

## Bridging early EFL and eco-literacy: expert validation of an eco-themed digital storybook series

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### Abstract

*Being in disaster-risk areas frequently affected by floods, landslides, and climate change, schools increasingly seek age-appropriate ways to introduce environmental awareness while sustaining meaningful early English exposure. However, early-grade EFL classrooms often have limited resources to integrate eco-centric themes into instruction. This study aimed to establish expert-based validity evidence for an interactive eco-themed e-storybook series designed for Indonesian Grade 1 EFL learners. Using a two-round modified Delphi approach, 12 experts (teachers, language specialists, and multimedia specialists) evaluated the series through structured questionnaires and open-ended feedback, followed by targeted revisions after Round 1. Quantitative judgments were analyzed using content-validity indices (I-CVI and S-CVI/Ave) and Aiken's V to estimate item relevance and agreement, while qualitative comments were analyzed thematically to identify revision priorities. After revision, expert judgments converged, indicating that the series is linguistically accessible for beginners, pedagogically feasible for routine-based classroom use, ecologically interpretable through child-friendly actions, and multimodally coherent when audio and interactive features remain purposeful. Qualitative feedback prioritized stronger text-image alignment for key expressions, simplified page layouts to minimize overload, improved replay and accessible glossary supports, and child-safety safeguards (e.g., ad-free, break reminder). Overall, the findings support the series as a validated instructional resource oriented to integrating early EFL learning with eco-literacy meanings.*

**Keywords:** English for Young Learners, Eco-literacy, E-storybook, Environmental Responsibility, Multimodality.

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### Introduction

Indonesia is known to be one of the countries with the greatest number of natural disasters, particularly hydrometeorological disasters. Recent flooding and landslides in several provinces in Sumatra (including Aceh, North Sumatra, and West Sumatra) have been widely reported, with substantial loss of life and property (Muhari, 2025; Nangoy & Widiyanto, 2025). While disaster events have multiple drivers, environmental degradation and land-use change can increase flood susceptibility in Indonesian watersheds, highlighting the importance of fostering environmental awareness and everyday protective habits from early childhood (Sugianto et al., 2022).

Against this background, the present study foregrounds expert validation of instructional media. It aims to establish expert-based validity evidence for an interactive, eco-themed e-storybook series

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designed for Indonesian Grade 1 EFL learners. Grade 1 is a practical milestone for introducing child-friendly eco-actions (e.g., waste sorting, water conservation, tree care) as routine-based meanings that can be represented through simple classroom language. Here, eco-oriented learning is treated as a pedagogical design intention (eco-literacy meaning-making), rather than as evidence of measured changes in learners' environmental responsibility.

In the context of EFL, environmental themes can support children's English on a practical, everyday level because young learners tend to absorb language that is concrete, repetitive, and routine-based (Gheitasi & Enever, 2022). Language like these fits well with eco-actions that use short, common phrases like "Put it in the bin!" "Turn off the tap!" and "Plant a tree!" In elementary schools with limited resources, teachers also use routine-friendly, engagement-oriented methods to keep students' attention and help them pronounce words and participate, which shows how important it is to have materials based on simple daily actions (Suryanto, 2025).

The present field provides promising foundations, yet simultaneously presents pragmatic challenges. The focus on sustainability in ELT is becoming more widely accepted, but putting it into practice often depends on having the right materials (Arslan & Curle, 2024; Yu et al., 2024). Research on children's digital storybooks indicates that multimedia can facilitate comprehension and vocabulary acquisition, although outcomes are highly reliant on design decisions. Li and Bus (2023) assert that digital picture books employing multimedia intentionally can improve story comprehension and vocabulary related to books in young children. A more recent meta-analysis also finds that interactive features don't always help comprehension; they are more likely to help when they help story processing directly instead of being distractions (Bus et al., 2025). Design details are very important. For example, vocabulary support is more likely to be useful when it is instructionally relevant (like glossary-like supports and prompts) than when it is just for decoration (Mahdi et al., 2024). Too much interactions and features that aren't aligned properly may hinder in the way of narrative processing and shared reading (Tunkiel & Bus, 2022).

Even with these changes, there is still a big gap in early-primary EFL settings. There is not much research on coherent book series with eco-themed collections for Grade 1, and there are still not many expert validation studies that compare the opinions of EYL teachers, language experts, and multimodal specialists. Thus, the main limitation is not simply a lack of evidence that digital storybooks can support learning, but the limited availability of expert-validated eco-themed materials that are demonstrably appropriate for early-primary EFL in terms of language level, classroom feasibility, eco-message interpretability, and multimodal coherence—conditions that matter for adoption in disaster-prone contexts such as Indonesia.

To frame this work, the study draws on four grounded theories. Eco-literacy links environmental knowledge with care and everyday action (Orr, 1990). Sociocultural theory views young children's language development as mediated through tools, interaction, and routines (Vygotsky, 1978). Multimodality treats meaning as distributed across text, images, audio, and interaction, with comprehension depending on coherent orchestration (Kress, 2010). Multimedia learning theory explains why orchestration must remain purposeful given limited-capacity processing of verbal and pictorial information (Mayer, 2009). For expert validation, these perspectives are operationalized into four evaluation domains: ecological meaningfulness, pedagogical feasibility, multimodal coherence, and usability/cognitive economy.

The instructional product is a set of five eco-themed digital storybooks intended to support everyday communicative English through child-friendly actions. Each book includes text, visuals, audio narration, and an interactive vocabulary feature that allows learners to click target words to access meaning and pronunciation, supporting form–meaning connections and stable oral models for beginners. Accordingly, this study addresses the following research question: To what extent is the eco-themed digital storybook series linguistically appropriate, pedagogically feasible, ecologically meaningful, and multimodally coherent for Grade 1 young EFL learners, as judged by young learner teachers, language experts, and multimodal experts?

This study offers three contributions to early EFL education and applied linguistics. From an application perspective, it provides an expert-validated set of eco-themed e-storybooks that combine routine-based English with child-friendly eco-literacy meanings. From a theoretical perspective, it contributes to discussions on how early EFL can be designed to accommodate eco-literacy orientations through developmentally appropriate storytelling without implying outcome claims. Finally, it offers a validation approach that prioritizes linguistic–pedagogical quality and multimodal coherence so that digital features enhance, rather than detract from, early primary learning. The remainder of this paper first explains the expert-validation approach used in the study, then reports the round-by-round quantitative indices and thematic qualitative findings, and finally interprets the results through the study’s theoretical framework before concluding with implications and directions for future research.

## Method

This study aimed to validate an eco-themed e-storybook series for young EFL learners. It employed a Delphi-based expert validation design combining quantitative validity indices with qualitative expert feedback. Twelve experts (teachers, linguists, and multimedia specialists) evaluated the series in two rounds. The unit of analysis was expert judgment, operationalized as panel ratings and written comments on the validation criteria.

## Research design

A quantitative–qualitative validation design using a modified Delphi technique was used to establish content, linguistic, pedagogical, and multimodal validity for Grade 1 EFL learners. Delphi is an iterative process that elicits structured expert judgments through questionnaires and progresses toward consensus across rounds (Hsu & Sandford, [2007](#)). The study was “modified” because Round 1 used a pre-specified set of indicators derived from theory and prior literature (rather than an open-ended first round) and the process was streamlined to two rounds while retaining the core cycle of rating, commenting, revision, and re-rating.

## Contextual setting and participants

The instructional product was a set of five environmentally themed digital storybooks combining text, images, audio, and clickable vocabulary to support everyday English and introduce eco-literacy meanings through child-friendly actions. The target users were Grade 1 learners (approximately 6–7 years old); however, learner outcomes were not assessed because the evaluation focused on expert appraisal of the materials.

Experts were purposively recruited to represent three complementary perspectives: (1) EYL teachers (classroom feasibility and age appropriateness), (2) language experts (linguistic accuracy and level suitability), and (3) multimodal/digital learning experts (text–image–audio coherence, interaction

design, and cognitive load). The panel comprised 12 experts (4 per group) to ensure balanced expertise while maintaining manageable Delphi rounds. Inclusion criteria required teachers to have current experience teaching early-grade EFL, language experts to have applied linguistics/ELT expertise, and multimodal experts to have experience in digital learning/multimodal design or multimedia-based instruction.

### Procedure

Validation occurred in two Delphi rounds. In Round 1, experts accessed the e-storybooks and completed an online validation rubric, rating each criterion and providing written suggestions. Quantitative indices and synthesized qualitative feedback were used to identify revision priorities. The storybooks were revised based on (a) criteria receiving lower endorsement, (b) expert suggestions, and (c) developmental appropriateness for Grade 1. In Round 2, revised versions were returned to the same experts for re-rating and additional comments to confirm improved appropriateness and stronger consensus.

### Data collection techniques and instruments

Data were collected using a structured expert validation rubric distributed via Google Forms. Items used a 4-point scale (1 = not appropriate to 4 = highly appropriate) across domains: (a) language and readability, (b) pedagogy and teachability, (c) eco-message clarity/actionability, and (d) multimodal/interactive quality (audio clarity, pacing, discoverability of clickable vocabulary, and text–image–audio alignment). Open-ended questions captured qualitative feedback.

### Data analysis techniques

Quantitative validity evidence was analyzed using the item-level Content Validity Index (I-CVI) and scale-level CVI by averaging (S-CVI/Ave). Ratings of 3–4 were treated as “relevant,” and I-CVI was calculated as the proportion of experts endorsing each item. Items were interpreted as strong when I-CVI = 1.00, acceptable when I-CVI  $\geq$  .70 ( $\geq$  8/12 experts), and revise/remove when I-CVI  $<$  .70. Scale adequacy was summarized using S-CVI/Ave, interpreted as strong when  $\geq$  .80. Aiken’s V was computed as complementary agreement evidence;  $V \geq$  .70 indicated acceptable agreement, while  $V <$  .70 signaled items requiring revision (Saiful & Yusoff, [2019](#)).

Qualitative comments were analyzed using thematic analysis (Braun & Clarke, [2006](#)) by familiarizing with comments, coding responses linked to the validation domains, clustering codes into themes, and refining themes to guide revisions between rounds. Finally, quantitative indices and qualitative themes were integrated to justify revision decisions and document how the series achieved expert-validated design appropriateness.

## Results and Discussion

This study validated an eco-themed e-storybook series for Grade 1 EFL learners in Indonesian classrooms. This digital storybook series consists of five books focusing on environmental themes, sequenced as follows: 1) My Clean School, My Healthy Earth, 2) Put It in the Bin! 3) Dira, the Water Guardian, 4) Protect Our Forest, 5) The Eco Heroes. The validation focused on linguistic and pedagogical suitability, eco-message clarity, and multimodal coherence. Expert panels rated the materials using a two-round Delphi process; they provided feedback through questionnaires. Following Round 1, revisions to the storybooks were made by targeting low-scoring items and key suggestions.

Round 2 was reassessment of the revised series as confirmation of improvement and strengthening of expert consensus. [Figure 1](#) shows the e-storybook series as the product of this study.



Figure 1: The Eco-themed E-storybook series

## Round 1

### Quantitative results of young EFL teacher panel

[Table 1](#) presents a series-level summary of the expert validation results provided by the Young EFL Teacher Panel ( $n = 4$ ) of the first rounds. Specifically, it reports teachers' judgments for each subdomain (Pedagogical Fit & Teachability, Engagement & Classroom Interaction, Eco-Message Appropriateness, and Usability).

Table 1. Young EFL teachers' series-level validity summary

Domain / Subdomain	Items	Mean Rating (1–4)	Mean S-CVI	Mean Aiken's V	Interpretation
Pedagogical Fit & Teachability	6	3,3	0,75	0,74	Acceptable
Engagement & Classroom Interaction	3	3,2	0,75	0,69	Need revision
Eco-Message Appropriateness	<b>3</b>	<b>3,4</b>	<b>0,75</b>	<b>0,75</b>	<b>Acceptable</b>
Usability (Teacher View)	3	3,13	0,75	0,67	Need revision
Overall (Series-Level)	3	3,15	0,75	0,63	Need revision

Overall, Round 1 ratings indicated that the series was viewed positively (mean ratings ranged from 3.13 to 3.40 across subdomains), with Pedagogical Fit & Teachability ( $M = 3.30$ ,  $S-CVI = 0.75$ ,  $V = 0.74$ ) and Eco-Message Appropriateness ( $M = 3.40$ ,  $S-CVI = 0.75$ ,  $V = 0.75$ ) interpreted as acceptable. However, agreement strength was lower for Engagement & Classroom Interaction ( $M = 3.20$ ,  $S-CVI = 0.75$ ,  $V = 0.69$ ) and Usability ( $M = 3.13$ ,  $S-CVI = 0.75$ ,  $V = 0.67$ ), both flagged for revision, and the overall series-level agreement was also categorized as revise ( $M = 3.15$ ,  $S-CVI = 0.75$ ,  $V = 0.63$ ). These results suggest that refinement was most needed to strengthen consensus and classroom feasibility in engagement- and usability-related aspects.

### Qualitative results of young EFL teacher panel

Teacher feedbacks were clustered into three themes describing feasibility-oriented refinements from routine alignment and child safety, to pacing. [Table 2](#) summarizes the teachers' feedback thematically.

Table 2. Summary of young EFL teachers' feedback

No.	Themes	Summary
1	Routine alignment supports engagement and interpretability	Teachers emphasized that scenarios reflecting children's daily routines and familiar eco-actions were engaging and easier to interpret at Grade 1 level. T1: "Sesuai dengan kebiasaan yang dilakukan anak." T2: "Menarik, mudah dipahami, bergambar." T3: "Mudah dipahami, menggunakan kosakata yg ringan untuk anak-anak dan visual menarik bagi anak."
2	Child safety and well-being as feasibility requirements	Teachers highlighted the need for child-safe access and classroom practicality, recommending an ad-free interface and a break reminder for extended use. T1: "Tambahkan fitur 'peringat istirahat' jika aplikasi digunakan terlalu lama." T4: "Pastikan antarmuka bebas dari iklan atau tautan eksternal yang tidak aman bagi anak-anak."
3	Pacing and avoidance of "boring parts"	Teachers noted that engagement could drop if segments felt boring, suggesting streamlined pacing and interest-aligned parts. T3: "Tidak berisi yang membosankan yaaaa."

Accordingly, revisions prioritized (1) a child-safe interface by ensuring the series is ad-free and contains no unsafe external links, (2) a break-reminder feature for extended use, and (3) clearer emphasis on child-doable eco-actions on each page to sustain engagement.

#### Quantitative results of language expert panel

Table 3 presents a series-level summary of the validation results from the Language Expert Panel (n = 4) across two Delphi rounds. It covers linguistic accuracy and naturalness, level appropriateness, input quality for young learners, and eco-thematic language integration

Table 3. Language experts' series-level validity summary

Domain / Subdomain	Items	Mean Rating (1-4)	Mean S-CVI	Mean Aiken's V	Interpretation
Linguistic Accuracy & Naturalness	4	3,25	0,75	0,75	Acceptable
Level Appropriateness (Grade 1)	5	3,2	0,75	0,73	Acceptable
Input Quality for Young Learners	3	3,4	0,75	0,8	Acceptable
Eco-Thematic Language Integration	3	3,17	0,75	0,8	Acceptable
Overall (Series-Level)	3	3,26	0,75	0,75	Acceptable

Round 1 results indicated overall linguistic appropriateness across all subdomains, with mean ratings ranging from 3.17 to 3.40 and consistent S-CVI values of 0.75 for every domain. Specifically,

Linguistic Accuracy & Naturalness was rated  $M = 3.25$  ( $V = 0.75$ ), Level Appropriateness (Grade 1)  $M = 3.20$  ( $V = 0.73$ ), Input Quality for Young Learners  $M = 3.40$  ( $V = 0.80$ ), and Eco-Thematic Language Integration  $M = 3.17$  ( $V = 0.80$ ). The overall series-level index was also acceptable ( $M = 3.26$ ,  $S-CVI = 0.75$ ,  $V = 0.75$ ), indicating consistent expert endorsement of linguistic suitability at the series level in Round 1.

### Qualitative results of language expert panel

Language expert comments were analyzed and clustered into three themes that capture how the linguistic input supports interpretability for Grade 1 learners. The themes summarize recurring judgments about simplicity, coherence, and the alignment of language with visual support. [Table 4](#) presents the feedbacks from language expert panel.

Table 4. Summary of language experts' feedback

No.	Themes	Summary
1	Simple, comprehensible language suited to Grade 1	Experts generally noted that vocabulary and sentence patterns were simple and accessible for Grade 1 learners, indicating appropriate overall level. This was reflected in direct comments such as, "Kata dan penggunaan kalimat cukup sederhana (L1)," and "Ekspresi/chunks yang disediakan sudah cukup baik (L2)."
2	Narrative and character coherence as clarity supports	Experts flagged that character role clarity and storyline focus should be consistent to avoid confusion, particularly across pages and across the series. One expert specifically noted the need for "Kesesuaian peran dengan cerita, fokus ke Andi (My Clean School) (L3)" indicating that a stable main character perspective supports clearer interpretation of events and actions.
3	Text-image alignment for key functional expressions	Experts emphasized that key classroom-action expressions should be explicitly supported by corresponding visuals so the intended meaning is immediately clear. This concern was stated directly as "Kesesuaian kalimat dan gambar (Put it in the bin) (L3)," alongside a general confirmation that the materials were visually understandable "Secara visual, e-story sudah cukup baik dan mudah dipahami (L2)." At the same time, an expert recommended design discipline to reduce potential ambiguity and processing demands: "Terapkan aturan 'satu ide utama per halaman'; perpendek/bagilah teks menjadi bagian-bagian (L4)."

Revisions prioritized clarifying character roles (e.g., maintaining focus on Andi in My Clean School), strengthening text-image correspondence for key functional expressions, and applying the "one main idea per page" principle by segmenting or shortening text to support linguistic interpretability.

### Quantitative results of multimedia expert panel

[Table 5](#) presents a series-level summary of the validation results from the Multimodal Expert Panel ( $n = 4$ ) across two Delphi rounds. It reports experts' evaluations of the digital storybook series across six multimodal design domains (multimodal coherence, visual design and readability, audio design quality, clickable-vocabulary interactivity, navigation and usability, and cognitive load/engagement balance).

Table 5. Multimedia experts' series-level validity summary

Domain / Subdomain	items	Mean Rating (1–4)	Mean S-CVI	Mean Aiken's V	Interpretation
Multimodal Coherence	4	3,5	1	0,83	Acceptable
Visual Design & Readability	4	3,3	1	0,77	Acceptable
Audio Design Quality	3	3,5	1	0,83	Acceptable
Interactivity (Clickable Vocabulary)	6	3,4	1	0,79	Acceptable
Navigation & Usability	4	3,6	1	0,85	Acceptable
Cognitive Load & Engagement Balance	3	3,5	1	0,83	Acceptable
Overall (Series-Level)	3	3,2	0,9	0,73	Acceptable

Round 1 multimodal judgments indicated generally strong design quality across domains, with mean ratings ranging from 3.30 to 3.60 and consistently high item relevance (S-CVI = 1.00 for all subdomains). Specifically, experts rated Navigation & Usability highest (M = 3.60, V = 0.85), followed by Multimodal Coherence (M = 3.50, V = 0.83), Audio Design Quality (M = 3.50, V = 0.83), and Cognitive Load & Engagement Balance (M = 3.50, V = 0.83). Interactivity (Clickable Vocabulary) was rated M = 3.40 (V = 0.79), while Visual Design & Readability had the lowest mean but remained acceptable (M = 3.30, V = 0.77). At the overall series level, the panel's indices also indicated acceptable agreement (M = 3.20, S-CVI = 0.90, V = 0.73), supporting the interpretation that multimodal quality was acceptable in Round 1.

#### Evaluation of multimedia expert panel

Multimodal expert comments were analyzed and clustered into three themes concerning multimodal coherence and cognitive economy. The themes reflect recurring judgments about how visual–audio–text alignment and interaction design can support interpretability for young EFL learners while minimizing unnecessary processing demands. [Table 6](#) shows the summary of multimedia experts' feedback.

Table 6. Summary of multimedia experts' feedback

No.	Themes	Summary
1	Coherence-first orchestration (text–image–audio–interaction)	Experts stressed that understanding is supported when visuals, simple contextual language, clear narration, and intuitive navigation converge. One expert noted the importance of “integrasi visual yang relevan dengan teks... serta navigasi yang intuitif (M1),” and emphasized that contextual illustrations should “jelas menunjukkan aksi, emosi, dan alur cerita, bukan sekadar dekorasi (M2).” They also highlighted readable typography and clear pronunciation: “tipografi yang mudah dibaca, serta audio narasi dengan pelafalan yang jelas (M3).”
2	Reducing extraneous design complexity to minimize processing demands	Experts warned that overload may arise from “animasi berlebihan, efek suara yang tidak relevan, serta teks yang terlalu panjang atau padat dalam satu halaman (M1),” as well as overly flashy colors or decorative fonts. They also noted that text placement should not disrupt visuals: “agar visual dari gambar tidak terganggu (M4).”

3	Support features should be usable and predictable	Experts recommended ensuring each multimedia element has a clear purpose and adding supports such as “opsi pengulangan (replay) dan kontrol kecepatan (M4),” plus “satu ide utama per halaman (M3)” and a “glosarium interaktif (M2)” for key eco-vocabulary.
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Revisions prioritized coherence-first alignment across text, visuals, audio, and interaction, alongside simpler page design to reduce unnecessary complexity. They also reduced non-essential effects, improved text placement to protect visual clarity, and strengthened learner supports through replay controls and an interactive visual glossary.

## Round 2

### Quantitative results of young EFL teacher panel

[Table 7](#) reports teachers’ Round 2 judgments across four subdomains (Pedagogical Fit & Teachability, Engagement & Classroom Interaction, Eco-Message Appropriateness, and Usability). The table summarizes the mean ratings alongside S-CVI and Aiken’s V indices, providing an overall picture of the extent to which the revised series was endorsed as feasible and appropriate for Grade 1 classroom use from the teachers’ perspective.

Table 7. Young EFL teachers’ series-level validity summary

Domain / Subdomain	Items	Mean Rating (1–4)	Mean S-CVI	Mean Aiken’s V	Interpretation
Pedagogical Fit & Teachability	6	3,6	1	0,86	Strong
Engagement & Classroom Interaction	3	3,4	1	0,78	Acceptable
Eco-Message Appropriateness	3	3,8	1	0,92	Strong
Usability (Teacher View)	3	3,4	1	0,78	Acceptable
Overall (Series-Level)	3	3,35	1	0,71	Acceptable

Overall, Round 2 results indicate strengthened endorsement across domains, with mean ratings ranging from 3.40 to 3.80. Specifically, Pedagogical Fit & Teachability was rated strong (M = 3.60, S-CVI = 1.00, V = 0.86) and Eco-Message Appropriateness was also strong (M = 3.80, S-CVI = 1.00, V = 0.92). Engagement & Classroom Interaction (M = 3.40, S-CVI = 1.00, V = 0.78) and Usability (Teacher View) (M = 3.40, S-CVI = 1.00, V = 0.78) were interpreted as acceptable, indicating favorable ratings with minor refinement suggestions. At the series level, the overall indices were acceptable (M = 3.35, S-CVI = 1.00, V = 0.71), supporting the interpretation that the revised series is judged feasible and usable for Grade 1 classroom implementation from a design standpoint.

### Qualitative results of young EFL teacher panel

[Table 8](#) presents the summary of the young EFL teacher panel’s feedback. The feedbacks are classified thematically into three themes: routine alignment, child safety and break reminder, and pacing and doable actions.

Table 8. Summary of young EFL teachers' feedback

No.	Themes	Feedback Summary	Before	After
1	Routine alignment strengthens engagement and Grade 1 teachability	Teachers reaffirmed that the stories fit children's daily routines and interests, making them easy to understand and teach. They noted simple, repetitive language supported by clear visuals, and reported that the storyline and activities can be used directly for basic vocabulary, listening, and simple speaking.	<p>Overall, the e-storybook series have already been daily routine aligned. However, some texts and visuals are simplified.</p>	<p>The text is simplified and unnecessary visuals are removed.</p>
2	Child safety and well-being as essential feasibility conditions	Teachers emphasized that the revised series is safer and more practical for use at school or home because it is ad-free, avoids unsafe external links, and includes a break reminder to support longer use in line with young learners' short attention spans.	No "break reminder"	
3	Pacing through clear child-doable eco-actions supports sustained attention	Teachers highlighted that each page now foregrounds concrete eco-actions children can do, which helps maintain engagement and keeps the eco-message practical and non-preachy. They also noted that the story encourages classroom interaction without overwhelming learners.	<p>Exp. The message conveyed in narrative mode.</p>	<p>Exp. Add one page contains clear action.</p>

Teachers summarized the series as feasible, practical, safe, and appropriate for Grade 1 use because it supports early English learning while orienting children toward realistic eco-actions through child-friendly storytelling.

#### Quantitative results of language expert panel

Table 9 presents language experts' Round 2 judgments across four subdomains: Linguistic Accuracy & Naturalness, Level Appropriateness (Grade 1), Input Quality for Young Learners, and Eco-Thematic Language Integration. The table summarizes mean ratings together with S-CVI and Aiken's V values, indicating the extent of expert endorsement regarding the accuracy, level suitability, and clarity of language used to express eco-themed actions in the revised series.

Table 9. Language experts' series-level validity summary





Domain / Subdomain	Items	Mean Rating (1–4)	Mean S-CVI	Mean Aiken's V	Interpretation
Linguistic Accuracy & Naturalness	4	3,44	1	0,81	Strong
Level Appropriateness (Grade 1)	5	3,5	1	0,82	Strong
Input Quality for Young Learners	3	3,67	1	0,89	Strong
Eco-Thematic Language Integration	3	3,42	1	0,81	Strong
Overall (Series-Level)	3	3,54	1	0,85	Strong



Round 2 results show consistently strong endorsement across domains, with mean ratings ranging from 3.42 to 3.67 and S-CVI = 1.00 for all subdomains. Linguistic Accuracy & Naturalness was rated strong (M = 3.44, V = 0.81), Level Appropriateness (Grade 1) was strong (M = 3.50, V = 0.82), and Input Quality for Young Learners received the highest mean rating and strongest agreement (M = 3.67, V = 0.89). Eco-Thematic Language Integration was also strong (M = 3.42, V = 0.81). At the overall series level, indices indicated strong linguistic validity (M = 3.54, S-CVI = 1.00, V = 0.85), supporting the interpretation that the revised series is judged linguistically appropriate for Grade 1 EFL learners.

#### Qualitative results of language expert panel

Table 10 shows the summary of the language expert panel's feedback. Three points are indicated from the feedbacks: clearer character role, stronger text-image correspondence, and focused idea in each page.

Table 10. Summary of young EFL teachers' feedback

No.	Themes	Feedback Summary	Before	After
1	Clearer Character Roles Supporting Linguistic Coherence	The revision that clarifies character roles—particularly maintaining consistent focus on Andi in My Clean School—significantly strengthens linguistic coherence and narrative clarity.		
			Exp. Two main characters.	Exp. Focus on one main character.
2	Stronger Text–Image Correspondence for Functional Expressions	The strengthened alignment between text and illustrations—especially for key functional expressions—greatly enhances linguistic interpretability.		
			Exp. The text writes a can, but the picture shows 2 cans.	Exp. One can is removed

3	"One Main Idea per Page" Principle Enhancing Interpretability	Applying the "one main idea per page" principle through segmentation and text shortening substantially improves readability and comprehension.		
			Exp. The page contains too much text.	Exp. The text is shortened.

The revisions have successfully strengthened linguistic clarity, interpretability, and Grade 1 suitability. The series is now strongly aligned with the language development needs of young EFL learners and is pedagogically sound for early elementary implementation.

### Quantitative results of multimedia expert panel

[Table 11](#) presents multimodal experts' Round 2 judgments across six design domains: multimodal coherence, visual design and readability, audio design quality, clickable-vocabulary interactivity, navigation and usability, and cognitive load/engagement balance. The table reports mean ratings alongside S-CVI and Aiken's V values, summarizing the extent to which the revised series was endorsed as coherent, usable, and developmentally appropriate in its multimodal design.

Table 11. Multimedia experts' series-level validity summary







Domain / Subdomain	Items	Mean Rating (1–4)	Mean S-CVI	Mean Aiken's V	Interpretation
Multimodal Coherence	4	3,68	1	0,89	Strong
Visual Design & Readability	4	3,56	1	0,85	Strong
Audio Design Quality	3	3,67	1	0,88	Strong
Interactivity (Clickable Vocabulary)	6	3,5	1	0,83	Strong
Navigation & Usability	4	3,69	1	0,89	Strong
Cognitive Load & Engagement Balance	3	3,67	1	0,88	Strong
Overall (Series-Level)	3	3,57	1	0,85	Strong

Round 2 results indicate consistently strong multimodal quality, with mean ratings ranging from 3.50 to 3.69, S-CVI = 1.00 for all subdomains, and strong agreement ( $V = 0.83$ – $0.89$ ). The highest ratings were observed for Navigation & Usability ( $M = 3.69$ ,  $V = 0.89$ ) and Multimodal Coherence ( $M = 3.68$ ,  $V = 0.89$ ), followed by Audio Design Quality ( $M = 3.67$ ,  $V = 0.88$ ) and Cognitive Load & Engagement Balance ( $M = 3.67$ ,  $V = 0.88$ ). Interactivity (Clickable Vocabulary) remained strong ( $M = 3.50$ ,  $V = 0.83$ ) and Visual Design & Readability improved to a strong interpretation ( $M = 3.56$ ,  $V = 0.85$ ). At the overall level, indices supported a strong multimodal quality interpretation ( $M = 3.57$ , S-CVI = 1.00,  $V = 0.85$ ).

### Qualitative results of multimedia expert panel

[Table 12](#) shows the summary of the language expert panel's feedback. Three points are indicated from the feedbacks: clearer character role, stronger text-image correspondence, and focused idea in each page.

Table 12. Summary of multimedia experts' feedback in round 2

No.	Themes	Feedback Summary	Before	After
1	Coherence-first multimodal alignment	Text, visuals, audio, and interaction are tightly aligned, so Grade 1 learners can follow the story easily.		
			"a can" in the text but "two cans" in the picture	Improving the alignment between text and the visual.
2	Simpler, child-friendly page design	Page layouts are cleaner and less complex, reducing cognitive overload for young learners. Non-essential effects are reduced, keeping focus on key content.		
			Some pages contain long text and unnecessary effects. The number of pages is varied	The text is shortened and illustration focuses on key points. Number of pages in each book is around 15-17.
3	Stronger learner supports	The interactive visual glossary clarifies vocabulary through clear visuals and easy access. Support features are simple to use, promoting more independent learning.		
			Exp. The clickable vocabularies are too complex and in black color.	Exp. The clickable vocabularies is reduced and typed in blue.

Overall, the multimedia quality of the eco-themed e-storybook series is strong and well-suited to Grade 1 learners. The coherence-first alignment, simplified design, and enhanced supports (replay controls and interactive accessible glossary) make the series clear, engaging, and developmentally appropriate for young EFL students.

## Discussion

The results obtained were carefully analyzed based on the grounded theories and relevant studies to explain what the expert judgments imply for the design validity and feasibility of the eco-themed e-storybook series. The discussion was presented thematically including how this study support Education for Sustainable Development (ESD) and eco-literacy, the sociocultural view on e-storybook as learning media, and how the e-storybook supports multimodal learning as well as its pedagogical implication.

### Validation summary and convergence across expert panels

This two-round modified Delphi approach thus offered convergent validity to the assessment that the series of e-storybooks is linguistically appropriate, pedagogically feasible, ecologically meaningful (with regard to its interpretability and action-oriented aspects), and multimodally coherent to Indonesian Grade 1 EFL students. In terms of the principles of content validity, the results of the unanimous judgments of relevance in the second round of the study, as well as the levels of information aggregation, could be interpreted to mean that the modifications and revisions made were successful in clarifying the ambiguities of the materials while providing a better fit within the parameters of the desired criteria (Aiken, [1985](#)). In addition, the qualitative results of the feedback offered a better sense of the actual manner of convergence of the judgments of the different team members, which could be described as design validity, without being interpreted as having any impact on the learning of the students.

### ESD and eco-literacy: embedding eco-message as early meaning-making

The strong endorsement of the clear use of the eco-message may also be seen as being consistent with the Education for Sustainable Development and eco-literacy emphases on the learning of sustainability as appropriate and action-oriented, as opposed to being abstract and information-oriented (Orr, [1990](#); UNESCO, [2020](#)). The teachers' narratives of the topics as topical and routine-aligned may mean that a connection is made between ecological meanings and child routines (e.g., keeping the school clean and sorting wastes), with a focus on the learning and the care and actions of the individual consistent with the eco-literacy perspective on learning and care (Orr, [1990](#)). This interpretation is also aligned with recent empirical work showing that integrating sustainability-oriented content in EFL contexts is commonly framed around making sustainability concrete and actionable through classroom tasks and materials, while highlighting implementation constraints and the need for carefully designed resources (Arslan & Curle, [2024](#); Yu et al., [2024](#)).

Importantly, the change in children's environmental responsibility is not reflected in the validation data; instead, it shows whether the experts considered the eco-messages to be understandable and feasible at the Grade 1 level. From the point of view of early EFL research and practice, this study offers verification for the initial assumption underlying the rationale for the study: micro-actions within the realm of environmental topics could offer contextualized and relevant situations for the situational use of linguistic functions as long as the stories remain understandable and semiotic support is provided.

### Sociocultural theory: storybooks as mediational tools and scaffolds

From a Sociocultural perspective, the series can also be seen as a tool wherein meaning is jointly negotiated using story language, visuals, audio narration, and teacher-led routines that can mediate learning within the learner's zone of proximal development (ZPD) (Vygotsky, [1978](#)). The concerns of the language experts regarding the characters and text-image correspondence can again be noted from this perspective as the uncertainty of the referent and poor images may limit the level of interpretation and support for emergent EFL learner needs who rely heavily on contextual clues to follow the story and relate form to meaning. On the other hand, the consistent characters and repetition of actions with expressions can be rated as providing a sense of narrative continuity wherein the mediation toolset can mediate learning most effectively. Recent empirical work on digital e-storybook processing supports this caution that interactive or animated elements tend to be beneficial

only when they remain tightly relevant to story processing, whereas low-relevance animations can divert attention and reduce comprehension (Bus et al., [2025](#)).

The concept of clickable-vocabulary can thus be interpreted as an on-demand support system, and its effectiveness can thus be determined depending on its minimality and its consequences on shared attention that is disrupted through clicking, especially if it is done without any purpose of understanding the text, which is why interpretations of expert opinions on additional improvements on the interactive glossary and the replay function can be directed towards enhancing the usability and minimality of scaffolding so that they are not disruptive on the shared attention and narrative continuity, which are also issues mentioned in Indonesian work on digital literacy, unlike focusing on merely using the technology and adding its features ([Ikaningrum & Sarwanti, 2021](#)).

### Multimodality and multimedia learning: coherence, cognitive load, and design discipline

In the light of multimodality theory and the importance of multimedia learning, the expert feedback, in this case, leads to the conclusion that, in digital storybooks, comprehension is achieved through the orchestration of modes to arrive at a unifying meaning, where the modes of words, images, audio, layout, and interaction converge (Kress, [2010](#)). In this context, the addition of features toward multimodal coherence is not the issue but, instead, the ways in which semiotic means are integrated to enhance interpretation. In multimodal learning, as illustrated in other multimodal theory, there are the ways in which meaning is constituted based on the interaction of modes, as well as its level of effectiveness (Lingga et al., [2021](#); Triana et al., [2025](#)).

For instance, these issues clearly align with multimedia learning and cognitive load theories, especially as far as young EFL learners, who typically lack sufficient linguistic proficiency in the target language, may be negatively affected by the unnecessary cognitive load of processing colors, that is, the necessity to simultaneously process existing decorative elements (Chandler & Sweller, [1991](#); Mayer, [2024](#); Sweller, [2011](#)). Moreover, the advice to rewrite text to simplify it, decrease unnecessary sounds/animations, and to present just one idea on the page can be seen as aligning well with the coherency-before-all discipline, which is necessarily connected to the cognitive load issue (Mayer, [2024](#)). The advice to replay speaks to the control of the time spent on the process, along with the need to avoid the new cognitive load of interface usability.

Another extension of teacher feedback to feasibility is child safety concerns, such as ad-free and no external link provisions, along with break reminders. These may be better seen as factors for the safety of the application in the classroom environment, falling in line with broader concerns for child safety and responsible use of internet resources, as emphasized in child online protection reports from international bodies like ITU/UNICEF (ITU and UNICEF, [2015](#)). Empirically, content analyses of educational apps for young children have shown that free apps often include more disruptive advertising and distracting features, which can undermine child-focused learning use and strengthen the rationale for ad-free classroom materials (Meyer et al., [2022](#)). In this particular case, feasibility is more aligned with usability and safety constraints rather than its use as an educational pedagogic construct.

## Conclusion

This research aims to determine the level of linguistically appropriateness, pedagogical viability, ecologic relevance in terms of interpretability and action-oriented nature, and finally, multimodal coherence of an eco-themed series of interactive e-storybooks from the viewpoint of ecologic relevance, linguistics, and pedagogy for Grade 1 EFL students in Indonesia. Based on two rounds of data gathering through the modified Delphi method, convergent levels of agreement among experts in linguistics, pedagogy, and finally, multimodality have revealed that the revised series is consistent in terms of design quality, usability, and appropriateness with the original intentions for series development. Thus, the research also points the way ahead for implementation priorities for series use in Indonesia, which include, but are not limited to, child safety, no harmful adverts, no unsafe external links; coherence-first multimedia principles for avoiding unnecessary complexity, and finally, a small amount of teacher's guide for intended routine-based classroom integration. Potential avenues for future research may involve an extension of this expert-based validation through the gathering of implementation and usability data through eventual child-based observations of usability.

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## Appendix

Link of the e-storybook: [https://linktr.ee/eco\\_english](https://linktr.ee/eco_english)