



From Learner Needs to Digital Design Adapting Reciprocal Teaching for Multimodal News Reading

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To cite this article. D. D. Pratiwi, Y. Mulyati, and R. Rahma, “From Learner Needs to Digital Design Adapting Reciprocal Teaching for Multimodal News Reading,” *Lang. Technol. Soc. Media*, vol. 4, no. 4, pp. 584–599, 2026.

DOI: <https://doi.org/10.70211/ltsm.3026-7196.693>

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Received: 12 July 2026

Revised: 20 July 2026

Accepted: 18 October 2026

Online: 21 October 2026

Abstract

Digital news reading requires learners to connect written and visual information while monitoring their understanding. However, the availability of multimedia resources does not establish how those resources support reading. This study examines how learner needs and limitations in existing materials informed the adaptation of Reciprocal Teaching into digital materials for Grade 7 Indonesian language instruction. A qualitative descriptive approach combined an analysis of two textbooks, a learner needs questionnaire, teacher interviews, and development documents, including expert review records. Reported questionnaire percentages were interpreted descriptively, while qualitative evidence was coded, categorized, compared, and synthesized to trace design decisions. Guidance in generating questions was the most frequently reported process-related need (85.0%), whereas easy and flexible access was the most frequently reported environmental need (94.0%). The synthesis identified six support requirements: initial orientation, attention direction, comprehension repair, information selection and organization, systematic guidance, and verbal–visual integration. These requirements informed adaptations of predicting, questioning, clarifying, and summarizing, represented through multimodal cues, focused prompts, contextual vocabulary support, sequenced activities, and integrated assessment. Expert feedback addressed linguistic clarity, visual consistency, and interface organization. The contribution is an explicit account of how reported needs were translated into reading functions and digital design decisions. The findings establish a design rationale rather than evidence of improved comprehension, usability, or transfer to independent news evaluation.

Keywords: Digital Reading Materials; Learner Needs; Multimodal News Reading; Reciprocal Teaching; Reading Comprehension.

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INTRODUCTION

Digital news reading brings language comprehension into contact with interface design and visual communication. A learner must interpret written propositions, connect them with headlines and images, and decide whether the resulting account is coherent. Contemporary reading research emphasizes that comprehension depends on interacting linguistic, cognitive, and self-regulatory processes [1]. Explicit comprehension instruction therefore concerns how readers construct and monitor meaning, as well as what information they retrieve [2]. Digital materials need to make those processes possible within the reading environment.

Reading digitally is not a single activity defined by a screen. Coiro distinguishes digital reading experiences by their purposes, resources, and levels of complexity [3], while a review of second- and foreign-language digital reading identifies variation in tasks, strategies, and research approaches [4]. An analysis across 31 economies associates digital reading performance with metacognitive reading strategies and reading self-concept, among other factors [5]. These findings make strategic support a more defensible design priority than an assumption that familiarity with devices is sufficient for comprehension.

Evidence concerning reading media also discourages technological determinism. A review and meta-analysis comparing handheld devices with paper identifies a medium effect and relevant moderators [6]. Research on leisure digital reading further shows that associations with comprehension vary by educational stage [7]. These studies concern different activities and cannot determine the effectiveness of a particular instructional product. They nevertheless establish why easy access should be treated as a condition for participation, rather than a substitute for support during reading.

The multimodal character of news adds a second design problem. Graphics can support comprehension, but their benefits depend on how they relate to the text and reading task [8]. Visual-literacy research likewise foregrounds the interpretation of images rather than their mere presence [9]. For a news reader, a photograph can orient attention, supply contextual information, or invite an inference that the written account does not substantiate. Instruction must therefore address relationships between verbal and visual evidence instead of treating images as self-explanatory additions.

In the Grade 7 Indonesian language context examined here, two textbooks already provided news-text content, exercises, visual elements, and some digital resources. The problem reported in the development record was that these components did not consistently guide learners through the process of understanding a news text. Learners also requested help with questioning, difficult information, pre-reading activity, and systematic directions. The resulting design question concerns how such reports become pedagogically justified decisions about prompts, support resources, navigation, and assessment.

Materials-development scholarship calls for closer attention to learning opportunities and the ways materials are used [10], [11]. Educational design research similarly links problem understanding with the development of practical solutions and theoretical insight [12]. This study addresses a bounded part of that relationship: the translation of reported learner needs into reading-support requirements, adaptations of Reciprocal Teaching, and digital components. It asks: (1) What support requirements emerge from the reported needs and material limitations? (2) How do those requirements inform the four reading strategies? (3) How are the adaptations represented and

refined in the digital design? The intended contribution is an inspectable design rationale for multimodal news reading, not an effectiveness claim.

LITERATURE REVIEW

Reciprocal Teaching as strategic reading support

Reciprocal Teaching coordinates predicting, questioning, clarifying, and summarizing within supported comprehension activity. Recent reviews describe its applications across learning contexts and emphasize the roles of scaffolding, dialogue, and strategic participation [13], [14]. Predicting generates provisional expectations; questioning identifies information and uncertainty requiring attention; clarifying recognizes and addresses comprehension breakdowns; and summarizing reorganizes the main meaning. These functions are connected, but a productive reading episode need not follow them in an inflexible order.

Intervention evidence supports the relevance of these strategies while also delimiting what can be inferred about their mechanisms. Kula and Budak examined comprehension, retention, and self-efficacy in a school setting [15]. Juhkam and colleagues found a comprehension benefit, particularly for students with learning difficulties, while changes in fluency and metacognitive knowledge did not simply distinguish the intervention and control groups [16]. Internet Reciprocal Teaching has also been investigated with Saudi university learners of English [17]. These studies establish precedents for strategy-based and digital adaptations; they do not validate the present prototype or demonstrate transfer to Indonesian junior secondary news reading.

An important distinction is between a material that represents the four strategies and classroom enactment of the full reciprocal process. A sequence of individual prompts can preserve reading functions without demonstrating peer dialogue, rotating responsibility, or the gradual transfer of control. Accordingly, this article uses adaptation to describe how the strategies are represented in the material. It does not assume that the existence of those components establishes implementation fidelity. The analysis concerns the rationale and documented form of support, whereas learners' use of that support remains an empirical question.

Multimodal design and comprehension repair

Multimedia learning provides a basis for connecting words, images, and learner activity [18]. An overview of reviews finds evidence for design principles including contiguity, signaling, and the exclusion of irrelevant content [19]. More focused meta-analyses address signaling [20] and the potentially distracting effects of seductive details [21]. Together, these sources justify examining where relevant information appears, what prompts direct attention to, and whether a visual element serves the reading task. They do not justify adding more media irrespective of purpose.

Classroom research on scaffolding with multimodal texts also draws attention to learners' perceptions of support and interaction [22]. A contextual glossary is one possible form of assistance, but evidence on glossing requires careful interpretation. A meta-analysis of vocabulary learning from reading found benefits of glossed reading and differences between gloss formats [23]. Another found that adding a gloss mode can help vocabulary learning, but that further modes do not necessarily produce further gains [24]. These findings come from second-language research and principally concern word learning. They support a rationale for accessible lexical assistance, not a claim that a glossary alone repairs discourse-level misunderstanding in this study.

Summarizing presents a related distinction between a visible task and the processing it requires. Research on generative learning treats sense-making as the construction of relationships among information and existing knowledge [25]. A meta-analysis of text-structure instruction reports different effects across comprehension, recall, and summarization measures [26]. Guidance should therefore support selection and organization before concise reformulation. A completed summary cannot by itself show whether a learner integrated the text's meaning or merely copied selected sentences.

Related digital language and news-literacy studies

Three Indonesian development studies involving Muhammad Aridan provide relevant contextual comparisons. Koderi, Aridan, and Muslim developed mobile learning for Arabic vocabulary in Islamic junior secondary education [27]. Hijriyah and colleagues developed digital comics for Arabic reading in Islamic primary education, combining media development with specialist and learner evaluation [28]. Masykur and colleagues developed and validated an electronic module addressing digital literacy and hoax prevention in Islamic higher education [29]. Their relevance lies in accessible language support, verbal–visual materials, and digital-information evaluation. Differences in language, age group, task, and evaluation design preclude transferring their results to the present learners.

News comprehension and news credibility must also remain conceptually distinct. Research on students' civic online reasoning documents difficulties in evaluating online information [30], while an intervention study demonstrates the teachability of evaluative approaches [31]. A broader review of educational responses to post-truth problems distinguishes epistemic challenges that extend beyond extracting information from a text [32]. The present design addresses strategic comprehension and verbal–visual interpretation. Source verification is a relevant direction for extension, but it is not reported as an assessed outcome or an established feature of this prototype.

The framework used here connects five levels: reported learner evidence, an interpreted reading-support requirement, the function of a reading strategy, a material component, and documented refinement. Systematic guidance and verbal–visual integration can influence all four strategies rather than map to one strategy each. This framework makes the reasoning between a learner report and a digital component explicit. Its value is explanatory: it clarifies why a component was selected and what it was intended to support, without treating intention as proof of learning.

METHODS

Research design and context

The study employed a qualitative descriptive approach in the context of Grade 7 Indonesian language instruction at junior secondary level. The focus was the analysis, design, and development of digital materials for multimodal news reading. Qualitative description is appropriate to a context-sensitive account of practices and their reported rationale, provided that methodological choices and evidential boundaries remain explicit [33]. The article examines relationships among reported needs, material limitations, strategy adaptations, and design decisions. It does not report an experiment, an implementation-effectiveness study, or a systematic review.

Four sources informed the study: two instructional textbooks, a learner needs questionnaire, teacher interviews, and development documents that included expert review records. The unit of interpretation was the relationship between a reported need or limitation and a corresponding design

decision. Published research supplies conceptual and comparative support; it is not used to replace missing participant data or to enlarge the study sample. [Table 1](#) identifies the contribution and boundary of each source.

Table 1. Evidence sources and their roles in the design account

Source	Coverage	Analytical role	Evidential boundary
Textbooks	Two Grade 7 Indonesian language textbooks	Identify content, activities, and support represented in existing materials	Does not establish classroom use
Learner questionnaire	Reported needs for reading and digital support	Describe the stated demand for assistance	No denominator or full instrument reported
Teacher interviews	Accounts of materials and instructional needs	Contextualize recurring support requirements	Interview coverage and quotations not reported
Development records	Conceptual design and prototype components	Trace the representation of adapted strategies	No complete version archive reported
Expert review	Media expert; content and language expert; teaching practitioner	Identify and interpret documented refinements	Does not establish learner outcomes

Data sources and collection

The two Grade 7 Indonesian language textbooks were examined for content organization, reading activities, multimodal resources, digital characteristics, and connections among materials, practice, and assessment. Document analysis permits close examination of such representations while requiring attention to the limits of documents as evidence of enacted practice [34]. The textbook analysis therefore concerns how support was represented, rather than how every teacher or learner used each book.

The needs questionnaire addressed pre-reading activity, assistance with difficult vocabulary and information, question generation, systematic instructions, visual support, digital access, and the integration of materials, activities, practice, and assessment. Closed-ended responses were summarized as percentages. Teacher interviews complemented this account by describing existing materials and the support needed during instruction. Development documents covered the conceptual design and prototype components. Review was provided by a media expert, a content and language expert, and an Indonesian language teaching practitioner.

The available study record does not specify the questionnaire denominator, recruitment procedure, school and collection dates, number of teacher interviewees, full item wording, or instrument reliability estimates. It also does not identify textbook editions or provide a complete inventory of development records. The reported percentages are therefore retained at their original precision as descriptive questionnaire summaries. They are not converted into participant counts, confidence intervals, population estimates, or statistical comparisons. This limits the quantitative interpretation and the reproducibility of the needs analysis.

Analysis and credibility

Questionnaire findings were interpreted descriptively alongside qualitative evidence. The qualitative procedure comprised familiarization, coding, categorization, comparison, and interpretive synthesis. Five analytical movements organized the account: identifying recurring needs and material limitations; interpreting their reading-support functions; relating those functions to the four strategies; tracing their representation in tasks and resources; and examining subsequent refinement through expert comments. This structure expresses the analytical relationship among decisions rather than a claim that development occurred in a single linear sequence.

The six support categories are interpretive constructions, not six directly measured scales. Some are closely connected to an individual questionnaire topic, whereas information selection and organization derives from the broader synthesis of reading demands, material limitations, and teacher perspectives. The strategy framework informed interpretation, so the analysis should not be characterized as wholly inductive. Contemporary guidance on thematic analysis emphasizes coherence between an analytical approach and its quality claims [35]. No intercoder-agreement statistic, saturation claim, or independent recoding procedure is asserted because these procedures are not documented in the available record.

Comparing textbooks, learner responses, teacher perspectives, and development records provided triangulation at the level of reported patterns. It helped distinguish a requested feature from the reading function it was intended to support. However, the article does not include raw interview transcripts, individual questionnaire responses, or a version-by-version prototype archive. The tables consequently summarize the documented account and its analytical interpretation; they are not presented as an independently reproducible audit of the primary data.

Ethics and reporting boundaries

The available record does not document ethics-review status, consent or assent procedures, or permissions for the original data collection. No approval number, exemption, or consent statement is inferred. This article reports aggregate needs and design decisions without participant names, quotations, or identifiable school information. The absence of an ethics record in the material available for this article is a reporting limitation; it does not establish that review or consent did not occur.

RESULTS AND DISCUSSION

Results

Reported needs and limitations of the existing materials

The textbook analysis identified a difference between the provision of instructional content and support during reading. Both materials presented news-text concepts systematically and included examples, exercises, visual elements, and access to digital resources. Activities nevertheless emphasized identifying information and completing exercises. Initial orientation, attention guidance, comprehension repair, and information organization were not consistently embedded across the reading process. The presence of verbal and visual resources did not ensure that tasks directed learners to interpret their relationship.

The learner responses showed a corresponding demand for guidance (Table 2). Question generation was the most frequently reported process-related need at 85.0%. Systematic instructions were reported by 78.8%, assistance with difficult information by 73.7%, and pre-reading activities

by 73.4%. Easy and flexible access had the highest reported percentage overall, at 94.0%. These values describe requests for support, rather than measured deficits in comprehension or the effectiveness of a proposed response.

Table 2. Learner needs reported in the original study

Percentage	Reported need	Design interpretation
94.0%	Easy and flexible access	Environmental condition for participation
85.0%	Guidance in generating questions	Support for attention direction and inquiry
78.8%	Systematic instructional guidance	Explicit directions across reading activities
78.8%	Integrated materials, activities, practice, and assessment	Continuity within the digital environment
78.8%	Visual presentation	Purposeful visual support
76.0%	Integrated verbal and visual information	Guidance for relating modes
73.7%	Assistance with difficult information	Support for comprehension repair
73.4%	Pre-reading activities	Initial reading orientation

Teacher perspectives reinforced the concern that the materials had not been organized to accompany learners throughout their understanding of news texts. The synthesis yielded six requirements: initial reading orientation, attention direction, comprehension repair, information selection and organization, systematic instructional guidance, and verbal–visual integration. Access was treated as a cross-cutting environmental condition. Its high reported frequency did not eliminate the need to specify what learners would do after entering the material.

The distinction between a questionnaire topic and an analytical category matters. The 85.0% response for question-generation guidance supported an interpretation concerning attention direction, but did not demonstrate that learners lacked all questioning skills. Similarly, information selection and organization was identified through the combined interpretation of sources; the record does not provide a separate percentage for that category. No additional percentage has been assigned to it.

Adaptations of the four reading strategies

The four strategies offered functional responses to the identified requirements (Table 3). Predicting addressed initial orientation by asking learners to interpret titles and images before reading the full text. The adaptation connected verbal and visual cues to expectations about events, participants, and issues. Those expectations remained provisional and could be reconsidered as further information became available. The intended function was evidence-guided anticipation, rather than guessing the answer that the material expected.

Questioning responded to the strongest reported process-related need. Focused prompts supported the generation of questions about events, participants, causes, consequences, and relationships among information. This differs from supplying a fixed set of comprehension questions: the learner still has to decide what deserves examination and what remains uncertain. The adaptation changed the amount of support available for formulating a question, without supplying its substantive answer.

Clarifying combined prompts for recognizing a comprehension problem with support available during reading. A contextual glossary addressed unfamiliar vocabulary or concepts, while directions encouraged learners to return to relevant text when relationships or references remained unclear. Glossary consultation was therefore one possible repair action. It did not replace the need to notice a problem, consider the surrounding discourse, and determine whether understanding had improved.

Summarizing was structured as selection and organization before final reformulation. Learners were guided to identify central information, distinguish it from supporting details, connect related information, and reconstruct the main content concisely. This was particularly relevant to news texts in which events, participants, explanations, quotations, and background details contribute differently to the overall account. The reported design provided guidance for these actions rather than a ready-made summary.

Table 3. Translation of support requirements into strategy adaptations

Support requirement	Strategy function	Reported adaptation	Digital representation
Initial orientation	Predicting	Interpret verbal and visual cues before full reading	Titles, images, and focused prompts
Attention direction	Questioning	Generate questions about information and relationships	Structured but open question prompts
Comprehension repair	Clarifying	Identify difficulties and seek contextual assistance	Glossary access and return-to-text directions
Information selection and organization	Summarizing	Select, connect, and reformulate central information	Guidance before summary production
Systematic guidance	Across strategies	Make expected actions and transitions explicit	Sequenced instructions and integrated activities
Verbal–visual integration	Across strategies	Relate representational resources to reading purposes	Task-linked images and verbal cues

Systematic guidance and verbal–visual integration shaped all four strategies. Directions made expected reading actions explicit; visual resources became potential evidence for prediction,

questioning, clarification, and interpretation. The strategies were organized as connected actions, with the possibility of returning to earlier information. This establishes the intended flexibility of the instructional sequence, but the record does not show how frequently learners actually moved between strategies.

Digital organization and expert refinement

The digital material connected initial orientation, conceptual content, guided reading tasks, contextual support, practice, and assessment within one environment. Its components represented intended reading actions: examining cues, generating questions, identifying difficulties, accessing assistance, selecting information, and constructing a summary. Integration was therefore pedagogical as well as technical. The development record does not provide usage logs, technical deployment records, or evidence that the environment functioned consistently across devices.

Visual resources were selected for identifiable reading purposes. Titles and images supported initial interpretation; verbal and visual relationships could also become objects of questions and clarification. The design account thus explains why multimedia was included. It does not report direct measures of visual attention, cognitive load, or cross-modal inference. Likewise, integrating assessment into the environment indicates a design decision, not evidence that the assessment was psychometrically validated.

The Wartalana digital material provides concrete examples of the four strategy-based reading activities (Figure 1). The predicting page introduces a news report through a headline and an accompanying image. The questioning page includes example questions and question words, while the clarifying page provides a contextual glossary. The summarizing page demonstrates how key information can be selected and restated. Figure 1 presents selected excerpts from these published pages; the full activities are available on the Wartalana website. These documented components illustrate the intended reading support, not evidence of its effects on learners.

WARTALANA

Examples drawn from the published learning pages

A MEMPREDIKSI Festival Literasi Anak “Rimba Kata” Kegiatan Memprediksi Teks Berita Amati terlebih dahulu gambar, judul, dan informasi yang disajikan. /memprediksi	B BERTANYA Kata Tanya dalam Teks Berita (5W+1H) Apa yang terjadi di Bandara Soekarno-Hatta? Mengapa jumlah penumpang meningkat? /bertanya
C MENGKLARIFIKASI Glosarium Atlet: Olahragawan; orang yang mahir dalam bidang olahraga tertentu... Klasemen: Daftar tingkatan atau urutan kedudukan para peserta pertandingan... /mengklarifikasi	D MERANGKUM Contoh Menentukan Informasi Penting Apa → Basral Graitto meraih medali emas SEA Games 2025. Di mana → Bangkok, Thailand. /merangkum

Source: Wartalana digital reading material - sites.google.com/upi.edu/wartalana

Figure 1. Illustrative overview of Wartalana activities: (a) predicting, (b) questioning, (c) clarifying, and (d) summarizing. Source: [Wartalana \(preview\)](#).

Expert comments led to refinements in language and presentation (Table 4). Content and language review addressed consistency of address terms, long sentences, instructional wording, capitalization, and title conventions. Media review addressed the initial display, color combinations, consistency of visual elements, and the relationship between layout and readability. The teaching practitioner did not request substantial revisions. That observation indicates acceptability within this review process, rather than proof of classroom usability or instructional effectiveness.

Table 4. Expert feedback and documented refinement

Review area	Reported issue or response	Refinement or interpretation
Content and language	Inconsistent address terms; long sentences; unclear directions; capitalization and title conventions	Standardized wording, simplified sentences, and clearer instructions
Media	Initial display, color combinations, visual consistency, and layout in relation to readability	Revised visual presentation and page organization
Teaching practice	No substantial revision requests reported	Contextual acceptability within expert review; no inference about learner outcomes

Discussion

From requested features to reading functions

The main contribution is the explicit intermediate reasoning between a learner report and a digital component. The findings distinguish demand for access from demand for assistance during meaning construction. A requested feature becomes a design justification only when its intended reading function is specified. For example, the glossary is tied to comprehension repair; a title–image display is tied to initial orientation; and summary guidance is tied to information selection. This interpretation connects materials development with the account of comprehension as an active, regulated process [1], [2], [10].

The pathway also clarifies the status of learner preferences. The highest questionnaire percentage cannot independently determine the most educationally valuable component. Easy access may be necessary for participation, but task guidance may still be necessary for productive use. Conversely, a theoretically important function need not have its own questionnaire percentage if it is transparently derived from the qualitative synthesis. The design argument therefore depends on connections across evidence sources and reading theory, rather than on ranking percentages as if they were a validated priority scale.

The adaptations are consistent with evidence that regulated-learning scaffolds can support learning, with effects that vary across tools and contexts [36]. Such evidence supports the decision to make reading actions visible and assistance available. It does not establish the appropriate amount of guidance for every learner. Overly directive prompts could constrain interpretation, whereas insufficient prompts could leave learners unable to begin. Testing how support can be reduced as competence develops is a necessary next step, especially because the present record does not document the gradual transfer of control central to Reciprocal Teaching.

Language and images within the reading interface

The study's contribution to digitally mediated language learning lies in treating interface components as part of the conditions for interpretation. A prompt tells the learner which relationship to examine; a glossary changes access to lexical meaning; the placement of an image affects the information available for a prediction. These functions make linguistic precision and interface organization analytically connected. Expert revision of address terms, sentence length, and directions thus addresses the usability of language within the material, rather than cosmetic presentation alone.

This account is compatible with multimedia research on coherent selection, signaling, and the relation of verbal and visual information [18], [19], [20], [21]. However, compatibility with a principle is not an empirical test of that principle. The study does not show that a revised color scheme reduced cognitive load or that an image prompt improved inference. Its evidence concerns the rationale and form of the revision. Outcome claims require observation of readers interacting with the revised interface.

The comparison with Aridan's collaborative research is useful precisely because the studies address different levels of evidence. Mobile vocabulary support, digital comics, and a hoax-prevention module illustrate distinct responses to language and information needs [27], [28], [29]. The present account contributes a more explicit explanation of how a need was interpreted as a reading function before becoming a component. It cannot adopt the other studies' learner gains, validation ratings, or acceptance results as evidence for its own product.

From comprehension toward critical news reading

The distinction between understanding a report and judging its credibility is especially important for future development. Research on truth judgments shows that perceived fluency and familiarity can influence belief [37]. A visually accessible report may therefore feel convincing without being reliable. In the current design, linking a photograph to a written claim supports interpretation, but does not establish that the photograph is authentic, current, or accurately contextualized. This remains a boundary of the documented design.

Published studies offer a basis for a subsequent extension. Digital tutorials have supported students' evaluation of news and social-media posts [38], and a district-wide field study examined lateral reading in high school government classes [39]. Work on teacher discussion after lateral reading highlights attention to evaluative processes [40], while curriculum-embedded civic online reasoning lessons connect those processes with subject teaching [41]. These approaches suggest future prompts for checking a source, comparing independent accounts, and examining image context. They are proposed extensions here, not retrospectively claimed prototype features.

An appropriate evaluation would distinguish comprehension, strategy use, interface usability, and credibility evaluation. Comprehension tasks could examine central information and relationships across modes; process evidence could show whether learners identify and repair misunderstandings; usability observations could reveal difficulties locating instructions or support. Credibility tasks would be needed only if source-verification functions were implemented. Separating these outcomes would prevent satisfaction ratings, expert approval, or completed activities from being treated as interchangeable evidence of learning.

CONCLUSION

The study identifies a design rationale connecting reported learner needs with strategic support for multimodal news reading in Grade 7 Indonesian language instruction. Six interpreted requirements informed adaptations of predicting, questioning, clarifying, and summarizing, while systematic guidance and verbal–visual integration operated across the strategies. The adaptations were represented through cues, prompts, contextual support, activity organization, navigation, and integrated assessment, with expert feedback refining language and visual presentation. The central contribution is the explanation of how a reported need becomes a reading function and then a digital design decision. This relationship provides a basis for examining the pedagogical purpose of individual components. It does not establish improved comprehension, full enactment of Reciprocal Teaching, or independent critical news-reading ability. The next empirical task is to examine how learners use the support and whether that use contributes to clearly differentiated reading outcomes.

LIMITATIONS

The findings concern one Grade 7 Indonesian language development context and cannot establish applicability across learner groups, languages, genres, or platforms. Questionnaire percentages lack a reported denominator and complete instrument description. Recruitment, teacher-interview coverage, textbook identities, collection dates, and ethics documentation are also absent from the available study record. These omissions limit reproducibility, assessment of representativeness, and the strength of triangulation. Aggregate percentages must therefore be read as descriptive reports within this development account. The article does not include primary transcripts, learner work, a complete coding record, archived prototype screenshots, detailed technical specifications, or an accessible version history. Expert feedback documents refinement but not observed use. No comprehension pretest–posttest comparison, control group, usability testing, or transfer measure is reported. Consequently, the six categories and their mappings are interpretive design propositions with empirical grounding in the reported needs, rather than validated mechanisms or demonstrated learning effects.

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AUTHOR CONTRIBUTION

D.D.P., Y.M., and R.R. are the three authors of this study and contributed to the preparation and critical review of the manuscript. Specific individual roles in conceptualization, investigation, formal analysis, methodology, supervision, and writing should be verified and approved by all three authors before the final publication record is confirmed.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

The author(s) used ChatGPT by OpenAI during the preparation of this work to assist in language refinement, grammar correction, academic paraphrasing, manuscript structuring, and translation of several sections into academic English. After utilizing the tool/service, the author(s) thoroughly reviewed, revised, and edited the content as necessary and assumed full responsibility for the publication's content.

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