Storytelling-Based Learning Intervention in Enhancing Dengue Prevention Knowledge Among Elementary School Learners in Tuguegarao City, Philippines

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ABSTRACT:
Dengue fever continues to be a significant global health burden, particularly in tropical regions like Philippines. Children are among the most vulnerable populations, facing heightened exposure to mosquito bites and possessing limited knowledge of preventive strategies. Despite existing government interventions, gaps remain in educating children about dengue prevention. This study aimed to assess the baseline knowledge of elementary school children on dengue prevention, develop and validate a localized storybook to address knowledge gaps, and evaluate the effect of a storytelling intervention on children's knowledge. The study utilized a three-phase mixed-methods design. Phase 1 assessed children's baseline knowledge through a questionnaire. Phase 2 involved designing and validating the storybook "Si Kikay at si Lala Lamok." Phase 3 implemented the storytelling intervention and measured pre- and post-test knowledge gains. Results showed that 85% of children had misconceptions about mosquito activity. After the intervention, significant knowledge gains were observed, particularly in younger children, with Grade 2 showing the largest improvement (5.16). The study concluded that storytelling is an effective tool for enhancing children's understanding of dengue prevention, especially when integrated with culturally relevant content.

Keywords: Dengue prevention, Storytelling, Children, Knowledge, Mosquito behavior

Introduction

Dengue fever remains a critical public health concern worldwide, with an estimated 390 million infections annually, of which approximately 96 million manifest clinically (WHO, 2022). This mosquito-borne viral disease predominantly affects tropical and subtropical regions, including Southeast Asia, where it is endemic. Among the most vulnerable populations are school-aged children, who face

increased exposure to mosquito bites during outdoor activities and often lack adequate knowledge of dengue prevention strategies (Fauzan et al., 2020). Children not only represent a significant proportion of dengue cases but also play a crucial role in community-level dengue control, highlighting the need for targeted educational interventions that address their specific knowledge gaps and misconceptions.

In Southeast Asia, including the Philippines, dengue fever is a recurring threat, particularly during the rainy season when mosquito breeding is rampant. The Department of Health (DOH, 2022) reported that approximately 220,000 dengue cases were recorded in the Philippines in 2021, with children aged 5 to 14 constituting a large portion of these cases. While government initiatives such as the "4S Strategy" (Search and Destroy, Self-protection, Seek Early Consultation, and Support Fogging/Spraying) and community engagement programs like "Aksyon Barangay Kontra Dengue" are in place, these efforts have largely focused on adults, leaving a critical gap in dengue education for children (Gupta et al., 2021).

Research indicates that school-aged children often harbor misconceptions about dengue, particularly regarding its transmission, mosquito breeding habits, and effective prevention strategies (Bravo et al., 2019; Makki et al., 2021). Common misunderstandings include the belief that mosquitoes only breed in dirty water or that dengue can spread directly from person to person. Addressing these misconceptions is essential, as children are not only at high risk of infection but also have the potential to influence their households and communities through proper understanding of prevention measures.

Recognizing these gaps, this study explores the use of storytelling as a health education strategy. Storytelling has been shown to effectively convey complex health messages to children in an engaging, memorable, and relatable way (Le et al., 2021). It has been used in various contexts to correct misconceptions, promote behavior change, and increase knowledge retention, particularly among school-age children. By framing health information within culturally relevant narratives, storytelling can make preventive messages more accessible and actionable for children (Pulimeno et al., 2020). Furthermore, storytelling as a tool for dengue education is an innovative approach that has not been fully explored in the Philippines, despite its potential to align with National Unified Health Research Agenda's (NUHRA) goal of improving community health literacy and Regional Unified Health Research Agenda's (RUHRA) regional priority of enhancing disease prevention among school-aged children.

This study aimed to assess the baseline knowledge of elementary school children in Annafunan East, Tuguegarao City, on dengue fever prevention and control, identify key knowledge gaps, and develop a storybook titled "Si Kikay at si Lala Lamok" to address these gaps. Beyond storybook development and validation, this research also evaluated the effectiveness of the storytelling intervention in improving children's knowledge of dengue prevention. By comparing pre- and post-intervention knowledge levels, the study assessed the impact of the storybook on correcting misconceptions and enhancing understanding of dengue prevention strategies.

The results of this study contribute to ongoing efforts to reduce the dengue burden among children in the Philippines by introducing an innovative, child-centered educational tool. Through the development and evaluation of a localized, culturally relevant storybook, this study offers a new approach to improving health literacy and empowering children to take an active role in dengue prevention in their communities. It also underscores the importance of integrating creative health education strategies, such as storytelling, to support the achievement of SDG 3 (Target 3.3) and to address national and regional health research priorities identified in NUHRA and RUHRA.

Conceptual framework

The creativity lies in localizing the narrative to the children's cultural context, incorporating familiar environments and everyday situations that make

the story more relatable and memorable. This culturally tailored approach ensures that the educational content is relevant to the children's real-world experiences, thereby enhancing the effectiveness of the intervention.

The framework connects the Narrative Learning Theory and the Health Belief Model to a storytelling intervention that uses culturally localized content. This, in turn, influences children's knowledge and behavior about dengue prevention. Narrative Learning Theory suggests that individuals, especially children, learn effectively through storytelling because narratives foster emotional engagement, enhance memory retention, and contextualize abstract concepts into familiar, relatable scenarios. The Health Belief Model (HBM) further provides insight into how individuals adopt health behaviors based on perceived susceptibility, severity, benefits, and barriers. This study incorporates HBM by addressing children's perceived susceptibility to dengue fever, the severity of the disease, the benefits of preventive actions, and potential barriers (such as misconceptions about mosquito behavior). The storybook "Si Kikay at si Lala Lamok" is specifically designed to challenge misconceptions and promote a clearer understanding of the dangers of dengue and the importance of preventive behaviors, using a narrative that makes these concepts accessible to children.

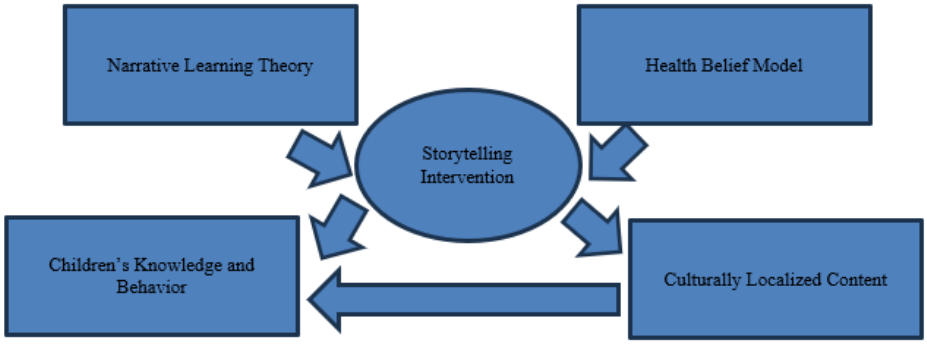

Figure 1. Conceptual Framework of the Storytelling Intervention for Dengue Prevention and Control Using Narrative Learning Theory and Health Belief Model

Objectives

1. To assess the baseline knowledge of elementary school children on dengue disease prevention and control.
2. To identify key areas of knowledge deficiency in disease prevention and control among elementary school children.
3. To design a localized storybook tailored to the cultural context of the target community focusing on key concepts of dengue prevention and control.
4. To validate the content and illustrations of the storybook as to content, format and language, presentation, usefulness and appropriateness, clarity, and appeal.
5. To assess the readability of the storybook for elementary school children.
6. To assess the effectiveness of a storytelling intervention in enhancing engagement among elementary school children.
7. To evaluate the effect of storytelling on children's knowledge by comparing pre-intervention and post-intervention results.

Methodology

Study Design

This research employed a three-phase mixed-methods design to assess, develop, and evaluate a health education intervention focused on dengue prevention and control among elementary school children. Phase 1 utilized a descriptive cross-sectional design to evaluate baseline knowledge, Phase 2 incorporated both qualitative and quantitative methods to design and validate a storybook, and Phase 3 employed a quasi-experimental pre-test/post-test format to measure the impact of the storytelling intervention.

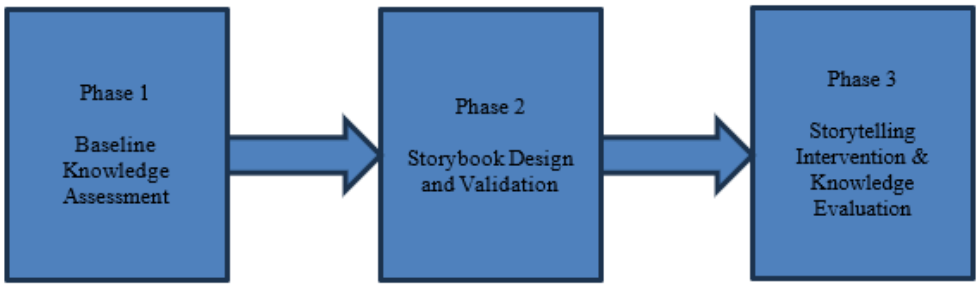

Figure 2. Methodological Paradigm of the Study on Storytelling as a Health Teaching Strategy for Dengue Prevention and Control

Phase 1: Baseline Knowledge Assessment

Sampling and Respondents

Stratified random sampling was employed to ensure proportional representation across Grades 2 to 6 at Annafunan Integrated School, Tuguegarao City. The sample included children aged 7 to 12 who met the inclusion criteria of enrollment in the designated grades, providing informed assent, and obtaining parental consent.

Research Instrument

A structured questionnaire with yes/no/I don't know responses was used to assess the children's knowledge of dengue fever, its causes, transmission, and prevention. The questionnaire was validated by experts in public health and education, yielding a Content Validity Index (CVI) of 0.90. A pilot test with 20 students ensured its reliability, with a Cronbach's alpha coefficient of 0.82 indicating strong internal consistency.

Data Collection and Analysis

Data were collected during class hours by trained data collectors, with assistance provided to Grades 2 and 3. Descriptive statistics, including frequency distributions and percentages, were used to summarize the responses.

Phase 2: Storybook Design and Validation

Sampling and Respondents

Purposive sampling was used to select validators, including educators and guardians.

Research Instruments

The primary instrument for validation was the localized storybook "Si Kikay at si Lala Lamok," designed based on the knowledge gaps identified in Phase 1. Validators assessed the content, format, language, presentation, usefulness and appropriateness, clarity, and appeal of the storybook using a structured validation checklist. The CVI score for the validation process was calculated. The Flesch Reading Ease formula was applied to ensure the storybook's readability for the target age group.

Data Collection and Analysis

The storybook underwent two stages of review: expert validation and readability assessment. Validators completed a 13-item questionnaire assessing various aspects of the storybook. The CVI was computed based on expert ratings, while Flesch Reading Ease scores ensured the material's suitability for elementary students. Descriptive statistics were used to summarize feedback from validators.

Phase 3: Storytelling Intervention and Knowledge Evaluation

Sampling and Respondents

A total of 149 children from Grades 2 to 6 participated in the storytelling intervention, which utilized stratified random sampling to ensure proportional representation across grade levels. The inclusion criteria included participation in the pre-test conducted in Phase 1, provision of assent, and parental consent.

Research Instruments

A 20-item multiple-choice test assessed children's knowledge of dengue prevention both before (pre-test from Phase 1) and after (post-test from Phase 3) the intervention. An observational checklist was used to categorize engagement

levels during the storytelling sessions, based on attention, interaction, and participation.

Data Collection and Analysis

The storytelling sessions were conducted in small groups, with each child's engagement level observed and recorded. Following the storytelling, students completed a post-test to assess knowledge gains. The Wilcoxon Signed Rank Test and Paired t-test were used to analyze pre- and post-test differences, and mean knowledge gains were calculated for each grade level. Descriptive statistics were used to analyze engagement levels.

Ethical Considerations

Ethical clearance was obtained from the R2TMC Ethics Committee. Parental consent and child assent were required for participation, and all data were anonymized to protect participant confidentiality.

Results and Discussions

Table 1. Baseline Knowledge of Elementary School Children in Annafunan East, Tuguegarao City on Dengue Fever Prevention and Control

ITEM	Correct Response	Incorrect Response	I Don't Know
Dengue is a sickness spread by mosquitoes.	116 (78%)	20 (13%)	13 (9%)
Mosquitoes spread dengue by biting infected people.	101 (68%)	40 (27%)	8 (5%)
Mosquitoes that spread dengue are most active at dusk and dawn.	103 (69%)	25 (17%)	21 (14%)
Wearing insect repellent can help prevent mosquito bites.	136 (91%)	6 (4%)	7 (5%)
Using a mosquito net while sleeping can protect you from mosquito bites.	125 (84%)	22 (15%)	2 (1%)
Mosquitoes can breed in clean water.	47 (32%)	87 (58%)	15 (10%)
Mosquitoes can breed in containers that hold water.	112 (75%)	25 (17%)	12 (8%)
Keeping our surroundings clean can help prevent mosquitoes from breeding.	137 (92%)	6 (4%)	6 (4%)
Emptying and cleaning containers that can hold water can prevent mosquitoes from breeding.	128 (86%)	13 (9%)	8 (5%)
Covering containers that store water can prevent mosquitoes from breeding.	131 (88%)	8 (5%)	10 (7%)
Mosquitoes that spread dengue fever usually rest indoors in dark areas.	112 (75%)	27 (18%)	10 (7%)
Wearing long sleeves and pants does not protect you from mosquito bites.*	90 (60%)	49 (33%)	10 (7%)
Mosquitoes that spread dengue are most active during the nighttime.*	23 (15%)	119 (80%)	7 (5%)
It's not important to keep windows and doors closed to prevent mosquitoes from entering.*	113 (76%)	33 (22%)	3 (2%)
Dengue can be spread directly from person to person.*	31 (21%)	101 (68%)	17 (11%)
Community clean-up activities play a role in preventing dengue.	138 (93%)	7 (5%)	4 (3%)
Keeping old tires and containers in your yard helps prevent dengue.*	73 (49%)	64 (43%)	12 (8%)
It's okay to leave trash uncovered.*	125 (84%)	22 (15%)	2 (1%)
Dengue is more common during rainy days.	88 (59%)	49 (33%)	12 (8%)

*statements coded as negative items

The results reveal that the majority of elementary children possess high knowledge in areas of preventive measures, community action, and mosquito breeding. The 91% of the children correctly responded that wearing insect repellent helps prevent mosquito bites, 84% knew that using a mosquito net while sleeping offers protection, and 92% understood the importance of keeping surroundings clean to prevent mosquito breeding. Furthermore, 93% of students correctly identified the role of community clean-up activities in preventing dengue, and 75% accurately recognized that mosquitoes can breed in containers holding water. Similar studies have found that awareness of preventive actions, such as using insect repellent and participating in environmental clean-up, are among the most well-understood measures among children in dengue-endemic areas (Dégallier et al., 2000; Koenraadt et al., 2006).

Despite these encouraging findings, several significant knowledge gaps were observed. Only 32% of the children correctly understood that mosquitoes can breed in clean water, while 58% were incorrect, highlighting a considerable misconception. Similarly, 68% of students mistakenly believed that dengue could spread directly from person to person, and 80% incorrectly thought that mosquitoes that spread dengue are most active during the nighttime, reflecting confusion about mosquito behavior. Other research has also noted significant misconceptions regarding mosquito behavior and breeding grounds, particularly the false belief that mosquitoes only breed in dirty water (Van Benthem et al., 2002).

These misconceptions indicate the need for further education. The areas where children exhibited high knowledge (over 80% correct responses) were typically focused on straightforward, action-oriented preventive measures. In contrast, lower knowledge areas (below 70% correct responses) involved more conceptual or less visible aspects of dengue prevention, such as mosquito breeding in clean water and misunderstandings about transmission routes. This pattern of knowledge gaps in the conceptual understanding of disease transmission has also been highlighted in other studies examining health education in schools (Clark et al., 2002).

While there is a solid foundation of knowledge regarding preventive measures, it is crucial to provide targeted health education to address specific misconceptions about dengue transmission and mosquito breeding habits. Failure to clarify these concepts could result in gaps in effective dengue prevention behaviors, potentially undermining broader community efforts to control the disease.

The ranking of knowledge deficiencies in Table 2 reveals that the most misunderstood areas among elementary school children relate to mosquito behavior, transmission, and breeding. Similar findings have been noted in other studies, where misconceptions about mosquito behavior and transmission routes are prevalent among school-aged children (Koenraadt et al., 2006; Van Benthem et al., 2002).

The results indicate that while children are well-informed about basic preventive actions, they struggle with the more conceptual and less visible aspects of dengue prevention. The most significant misconception, held by 85% of students, is the belief that mosquitoes that spread dengue are most active at night, when in reality, they are most active during dusk and dawn. This misunderstanding may lead to a lack of protective measures during the critical times of mosquito activity. This trend has also been observed in other studies, where children are often more aware of visible preventive actions but lack understanding of the biological aspects of disease transmission (Clark et al., 2002).

Table 2. Ranking of Knowledge Deficiencies in Dengue Prevention and Control Among Elementary School Children in Annafunan East, Tuguegarao City

Item	Correct Responses (%)	Incorrect + I Don't Know (%)	Rank
Mosquitoes that spread dengue are most active during the nighttime.*	15	85	1
Dengue can be spread directly from person to person.*	21	79	2
Mosquitoes can breed in clean water.	32	68	3
Keeping old tires and containers in your yard helps prevent dengue.*	49	51	4
Dengue is more common during rainy days.	59	41	5
Wearing long sleeves and pants does not protect you from mosquito bites.*	60	40	6
Mosquitoes spread dengue by biting infected people.	68	32	8
Mosquitoes that spread dengue are most active at dusk and dawn.	69	31	9
Mosquitoes can breed in containers that hold water.	75	25	10
Mosquitoes that spread dengue fever usually rest indoors in dark areas.	75	25	10
It's not important to keep windows and doors closed to prevent mosquitoes from entering.*	76	24	12
Dengue is a sickness spread by mosquitoes.	78	22	13
Using a mosquito net while sleeping can protect you from mosquito bites.	84	16	14
It's okay to leave trash uncovered.*	84	16	14
Emptying and cleaning containers that can hold water can prevent mosquitoes from breeding.	86	14	16
Covering containers that store water can prevent mosquitoes from breeding.	88	12	17
Wearing insect repellent can help prevent mosquito bites.	91	9	18
Keeping our surroundings clean can help prevent mosquitoes from breeding.	92	8	19
Community clean-up activities play a role in preventing dengue.	93	7	20

*statements coded as negative items

The second major deficiency, with 79% incorrect responses, is the false belief that dengue can be spread directly from person to person. This shows a lack of understanding of dengue as a vector-borne disease, which could result in inappropriate preventive behaviors or unnecessary fear. Similar misconceptions about dengue transmission have been reported in regions with high dengue prevalence (Espinoza-Gómez et al., 2002), where confusion about how the disease spreads leads to ineffective preventive measures.

Another significant gap in knowledge is related to mosquito breeding habits, with 68% of students unaware that mosquitoes can breed in clean water. This lack of understanding could leave many breeding grounds unchecked, increasing the risk of dengue outbreaks. Studies by Van Benthem et al. (2002) and Koenraadt et al. (2006)

support these findings, highlighting the importance of educating children about mosquito breeding in both clean and dirty water.

Children also demonstrated confusion about the role of environmental management in dengue prevention, with 51% not realizing that discarding old tires and containers out of yards helps reduce mosquito populations. Additionally, 41% of students incorrectly believed that dengue is not common during rainy days, revealing confusion about the seasonal factors associated with the disease. These knowledge gaps are consistent with other research, which has found that children often misunderstand the environmental factors influencing mosquito populations (Dégallier et al., 2000).

These findings suggest that while children have a solid understanding of practical dengue prevention measures—such as using insect repellent and keeping their surroundings clean—they lack critical knowledge in areas that could impact the effectiveness of their overall prevention efforts. Therefore, targeted education is needed in mosquito behavior, dengue transmission, mosquito breeding, environmental management, and seasonal risk factors. There is a need to clarify that mosquitoes that spread dengue are most active during dusk and dawn, not nighttime. There is also a need to emphasize that dengue is transmitted through mosquito bites, not by direct person-to-person contact. Further, it is essential to educate children on the fact that mosquitoes can breed in clean water, and stress the importance of removing all standing water, regardless of its cleanliness. Providing accurate information about the relationship between dengue outbreaks and weather conditions is also crucial, ensuring students understand the connection between mosquito populations and rainy conditions.

Table 3. Key Concepts and Cultural Integration in the Storybook "Si Kikay at si Lala Lamok

	Key Concepts Addressed in the Storybook	**Cultural Context/Localized Elements in the Story**
Dengue Transmission and Prevention	- Dengue is spread by mosquitoes.	Story characters, such as Kikay and her mother, discuss preventive measures, including applying repellent and wearing long clothing. Conversations reflect typical interactions within Filipino households.
	- Mosquitoes bite infected people to transmit dengue.	
	- Wearing long sleeves, pants, and using mosquito repellent can help prevent bites.	
	- Dengue is not spread from person to person.	
Mosquito Behavior	- Mosquitoes are most active at dusk and dawn.	Lala the mosquito explains when and where mosquitoes are most active, specifically highlighting dark areas and twilight hours. The story uses common environments such as backyards and homes in the Philippines.
	- Mosquitoes rest indoors in dark areas.	
	- Misconception that mosquitoes are most active at night is corrected.	
Mosquito Breeding and Control	- Mosquitoes can breed in both clean and dirty water.	Lala shows Kikay where mosquitoes breed, highlighting clean water sources like rainwater in tires and containers. Kikay and her friends clean up the backyard, which reflects Filipino community practices of cooperation and teamwork.
	- Cleaning stagnant water in containers (tires, bottles) helps prevent mosquitoes from breeding.	
	- Community clean-up activities prevent dengue outbreaks.	
	- It's important to keep doors and windows closed.	

The storybook "Si Kikay at si Lala Lamok" effectively conveys key messages about dengue prevention by combining educational content with a culturally relatable narrative. Through the playful interactions between Kikay and Lala, the mosquito, the story addresses common misconceptions about dengue transmission, mosquito behavior, and preventive measures. Key cultural elements, such as family conversations, community clean-ups, and traditional environmental practices (e.g., cleaning containers, using mosquito nets), are woven into the story, making it more engaging and relevant to Filipino children. Similar to the approaches used in other health-focused storybooks, "Si Kikay at si Lala Lamok" balances entertainment and education to promote healthy behaviors in a way that children can understand and relate to (Browne et al., 2017; Susanto & Nufus, 2020).

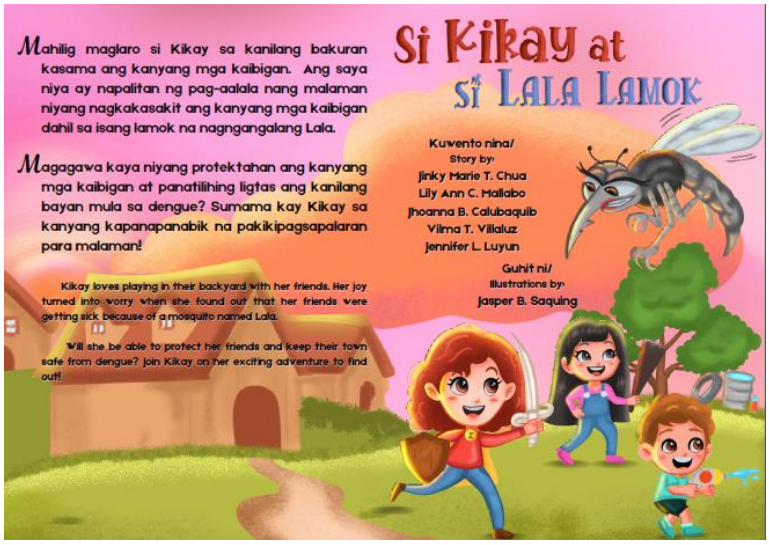

Figure 3. Cover page of "Si Kikay at si Lala Lamok" storybook (copyrighted)

The dialogue between Kikay and her mother emphasizes the importance of preventive measures like using mosquito repellent and wearing protective clothing. By embedding these discussions within a relatable family setting, the storybook ensures that children can relate the preventive advice to their daily lives. This approach is consistent with the findings of Villalobos et al. (2019), who argue that stories that embed health messages within familiar family dynamics tend to resonate more effectively with younger audiences. By situating these conversations within everyday life, the story makes the advice practical and actionable for children.

The story educates children about the times when mosquitoes are most active, using the character of Lala to highlight the correct information about mosquito activity at dusk and dawn, dispelling myths about mosquitoes being primarily active at night. This aligns with the approach used in other health storybooks that aim to correct misconceptions through character-driven narratives (Yoon et al., 2018). The use of characters to embody health messages not only enhances understanding but also makes the information more memorable.

The scenes where Kikay and her friends clean up stagnant water reflect the importance of community action, which is a significant part of Filipino culture. By involving children in these clean-up activities, the storybook reinforces the role of collective responsibility in preventing dengue outbreaks. Similar to other storybooks focused on community health, such as those in India that emphasize collective action for sanitation (Patel & Rathod, 2021), "Si Kikay at si Lala Lamok" highlights the importance of a community-based approach to disease prevention, helping children to understand that preventing dengue is not just an individual effort but a shared responsibility.

The storybook uses narrative techniques to engage children in identifying and correcting

misconceptions. This method of presenting and correcting misinformation through character dialogue has been shown to be effective in other health education literature for children, as it encourages active learning (Carroll et al., 2019). The story not only teaches children about dengue prevention but also enhances their critical thinking skills by allowing them to distinguish between correct and incorrect information.

The depiction of the rainy season and the use of local environmental settings, such as backyards filled with rainwater in containers, enhances the story's relevance to Filipino children. By situating the narrative in familiar environments, the story makes the educational messages about dengue prevention more meaningful and actionable. As noted by Liu and King (2020), storybooks that incorporate local environmental and cultural contexts tend to have a higher impact on knowledge retention and behavior change among children. In this case, the focus on localized settings allows Filipino children to relate more closely to the story, increasing the likelihood of implementing preventive measures in their own lives.

Table 4. Validation of the Storybook in Terms of Content, Format & Language, Presentation, Usefulness & Appropriateness, Clarity, and Appeal

Parameters	Teacher (n=6)	Parent/ Guardian (n=10)	CVI
Content			
Did the storybook effectively convey key messages about dengue prevention and control?	5	10	0.92
Were there any specific aspects of dengue prevention not adequately covered?	5	10	0.92
Format and Language			
Was the format suitable for children aged 6–11?	6	10	1.00
Were the language and vocabulary appropriate and understandable?	6	10	1.00
Presentation			
Were the illustrations and visuals engaging?	6	10	1.00
Will the storybook effectively capture and maintain children's attention?	5	10	0.92
Usefulness and Appropriateness			
Would the storybook be useful for educating children about dengue prevention?	6	10	1.00
Is the content appropriate for children aged 6–12?	5	10	0.92
Clarity			
Was the information clear and easy to understand?	6	10	1.00
Were there any confusing or difficult parts?	5	10	0.92
Appeal			
Did you find the storybook appealing overall?	6	10	1.00
Would you recommend the storybook to others?	6	10	1.00
Overall CVI			0.96

From the validation results, the storybook "Si Kikay at Si Lala Lamok" received high ratings across all parameters, with an overall CVI of 0.96. The highest-rated aspects were format and language, clarity, and appeal, each receiving a CVI of 1.00. Teachers and parents/guardians agreed that the storybook is appropriate for children aged 6 to 12 and is effective in conveying dengue

prevention messages.

Both teachers and parents recognized that the storybook effectively conveyed key dengue prevention messages (CVI: 0.92), though one teacher felt a school-based scenario should have been included. This highlights a potential area for future revisions or supplementary materials. Validators unanimously agreed on the suitability of the format and language for the target audience (CVI: 1.00), affirming the appropriateness of the vocabulary and structure used. Visual engagement was rated highly (CVI: 1.00), but maintaining children's attention was a point of concern for one validator, suggesting that the content may be too lengthy for younger readers. Both groups saw the storybook as highly useful for educating children on dengue prevention (CVI: 1.00), though one teacher suggested it could benefit from integration with other subject areas. Information was found to be clear, though one teacher noted confusion over the term "mosquito swatter." Both teachers and parents found the storybook appealing and recommended it for further educational use (CVI: 1.00).

The general CVI of 0.96 suggests that the storybook is ready for use in school and community settings, with minor revisions to address the few suggestions made by the validators. Based on the findings, incorporating interactive elements such as questions or activities at the end of each chapter may further enhance the children's learning experience and address concerns regarding content length and attention span. Additionally, expanding the story's settings to include school-based scenarios could address the feedback related to the story's environment.

Table 5. Flesch Reading Ease Analysis for "Si Kikay at Si Lala Lamok" Storybook Text

Section	Flesch Reading Ease Score	Number of Words	Number of Sentences	Number of Syllables	Reading Level Interpretation
"Si Kikay at Si Lala Lamok" Storybook Text	92	553	44	667	Very Easy (5th Grade Level and below)

The Flesch Reading Ease score for the storybook "Si Kikay at si Lala Lamok" is 92, which indicates that the text is very easy to read. This score suggests that the content is suitable for readers around the 5th grade level, making it highly accessible to younger elementary school children. The readability of the storybook is now better aligned with the developmental stages and reading capabilities of children in the target audience, ensuring that even younger readers can easily understand the key concepts presented in the story. Studies have shown that materials designed for lower grade levels increase comprehension and retention, especially when addressing public health topics (Tariq et al., 2018).

The high Flesch score reflects the text's use of simpler vocabulary and shorter sentence structures, which help to reduce cognitive load on the reader. The storybook is well-suited for its educational purpose of teaching dengue prevention and control to children, ensuring that critical information is conveyed in a manner that is both engaging and comprehensible. The simplified language and clear sentence structure allow children to focus more on the message and less on deciphering complex words or sentences. This is crucial for health education materials, where the priority is to ensure that key information, such as how to prevent dengue, is easily retained and understood by the readers. According to Kunkel and Burgoon (2021), accessible health communication is essential in improving children's health literacy, particularly when targeting preventable diseases like dengue.

The results from the intervention reveal a high level of engagement among children across different grade levels (Table 8). On average, 66% of the participants displayed high engagement during the storytelling sessions, actively participating, paying close attention, and interacting with the storyteller. Moderate engagement was observed in 28% of the children, while only 6% demonstrated low engagement.

Table 6. Engagement Levels of Children During Storytelling Intervention by Grade Level

Grade Level	High Engagement	Moderate Engagement	Low Engagement
Grade 2	19 (63%)	9 (30%)	2 (7%)
Grade 3	21 (70%)	7 (23%)	2 (7%)
Grade 4	20 (67%)	8 (27%)	2 (7%)
Grade 5	17 (59%)	10 (34%)	2 (7%)
Grade 6	22 (73%)	7 (23%)	1 (3%)
Total	**99 (66%)**	**41 (28%)**	**9 (6%)**

Among the grade levels, Grade 6 students had the highest percentage of high engagement (73%), possibly due to their more advanced cognitive abilities and ability to relate more readily to the content. Studies have shown that older children tend to have better attention spans and can connect better with content that relates to their life experiences (Pulimeno et al., 2020). Grade 5 showed the lowest percentage of high engagement at 59%, with a slightly higher portion of students in the moderate engagement category. This could be attributed to individual differences in interest or comprehension, as has been seen in other educational studies where some students exhibit greater variation in engagement during story-based interventions (Rahiem, 2021).

The storytelling method proved to be an effective strategy for conveying key dengue prevention messages to children, as evidenced by the high levels of engagement across all grade levels. Storytelling has been highlighted as an effective educational strategy because it fosters both emotional connection and knowledge retention (Costa & Jorge, 2022). This supports the idea that storytelling is an engaging educational tool for young learners, blending entertainment and learning in a way that makes health concepts more relatable and easier to understand (Pulimeno et al., 2020).

Table 7. Pre-test and Post-test Knowledge Scores on Dengue Prevention and Control by Grade Level

Grade Level	Pre-Test Mean Score	Post-Test Mean Score	Mean Knowledge Gain	p-value
Grade 2	11.77	16.93	5.16	0.000[a]
Grade 3	14.2	16.73	2.53	0.002[b]
Grade 4	14.67	16.33	1.66	0.016[a]
Grade 5	15.66	16.69	1.03	0.043[a]
Grade 6	11.77	15.90	4.13	0.000[a]
Total	**13.61**	**16.52**	**2.90**	**0.000[a]**

a=Wilcoxon Signed Rank test

b=Paired t-test

The results show that storytelling as a teaching method significantly improved children's knowledge on dengue prevention and control. Younger students, particularly those in Grade 2, showed the largest knowledge gain of 5.16, likely due to the simplicity and engaging nature of the storybook used in the intervention. This is consistent with previous studies suggesting that young children respond well to educational materials that are interactive and relatable to their daily lives (Pulimeno et al., 2020).

Students in Grade 6 also exhibited substantial knowledge improvement (4.13), suggesting that storytelling is not only effective for younger children but can also engage older students when cultural and contextual elements are incorporated into the learning material (Rahiem, 2021).

Interestingly, Grade 5 had the smallest knowledge gain (1.03), which may imply that students at this level might require additional pedagogical approaches to complement storytelling, such as interactive discussions or hands-on activities. As children get older, their cognitive demands increase, and they may benefit from more varied instructional strategies (Garcia et al., 2020).

The data indicate a consistent increase in knowledge across all grade levels, with significant knowledge gains observed between pre-test and post-test scores. All grade levels showed statistically significant knowledge gains ($p < 0.05$). These results highlight the effectiveness of storytelling as a strategy for health education.

Implications

The findings of this study represent a significant advancement in the understanding and application of educational strategies for improving health literacy, particularly in the context of child-focused dengue prevention. By developing and validating a culturally relevant storybook, "Si Kikay at Si Lala Lamok," the study addresses key knowledge gaps in dengue prevention among school-age children.

The study highlights that traditional health education strategies, such as lectures and informational campaigns, are not sufficient for addressing misconceptions and enhancing health literacy among young learners. Through storytelling, children were not only more engaged but also demonstrated significant improvement in their understanding of dengue transmission and prevention. This study adds to the growing body of research showing that interactive, culturally relevant, and localized educational materials can be more effective than conventional teaching methods.

These have critical implications for national public health programs, particularly the National Dengue Prevention and Control Program by DOH. By providing a tool specifically designed to educate children, this research fills a gap in the current prevention strategies, which tend to focus more on adults and general community efforts. Integrating the storybook into the Department of Education's (DepEd) curriculum could significantly enhance the scope of dengue prevention education in schools, ensuring that children are active participants in public health efforts.

Moreover, the validated storybook and its methodology offer potential for broader implementation in national dengue campaigns, supporting the DOH's 4S Strategy. By empowering children with accurate knowledge of dengue prevention, this study aligns with national public health objectives and contributes to reducing the dengue burden at the community level.

In the Cagayan Valley, where the research was conducted, dengue remains a significant public health concern. This study directly addresses the need for targeted health interventions tailored to the specific cultural and educational needs of children in the region. By utilizing localized content and familiar settings, the storybook enhances its relevance and effectiveness, making it an ideal tool for community-level interventions in dengue-endemic areas.

Furthermore, the results of this study could inform regional public health policies by providing evidence-based educational strategies that can be integrated into existing dengue

prevention efforts. The regional government and local schools could adopt this tool as part of their health education programs, thereby contributing to the RUHRA goal of improving health outcomes through targeted education.

At both the national and regional levels, this research offers a scalable, replicable model for improving health literacy among children. The storybook's format and storytelling approach could be adapted to other health issues or regions, allowing for broader use in public health education.

Additionally, the research holds potential for intellectual property development, such as obtaining a copyright or utility model for the storybook, which could facilitate its distribution and use across the country.

In terms of policy impact, this study provides a framework for integrating culturally relevant educational materials into the national health and education sectors. The storybook could serve as a model for future collaborations between the DOH, DepEd, and local governments to create educational tools that resonate with young learners, filling a critical gap in existing health education approaches. By emphasizing localized content, the study also opens the door for future research on the role of cultural relevance in health interventions, with potential applications across various public health challenges.

Conclusion

The study demonstrates that storytelling is an effective strategy for improving children's knowledge of dengue prevention and control, as evidenced by significant knowledge gains across all grade levels following the intervention. The storybook, "Si Kikay at si Lala Lamok," was validated with a high Content Validity Index (CVI) of 0.96, confirming its appropriateness, clarity, and effectiveness in conveying key health messages. The overall positive feedback from both teachers and parents supports its use as a teaching tool. The intervention successfully addressed key misconceptions and enhanced children's understanding of practical preventive measures.

Recommendations

1. For DepEd to integrate targeted dengue prevention education in the elementary school curriculum, emphasizing key misconceptions such as mosquito activity and breeding habits.
2. For DOH to collaborate with schools to provide updated dengue prevention materials and support educational campaigns, ensuring consistent and accurate health messaging.
3. For the LGU to facilitate community-based clean-up activities in coordination with schools, focusing on both clean and dirty water mosquito breeding sites to reinforce lessons from school-based programs.
4. For DepEd and DOH to conduct training workshops for teachers to effectively teach students about dengue prevention, incorporating interactive activities to sustain student engagement.
5. For DepEd to incorporate storytelling sessions into the health education curriculum to address knowledge gaps among students and strengthen retention of preventive behaviors.
6. For DOH and DepEd to establish monitoring systems to assess the effectiveness of dengue education programs, particularly in addressing misconceptions about mosquito behavior and disease transmission.

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