table 5 provide a foundation for the subsequent discussion. The findings indicate that at the outset, the students in both the experimental and control groups exhibited comparable levels of development, characterized as "undeveloped." However, the experimental class that received e-story books presented greater requirements for "Very Well Developed" than did the control class, which was categorized as "Development as Expected." To ascertain the statistical significance of this observed increase, an inference analysis was conducted, preceded by a parametric assumption analysis (e.g., normality  $P > 0.05$ ). The resulting data were found to be homogeneous, with a significance value (sig) based on the mean of  $0.689 > 0.05$ . A parametric analysis employing a paired t test was subsequently conducted, as shown in Table 6.

**Table 6** Paired t test results.

Measure 1	Measure 2	Test	Statistics	Z	df	p
EXP_PostTest	EXP_PreTest	Student	13.057		13	< .001
		Wilcoxon	105.000	3.296		< .001
Con_PostTest	Con_PreTest	Student	4.822		10	< .001
		Wilcoxon	55.000	2.803		0.003

Note: The alternative hypothesis specifies that Measure 1 is more significant than Measure 2 for all tests. For example, EXP\_PostTest is greater than EXP\_PreTest.

The t test yielded a Sig. (2-tailed) value of  $0.001 < 0.05$ , or  $T_{count} 13.061 > T_{table} 2.16037$ , indicating a statistically significant difference in the average of students' clean and healthy living behavior habits before and after learning via the development of e-story book media for clean and healthy living behavior material. Conversely, the control class presented a Sig. (2-tailed) value of  $0.001 < 0.05$ , or  $T_{count} 4.822 < T_{table} 2.22814$ , suggesting the presence of a statistically significant difference in the average Clean and Healthy Living Behavior Habits of students before and after learning clean and healthy living behavior material via conventional methods.

#### 4. Discussion

##### 4.1. Effectiveness of E-Story Books in Promoting Clean and Healthy Habits

The results of this research indicate that E-Story Books play an important role in facilitating clean and healthy practices among kindergarten students. Table 6 indicates that a large difference was found between the control class and the experimental class and between the pretest and posttest examinations. The quantitative findings revealed significant differences between the experimental groups in terms of their behavioral outcomes, such as better oral hygiene behavior (e.g., brushing teeth before sleeping and after waking), proper disposal of waste, and better food habits. The N-Gain test revealed that the experimental class had greater effectiveness scores (0.3–0.9) than did the control group (0.0–0.5), with 60% of the experimental class students falling under the "Effective" or "Quite Effective" categories. These results indicate that, while there were notable differences between the pretest and posttests of both the experimental group using E-Story Books and the control class using traditional learning materials, there were also notable differences in the effectiveness levels achieved. These results confirm Gagné's nine events of instruction, which highlight the strength of organized, interactive learning approaches in stimulating learners and increasing retention. The application of audio-visual features, including rich illustrations and narrated stories, in E-Story Books has been found to offer multisensory stimulation, thus rendering intangible health notions concrete for preschool children.

The efficacy of e-story books can be attributed to their compatibility with the constructivist theory of learning (Brau, 2020; Isik, 2018), in which the active use of digital media enables cognitive and behavior development (Haddock et al., 2022). For example, the use of audio narratives in E-Story Books overcame reading restrictions in kindergarteners (Melzi et al., 2023)



and enabled them to manage narrative structures alone. This finding supported the findings of Sinaga & Nandiyanto (2022) that technology tools enable motivation through a variety of approaches to learning. Iterative refinement, facilitated through expert feedback, such as pace and sound level adaptations, identifies value in a user-focused design in educational technology (Al-Sa'di & McPhee, 2021; Santos & Silveira, 2021). These adaptations were implemented to make the media not only educational but also accessible and enjoyable for children. Interactive learning maximized intervention efficacy even further. Teachers and parents reported that shared reading sessions encouraged children to practice healthy habits at school and at home and that social modeling supported positive behavior through social modeling. This finding supported Wu (2022) observation that shared spaces enable peer learning and accountability. By combining group work with a digital narrative, the study constructed an integral environment for a whole-person, whole-setting, and whole-community intervention, in which behavior change could occur through iterative practice and social reinforcement.

#### 4.2. Level of Habituation of the Clean and Healthy Living Behavior of Kindergarten Students

The study revealed a considerable improvement in kindergarten students' habituation to healthy and clean behavior through E-Story Book intervention. Following the intervention, the experimental group reached an average rating of 81.7 ('Very Well Developed') compared with 60.6 ('Development as Expected') in the control group. The most significant improvements in key markers, such as brushing and healthy food consumption, improved, aligning with the intervention's focus on real-life stories such as *Dani Likes to Eat Vegetables* and *Lea's Dream*. These findings highlight the importance of early habit formation, as these behaviors are more likely to persist into adulthood (Bánfai-Csonka et al., 2022). Establishing these habits early reduces long-term health risks such as dental caries and obesity while fostering self-efficacy and accountability. Storytelling proved to be a powerful tool for habituation by embedding health messages within emotionally resonant narratives. Research by Pulimeno et al. (2020) suggests that stories simplify complex ideas, making them memorable and actionable for young minds. For example, the story *Throw Garbage in Its Place* framed proper waste disposal as a communal responsibility, encouraging children to adopt this behavior as a social norm. The use of anthropomorphic characters (e.g., 'tooth germs') tapped into children's imaginative thinking, a strategy supported by (Haryani et al., 2023), who reported that metaphorical storytelling enhances emotional engagement and memory retention. E-Story Books turn routine behaviors into meaningful, goal-driven activities by presenting health habits as adventures or challenges. Collaborative learning environments further strengthen habituation by offering opportunities for peer interaction and adult guidance. Group discussions and parent-child storytelling sessions helped children verbalize their understanding of health practices, solidifying their commitment to these behaviors. This aligns with Bandura's social learning theory (Bandura et al., 1977), which emphasizes that observational learning and social reinforcement are crucial for behavioral change. For example, when children saw peers disposing of trash correctly or parents praised healthy eating, they were more likely to imitate these actions. By incorporating group activities, the intervention ensured that habituation was not just individual but part of a supportive community, thus increasing its real-world sustainability and applicability.

#### 4.3. Implications for Practice

The findings confirm the importance of combining digital tools with early child instruction. E-story books can enhance motivation and performance when accompanied by traditional teaching methods. However, teachers and parents play a role in balancing and purposefully using digital media to reduce the potential negative effects of screen time. Parental involvement in reinforcing the lessons learned through E-Story Books is crucial, as the study shows. Discussions between parents and children about the content help deepen understanding and allow lessons to be translated into practical actions. As noted by Ohara (2023), parental modeling of positive behavior maximizes the educational impact of media, fostering a supportive environment for young children's development.

#### 4.4. Future Research Directions

Future research will need to address gaps in understanding the long-term effects of digital tools on early childhood education. Longitudinal studies are necessary to assess the lasting impacts of digital interventions on both behavior and learning outcomes over time. Kulaksız et al. (2023) emphasize the importance of experimental designs that control for biases and include diverse participant groups to improve the generalizability of findings. Comparative studies of various digital tools in different educational settings can offer valuable insights into best practices for incorporating technology in early childhood education, as suggested by (Akintayo et al., 2024). Furthermore, mixed-method approaches provide another opportunity to deepen future evaluations. By combining both quantitative and qualitative data, researchers can gain a fuller understanding of how digital tools affect children's learning behaviors. Aguirre et al. (2022) highlight the usefulness of mixed methods in identifying challenges related to digital literacy among both educators and students, which can guide focused interventions to optimize the use of technology in education. Finally, addressing the digital divide remains a top priority for future research. Ensuring equitable access to technology across different socioeconomic contexts is crucial for maximizing the educational benefits of digital tools. Watermeyer et al. (2021) emphasize the need to close gaps in access and digital literacy to create

inclusive learning environments for all children, regardless of their background. The findings of this study contribute to the growing body of work on improving early childhood education through innovative digital solutions while offering directions for future research to address existing gaps and emerging challenges.

## 5. Conclusions

This study highlights the development and significant role of E-Story Books in fostering clean and healthy habits, improving language and literacy skills, and enhancing engagement among kindergarten students. E-Story Books were successfully developed, and the findings demonstrate that integrating interactive digital storytelling into early childhood education can address key behavioral and educational challenges effectively. Using E-Story Books promoted essential habits such as oral hygiene, proper waste disposal, and nutritious eating and strengthened social-emotional competencies through collaborative learning frameworks involving parents and educators. Statistical analysis confirmed significant improvements in Clean and Healthy Habits outcomes among students who used digital tools, emphasizing their educational value.

The intervention's success was largely attributed to the involvement of parents and educators in the learning process, which fostered a supportive environment for habit formation. Statistical analyses confirmed that students in the experimental group exhibited significantly greater improvements in health-related behaviors than did those in the control group. These results underscore the potential of E-Story Books as effective tools for early childhood education, bridging the gap between traditional teaching methods and modern digital learning strategies.

While the findings demonstrate the effectiveness of E-Story Books, their successful implementation requires careful consideration of digital accessibility and content adaptation for diverse learning environments. Future research should explore the long-term impact of digital interventions on behavioral and cognitive development and address potential challenges such as equitable access to digital resources and the balance between screen time and traditional learning methods.

This study contributes to the growing body of literature supporting the integration of technology into early education. By leveraging digital storytelling, educators and policymakers can enhance learning experiences, improve health literacy, and cultivate essential life skills in young children. These findings provide practical insights for the future development of scalable, interactive, and inclusive educational strategies aimed at fostering holistic child development.

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## Ethical considerations

Ethical permission was acquired from the Ethics Committee for Research Involving Human Subjects, Universitas Muria Kudus, Ref. 401/MPD.FKIP.UMK/B.15.56/XI/2024. Written informed consent was obtained from all participants before data collection.

## Conflict of interest

The authors declare that they have no conflicts of interest.

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