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Bercerita Digital Dan E-Book Interaktif: Meningkatkan Keterlibatan Membaca Dan Penguasaan Kosakata Peserta Didik Usia Remaja

Digital Storytelling And Interactive E-Books: Fostering Young Adult Learners' Reading Engagement And Vocabulary Acquisition

Fovi Sriyuliawati[a*], Rika Septiani, Rinaepi[c]
Universitas Islam Al-Ihya Kuningan, Indonesia[a,b,c]
fovisriyuliawati@gmail.com[a]

Abstract

This article synthesizes contemporary research on the integration of digital storytelling and interactive e-books in secondary and higher education, with particular attention to their contribution to young adult learners' reading engagement and vocabulary acquisition. Using a systematic literature review approach guided by PRISMA 2020, the study examines empirical research on interactive digital texts, multimodal glosses, audio-supported reading, branching narratives, and learner-generated digital stories. The analysis is informed by Paivio's Dual Coding Theory, Mayer's Cognitive Theory of Multimedia Learning, and Sweller's Cognitive Load Theory. The findings indicate that well-designed interactive digital texts generally support receptive vocabulary learning, lexical retention, reading motivation, and active participation by combining verbal, visual, and auditory information. However, productive vocabulary mastery and higher-order reading comprehension require more than exposure to multimedia input. Their development depends on meaningful vocabulary retrieval, communicative production, teacher scaffolding, peer interaction, and structured opportunities for reflection. The review also shows that decorative animations, unrelated sound effects, excessive hyperlinks, and poorly positioned interactive features may increase extraneous cognitive load and encourage fragmented or superficial reading. Therefore, the effectiveness of digital storytelling and interactive e-books is determined by feature congruence, cognitive-load management, learner control, accessibility, and pedagogical mediation. When integrated into task-based, collaborative, and participatory learning environments, these technologies can move young adult learners from passive digital-text consumption toward active interpretation, productive language use, and multimodal meaning-making.

Keywords: *digital storytelling, interactive e-books, young adult literacy, vocabulary acquisition, reading engagement*

Abstrak

Artikel ini menyintesis penelitian terkini mengenai integrasi *digital storytelling* (bercerita secara digital) dan *e-book* interaktif dalam pendidikan menengah dan tinggi, dengan perhatian khusus pada kontribusinya terhadap keterlibatan membaca dan penguasaan kosakata pembelajar dewasa muda. Dengan menggunakan pendekatan tinjauan pustaka sistematis yang berpedoman pada PRISMA 2020, studi ini mengkaji penelitian empiris mengenai teks digital interaktif, glosarium multimodal, kegiatan membaca dengan dukungan audio, narasi bercabang (*branching narratives*), dan cerita digital yang dibuat oleh pembelajar. Analisis ini didasarkan pada Teori *Dual Coding* Paivio, Teori Kognitif Pembelajaran Multimedia Mayer, dan Teori Beban Kognitif Sweller. Temuan menunjukkan bahwa teks digital interaktif yang dirancang dengan baik umumnya mendukung pembelajaran kosakata reseptif, retensi leksikal, motivasi membaca, dan partisipasi aktif melalui kombinasi informasi verbal, visual, dan auditori. Namun, penguasaan kosakata produktif dan pemahaman bacaan tingkat tinggi memerlukan lebih dari sekadar paparan terhadap input multimedia. Pengembangannya bergantung pada pemanggilan kembali kosakata secara bermakna, produksi komunikatif, perancah (*scaffolding*) dari guru, interaksi antar-rekan, serta kesempatan refleksi yang terstruktur. Tinjauan ini juga menunjukkan bahwa animasi dekoratif, efek suara yang tidak relevan, hipertautan yang berlebihan, serta fitur interaktif dengan penempatan yang kurang tepat dapat meningkatkan beban kognitif ekstraneus dan mendorong cara membaca yang terfragmentasi atau dangkal. Oleh karena itu, efektivitas *digital storytelling* dan *e-book* interaktif ditentukan oleh keselarasan fitur, pengelolaan beban kognitif, kendali pembelajar, aksesibilitas, dan mediasi pedagogis. Ketika diintegrasikan ke dalam lingkungan pembelajaran berbasis tugas, kolaboratif, dan partisipatif, teknologi-teknologi ini dapat menggeser

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peran pembelajar dewasa muda dari sekadar konsumen pasif teks digital menuju interpretasi aktif, penggunaan bahasa secara produktif, dan konstruksi makna secara multimodal.
Kata kunci: *digital storytelling*, *e-book* interaktif, literasi dewasa muda, penguasaan kosakata, keterlibatan membaca

1. Introduction

Digital transformation has changed not only the formats through which young adults encounter written texts but also the cognitive, affective, and social processes involved in reading. In secondary and higher education, learners increasingly access academic and literary texts through smartphones, tablets, laptops, learning management systems, interactive applications, and digital reading platforms. These environments extend conventional written texts by incorporating audio narration, images, animation, hyperlinks, glossaries, comprehension prompts, and opportunities for reader participation. Consequently, literacy can no longer be understood exclusively as the ability to decode and comprehend printed language. It also involves navigating multimodal information, evaluating digital resources, connecting verbal and visual representations, and producing meaning across different modes.

Among the digital approaches increasingly used in language education are digital storytelling and interactive e-books. Digital storytelling combines narrative with multimedia elements such as written text, voice-over narration, still or moving images, music, and sound effects. In language classrooms, it may be used as teacher-produced instructional input or as a learner-generated project in which students plan, write, revise, narrate, and publish their own stories. Interactive e-books, by comparison, primarily function as digital reading environments enhanced with features such as clickable vocabulary glosses, synchronized audio, highlighting, embedded questions, feedback, and nonlinear navigation. Although the two technologies differ in their primary functions, they share an emphasis on multimodality, interaction, and active learner participation.

Previous research indicates that digital storytelling can produce educational benefits extending beyond technological competence. A systematic review by Wu and Chen (2020) showed that educational digital storytelling has been associated with content learning, motivation, critical thinking, collaboration, and multiliteracy development. More recent language-learning studies similarly suggest that learner-generated digital stories can provide meaningful opportunities to use language while developing digital and collaborative skills. For example, Nami and Asadnia (2024) found that collaborative student-generated digital stories supported EFL learners' vocabulary development and encouraged positive attitudes toward vocabulary learning. Yu and Wang (2025) also reported that digital storytelling activities could support language learning, digital skills, and collaboration among English pre-service teachers.

Digital storytelling may be particularly relevant to young adult learners because narrative production enables them to connect classroom texts with personal experience, identity, and contemporary social issues. Haring (2024) proposes combining extensive reading of Young Adult Literature with scaffolded digital storytelling as a post-reading activity. In this model, students do not merely reproduce a story but interpret its themes, relate them to individual and collective experiences, and transform their responses into multimodal narratives. Similarly, Fina et al. (2024) found that upper-secondary EFL students used different multimodal strategies to reinterpret themes from Young Adult Literature. Students valued collaboration and

creative expression, although they also experienced challenges in brainstorming, researching, and editing their stories. These findings suggest that digital storytelling can reposition learners from passive recipients of texts to active interpreters and creators.

Interactive e-books may also support language learning by providing immediate assistance during reading. Digital glosses, illustrations, audio pronunciation, highlighting, and contextual definitions can make unfamiliar words more noticeable and accessible. Zhu et al.'s (2024) meta-analysis demonstrated that digital reading can positively affect second- and foreign-language vocabulary learning across different learning environments. Similarly, Ramezanali et al. (2021) found that multimodal glossing generally supported L2 vocabulary learning, although its effectiveness varied according to learner proficiency, text type, gloss characteristics, and assessment format. Such findings indicate that interactive support can facilitate lexical processing by connecting unfamiliar word forms with meanings, sounds, and visual representations.

Nevertheless, the educational value of digital texts cannot be assumed merely because they contain multimedia or interactive elements. Research comparing reading on screens and paper has identified a small but meaningful disadvantage for screen-based reading in some comprehension contexts, particularly when readers experience time pressure or inaccurately evaluate their own understanding (Clinton, 2019). Furthermore, interactive features may either support or interfere with learning. Clinton-Lisell et al. (2023) found an overall positive effect of interactive e-text features, but they also emphasized that outcomes depend on the function and design of the features. Multimedia elements that clarify meaning, direct attention, or support comprehension may be beneficial, whereas decorative animation, unrelated sound effects, excessive hyperlinks, and unnecessary hotspots can divide attention and interrupt the construction of a coherent mental representation of the text.

This tension can be explained through the Cognitive Theory of Multimedia Learning and Cognitive Load Theory. The Cognitive Theory of Multimedia Learning proposes that individuals process verbal and visual information through separate but interconnected channels, each of which has limited processing capacity. Meaningful learning occurs when learners select relevant information, organize it into coherent verbal and visual representations, and integrate these representations with prior knowledge (Mayer, 2024). Cognitive Load Theory similarly emphasizes that working memory is limited and that instructional materials should minimize processing unrelated to the learning objective while supporting cognitive activity that contributes to schema construction (Sweller et al., 2019). From these perspectives, digital storytelling and interactive e-books are most effective when their verbal, visual, and auditory components are instructionally relevant and coherently organized.

Despite growing scholarship on digital storytelling and digital reading, several gaps remain. First, digital storytelling and interactive e-books are frequently examined as separate instructional technologies, even though both depend on multimodal processing, learner interaction, and instructional scaffolding. Second, existing studies often focus on a single outcome, such as general achievement, reading comprehension, motivation, or digital competence. Fewer studies and reviews simultaneously examine reading engagement and vocabulary acquisition, even though affective involvement in reading may influence attention to unfamiliar words, persistence, and repeated exposure. Third, the literature does not always distinguish receptive vocabulary

knowledge—the ability to recognize and understand a word—from productive vocabulary knowledge—the ability to use that word accurately in speaking or writing. Digital reading may promote recognition and recall, but productive mastery normally requires retrieval, contextual use, and communicative output. Fourth, the effectiveness of digital features is often discussed without sufficient attention to feature congruence, cognitive load, learner proficiency, and teacher mediation. Finally, much of the literature focuses either on young children or adult university learners, leaving the broader category of young adult learners across secondary and tertiary education comparatively fragmented.

To address these gaps, this article synthesizes current theoretical and empirical literature concerning digital storytelling and interactive e-books in young adult language-learning contexts. It investigates how multimodal and interactive features influence reading engagement and vocabulary acquisition and identifies the cognitive and pedagogical conditions under which these technologies support meaningful learning. The review is guided by the following questions:

1. What design and pedagogical features of digital storytelling and interactive e-books influence young adult learners' reading engagement?
2. How do digital storytelling and interactive e-books affect receptive and productive vocabulary acquisition?
3. Under what cognitive and instructional conditions do interactive digital texts support or hinder language learning?

By integrating research on digital storytelling, interactive reading, multimedia learning, cognitive load, and vocabulary development, this article contributes a framework for understanding technology-enhanced literacy as an interaction among digital design, learner agency, cognitive processing, and pedagogical mediation. Rather than treating technology as an independent cause of learning, the article argues that its effectiveness depends on how digital features are aligned with linguistic objectives, narrative meaning, learners' cognitive capacities, and structured opportunities for language production.

2. Literature Review

Digital Storytelling in Language Education

Digital storytelling combines written text, narration, images, video, music, and other multimodal elements to present or create a narrative. In language education, it can be used either as teacher-produced material or as a learner-generated project. Learner-generated digital storytelling is especially valuable because students engage in planning, writing, revising, recording, and selecting media, thereby integrating reading, writing, listening, speaking, and digital literacy.

Previous research shows that digital storytelling can support motivation, collaboration, creativity, critical thinking, and language learning when it is accompanied by clear instructional guidance (Wu & Chen, 2020). Nami and Asadnia (2024) found that learner-generated digital stories promoted vocabulary learning through repeated exposure, rehearsal, peer interaction, and active language production. Similarly, Yu and Wang (2025) reported that digital storytelling strengthened language learning, digital skills, and collaboration. However, its effectiveness depends on teacher support, clear task stages, balanced group participation, and appropriate assessment.

Digital Storytelling and Young Adult Literature

Young Adult Literature provides themes that are closely connected to adolescents' and young adults' experiences, including identity, belonging, relationships, conflict, and social change. When combined with digital storytelling, literary reading can develop from text comprehension into interpretation and multimodal creation.

Haring (2024) proposes digital storytelling as a post-reading activity in which learners interpret literary themes and transform their responses into new narratives. Fina et al. (2024) also found that students used language, images, voice, and sound to reinterpret Young Adult Literature while developing creativity, collaboration, multiliteracies, and critical engagement. These findings suggest that digital storytelling can connect reading engagement with productive vocabulary use because learners must retrieve and reuse language from the source text.

Interactive E-Books and Reading Engagement

Interactive e-books extend conventional digital texts by incorporating features such as glosses, audio narration, synchronized highlighting, dictionaries, annotations, comprehension prompts, and branching choices. These features can provide immediate vocabulary support, improve decoding, guide attention, and encourage active reading.

Clinton-Lisell et al. (2023) found that interactive e-text features generally support learning, although their effectiveness depends on instructional relevance. Functional features, such as vocabulary definitions and synchronized audio, can improve comprehension, whereas decorative animations, unrelated sounds, and excessive interaction may distract learners. Therefore, the educational quality of an interactive e-book should be assessed according to how its features support reading and language objectives rather than how many technological elements it contains.

Reading engagement includes behavioral participation, emotional interest, cognitive processing, and learner agency. Digital texts may support engagement by reducing language difficulty, increasing autonomy, and facilitating peer interaction. Nevertheless, clicking, scrolling, or responding to gamified features does not necessarily indicate deep engagement. Meaningful engagement requires learners to interpret ideas, monitor comprehension, make connections, and use relevant language.

Vocabulary Acquisition Through Digital Reading

Vocabulary knowledge includes receptive knowledge, or the ability to recognize and understand words, and productive knowledge, or the ability to use them accurately in speaking and writing. Digital reading is particularly effective in supporting receptive vocabulary through glosses, images, pronunciation, translation, and contextual examples.

Zhu et al. (2024) found that digital reading positively influenced second- and foreign-language vocabulary learning, although outcomes varied according to learner proficiency, digital features, and assessment methods. Ramezanali et al. (2021) similarly reported that multimodal glosses generally improved immediate vocabulary learning, but excessive information could divide attention. Webb et al. (2023) further emphasized that vocabulary learning through reading depends on repeated exposure, prior knowledge, input conditions, and opportunities for retrieval.

Interactive e-books can therefore support initial word recognition, but productive vocabulary development requires additional speaking, writing, discussion, and feedback. Digital storytelling complements interactive reading by requiring learners to reuse vocabulary in scripts, narration, peer interaction, and revision.

Cognitive Foundations of Digital Reading

The Cognitive Theory of Multimedia Learning explains that verbal and visual information are processed through separate but connected channels with limited capacity (Mayer, 2024). Meaningful learning occurs when learners select relevant information, organize it into coherent representations, and integrate it with prior knowledge. This theory supports the use of relevant images, synchronized audio, signaling, and well-positioned glosses in digital texts.

Cognitive Load Theory further explains that poorly designed multimedia can overload working memory (Sweller et al., 2019). Confusing navigation, unnecessary animation, excessive links, and competing audio may increase extraneous cognitive load. Clinton (2019) also found that screen reading may produce lower comprehension in some contexts because of distraction, scrolling, and weak spatial orientation.

Accordingly, digital reading is not automatically superior to print. Its effectiveness depends on whether digital features reduce linguistic difficulty, guide attention, and support comprehension. Well-designed interactive texts can improve reading and vocabulary learning, whereas poorly aligned multimedia may encourage fragmented and superficial processing.

3. Method

This study employed a systematic literature review to identify, evaluate, and synthesize empirical research on the use of digital storytelling and interactive e-books in supporting young adult learners' reading engagement and vocabulary acquisition. The review followed the PRISMA 2020 guidelines for study identification, screening, eligibility assessment, and reporting (Page et al., 2021). The literature-search process was also informed by PRISMA-S to ensure transparency in documenting the databases, search terms, search dates, and supplementary retrieval procedures (Rethlefsen et al., 2021). Because the selected studies used quantitative, qualitative, and mixed-methods designs, the review adopted a mixed-studies approach. It focused on the technological and pedagogical features influencing reading engagement, the effects of digital tools on receptive and productive vocabulary learning, the conditions supporting or hindering their effectiveness, and learners' perceptions of motivation, agency, interaction, and cognitive difficulty.

The literature search covered peer-reviewed studies published between January 2018 and July 2026. The main searches were conducted through Scopus, Web of Science Core Collection, ERIC, ProQuest Education Database, and Education Source. Google Scholar, ScienceDirect, SpringerLink, SAGE Journals, and Taylor & Francis Online were used as supplementary sources. Backward citation searching was conducted by examining the reference lists of relevant studies, while forward citation searching was undertaken to identify newer publications that cited key articles. The search was carried out from July 15 to July 25, 2026. Search terms combined concepts related to digital storytelling and interactive texts, young adult and language-learning populations, and vocabulary or reading outcomes. The principal Boolean terms included "*digital storytelling," "interactive e-book," "interactive fiction," "hypermedia*

text," and "multimodal gloss," combined with terms such as "young adult," "adolescent," "secondary school," "undergraduate," "EFL," and "ESL," as well as "reading engagement," "reading comprehension," "vocabulary acquisition," "retention," and "agency." The search syntax was adjusted according to the indexing system of each database.

Studies were included when they were published between 2018 and July 2026, involved secondary-school, college, university, or comparable young adult learners, and examined digital storytelling, interactive e-books, digital glosses, hypermedia reading, branching narratives, or learner-generated multimodal stories. Eligible studies were also required to contain meaningful multimodal, interactive, or participatory features and to report outcomes related to vocabulary learning, vocabulary retention, reading engagement, reading motivation, reading comprehension, learner agency, cognitive load, or perceptions of digital reading. Quantitative, qualitative, and mixed-methods primary studies published as full-text peer-reviewed articles in English were considered. Studies were excluded when they focused exclusively on preschool or primary-school learners, examined static PDF reading without interactive support, used digital storytelling for non-educational purposes, measured technological usability without relevant literacy outcomes, or were non-empirical publications. Duplicate publications based on the same dataset were also excluded.

All retrieved records were exported to Mendeley Reference Manager. Duplicate records were removed using the automatic duplicate-detection function and subsequently checked manually. The selection process was conducted by the principal researcher in two stages. First, titles and abstracts were screened according to the eligibility criteria. Second, the full texts of potentially relevant articles were assessed. Articles with uncertain eligibility were reviewed again after the initial full-text screening to improve consistency. Screening decisions and reasons for exclusion were recorded in a Microsoft Excel audit file. The database and supplementary searches identified 1,300 records. After 286 duplicates were removed, 1,014 records remained for title and abstract screening. Of these, 904 were excluded, leaving 110 articles for full-text assessment. A further 68 articles were excluded because of inappropriate participant populations, non-interactive interventions, irrelevant outcomes, non-empirical designs, duplicate datasets, unavailable full texts, or insufficient methodological information. Consequently, 42 empirical studies were included in the final synthesis.

The methodological quality of the included studies was assessed using the Quality Assessment with Diverse Studies tool developed by Harrison et al. (2021). QuADS was selected because it can be applied to quantitative, qualitative, and mixed-methods research. The appraisal considered the clarity of research aims, appropriateness of the research design and setting, participant selection, suitability of data-collection procedures, transparency of the analysis, and alignment between findings and conclusions. The appraisal criteria were pilot-tested on five studies before being applied to the complete dataset. Methodological weaknesses were not used as an automatic reason for exclusion but were considered when interpreting the strength and reliability of the findings.

Data were extracted using a standardized Microsoft Excel form. The information recorded included authorship, publication year, country, educational context, research design, participant characteristics, intervention type, digital platform, duration, interactive features, pedagogical procedures, assessment instruments, principal

findings, participant perceptions, and study limitations. Technological features were classified into categories such as visual glosses, first-language translations, audio pronunciation, text-to-speech, synchronized highlighting, comprehension prompts, automated feedback, branching narratives, multimodal authoring, social annotation, gamification, and transmedia resources. Pedagogical features included explicit vocabulary instruction, collaborative story production, teacher questioning, peer feedback, communicative output, visual story mapping, and post-reading reflection. Vocabulary outcomes were classified as receptive when they measured recognition, form–meaning matching, or definition recall, and as productive when learners were required to use target words in speaking, writing, narration, or other original language production. Reading engagement was categorized into behavioral, emotional, cognitive, and agentic dimensions.

A statistical meta-analysis was not conducted because the included studies differed substantially in participant characteristics, research designs, intervention duration, technological features, comparison conditions, and assessment instruments. Quantitative findings were therefore synthesized narratively according to the Synthesis Without Meta-analysis guideline proposed by Campbell et al. (2020). The studies were organized around interactive e-books and receptive vocabulary learning, digital storytelling and productive vocabulary use, interactive reading and comprehension, digital storytelling and reading engagement, multimodal production and learner agency, and cognitive-load or design-related barriers. Qualitative findings were analyzed using the thematic-synthesis procedure developed by Thomas and Harden (2008). Relevant findings were coded, grouped into descriptive themes, and then developed into broader analytical themes. Deductive categories were informed by multimedia learning, cognitive load, reading engagement, and pedagogical mediation, while inductive themes included technical anxiety, unequal participation, digital distraction, accessibility limitations, and learner ownership. Quantitative and qualitative findings were subsequently integrated through a convergent narrative synthesis focusing on technological affordances, cognitive processing, affective and agentic engagement, and pedagogical mediation.

To support transparency and methodological consistency, the eligibility criteria, database searches, screening decisions, data-extraction categories, quality-appraisal procedures, and reasons for exclusion were documented in an audit file. Although the review was conducted by a single researcher, consistency was strengthened through standardized screening, appraisal, and extraction forms, repeated assessment of uncertain studies, and verification of extracted information against the original publications. Formal ethical approval was not required because the study analyzed previously published research and did not involve direct interaction with human participants or access to confidential data.

4. Results and Discussion

Overview of the Synthesized Evidence

The 42 studies included in the review were synthesized according to four interconnected dimensions: vocabulary acquisition, reading engagement, learner agency, and the cognitive and pedagogical conditions underlying effective digital literacy instruction. The evidence covered interactive e-books, multimodal glosses, digital storytelling, digital social reading, hypermedia texts, learner-generated stories, audio-supported reading, and other digitally scaffolded literacy activities.

Because the included studies differed substantially in research design, participant characteristics, intervention duration, technological features, comparison conditions, and assessment instruments, the findings were synthesized narratively rather than statistically pooled. Therefore, the results are presented in terms of recurring patterns, convergent findings, contradictory evidence, and contextual conditions. No overall effect size is reported because the present review did not conduct a formal meta-analysis.

The synthesis produced five principal findings. First, interactive digital reading generally supported receptive vocabulary acquisition when lexical assistance was directly connected to the target words. Second, productive vocabulary development required activities involving retrieval, oral or written production, revision, and feedback. Third, digital storytelling and social reading tended to strengthen motivation and learner agency when students were given meaningful choices and opportunities to create. Fourth, interactive features did not automatically improve learning; decorative or poorly integrated multimedia could increase distraction and cognitive load. Fifth, teacher mediation consistently emerged as a central condition connecting technological affordances with meaningful literacy outcomes.

These findings suggest that the educational effectiveness of digital storytelling and interactive e-books cannot be attributed to technology alone. Instead, learning outcomes appear to result from an interaction among feature congruence, cognitive processing, learner participation, and pedagogical mediation.

Interactive Digital Reading and Vocabulary Acquisition

Advantages for receptive vocabulary knowledge

The synthesis indicates that interactive digital texts generally offer favorable conditions for receptive vocabulary acquisition. Features such as clickable definitions, first-language translations, audio pronunciation, contextual examples, illustrations, and synchronized highlighting can make unfamiliar words more noticeable and reduce interruptions during reading. Rather than leaving the main text to consult a separate dictionary, readers can access lexical support within the immediate reading environment.

This finding is consistent with Zhu et al. (2024), whose meta-analysis showed that digital reading had an overall positive effect on second- and foreign-language vocabulary learning. However, the magnitude of the effect varied according to learners' proficiency, the type of digital reading resource, the learning context, and the format used to assess vocabulary knowledge. Therefore, digital reading should not be treated as a homogeneous intervention. An interactive e-book containing pedagogically relevant lexical support is substantially different from a static text displayed on a screen.

Multimodal glossing was among the most frequently reported forms of vocabulary support. A multimodal gloss may combine a written definition with an image, pronunciation, translation, animation, or contextual example. Such combinations can facilitate the establishment of form–meaning connections because learners encounter the same lexical item through more than one representational mode.

Ramezanali et al. (2021) found that adding a relevant gloss mode generally improved immediate second-language vocabulary learning. Nevertheless, the effectiveness of multimodal glosses was moderated by learner characteristics, text

conditions, gloss design, and test format. The implication is that a greater number of modes does not automatically generate better learning. A picture or audio recording is beneficial when it clarifies the meaning, pronunciation, or contextual use of a word. Conversely, an irrelevant image or excessive explanation may divide attention and make lexical processing less efficient.

The results can be explained through the Cognitive Theory of Multimedia Learning. When written definitions, relevant images, and audio pronunciations are coherently presented, learners can construct connected verbal and visual representations. These representations may strengthen initial word recognition and meaning recall. However, each processing channel has limited capacity. Presenting several competing elements at the same time may overload working memory rather than strengthen learning.

The location of lexical assistance is also important. Glosses that appear close to the relevant word can reduce unnecessary visual searching. By contrast, pop-up windows that obscure the sentence, require several navigation steps, or contain lengthy explanations may create split attention. Effective lexical scaffolding should therefore be brief, context-sensitive, easy to close, and spatially connected to the target word.

Receptive gains do not automatically become productive mastery

A central pattern in the evidence was the distinction between receptive and productive vocabulary knowledge. Interactive e-books frequently supported learners' ability to recognize target words, match words with definitions, and recall meanings. However, these gains did not always result in the ability to use the same words accurately and independently in speaking or writing.

Receptive knowledge requires learners to recognize or understand a lexical item when it is presented. Productive knowledge places greater demands on memory because learners must retrieve the word without being shown it, select an appropriate form, and integrate it into a meaningful utterance. Thus, clicking on a gloss and recognizing a definition is cognitively different from using the word in an original sentence, oral presentation, or narrative.

This interpretation is consistent with research on incidental vocabulary acquisition. Exposure to vocabulary through meaningful reading or listening can produce measurable learning, but the depth and durability of learning depend on repetition, prior knowledge, attention, retrieval opportunities, and the nature of the assessment (Webb et al., 2023). Recognition-based post-tests are generally more sensitive to partial lexical knowledge than productive assessments.

Digital storytelling can help bridge this receptive–productive gap because it requires learners to reuse vocabulary during script writing, narration, peer discussion, editing, and revision. Nami and Asadnia (2024), for example, examined EFL learners' self-made digital stories and reported positive effects on vocabulary learning. The value of the intervention was not limited to multimedia exposure. Students actively selected vocabulary, incorporated words into narratives, rehearsed pronunciation, and revised their stories.

Therefore, the findings do not support the use of interactive reading applications as stand-alone solutions for complete vocabulary mastery. Interactive e-books can provide accessible and memorable input, but productive development requires retrieval and communicative use. A more effective instructional sequence involves

encountering a word during reading, accessing relevant multimodal support, retrieving the word through a short task, and subsequently using it in speaking, writing, or digital storytelling.

Retention depends on repeated and meaningful use

The evidence also suggests that immediate post-test improvement should not be interpreted as durable vocabulary acquisition. Learners may remember definitions shortly after interacting with a gloss while failing to retain the words over longer intervals. This concern is particularly relevant when studies rely exclusively on immediate recognition tests.

Repeated exposure can strengthen lexical representations, but repetition is most effective when learners encounter vocabulary in varied and meaningful contexts. Reading the same definition several times may produce familiarity, whereas using the word to describe a character, justify an interpretation, or construct a digital narrative requires deeper processing.

The role of digital storytelling is consequently important because it can extend vocabulary learning beyond the initial reading event. A target word may first appear in an interactive e-book, reappear during discussion, be selected for a script, be rehearsed during recording, and be reconsidered during peer feedback. Such repeated encounters combine receptive exposure with productive retrieval.

The review therefore indicates that future evaluations should distinguish immediate learning from delayed retention. Studies should also report whether target vocabulary is measured through recognition, cued recall, sentence completion, oral production, or independent writing. Without these distinctions, claims about "vocabulary acquisition" may conceal substantial differences in the depth of lexical knowledge being assessed.

Effectiveness of Interactive and Multimodal Features

The evidence demonstrates that interactive features should be evaluated according to their instructional function rather than their technological novelty. Table 1 summarizes the principal features identified in the review, their cognitive mechanisms, potential literacy contributions, associated risks, and recommended forms of implementation.

Table 1. Interactive Features, Cognitive Mechanisms, Literacy Contributions, and Design Implications

Digital feature	Principal cognitive or pedagogical mechanism	Potential contribution	Main risk	Recommended implementation	Supporting literature
Dynamic textual and visual glosses	Verbal–visual association, lexical noticing, and immediate form–meaning support	Word recognition, definition recall, contextual understanding, and delayed recognition	Split attention, obscured text, or unnecessary visual detail	Present concise glosses next to the target word; use only semantically relevant images	Ramezan ali et al. (2021); Zhu et al. (2024)

Audio pronunciation and synchronized highlighting	Connection between phonological and orthographic representations; attention guidance	Pronunciation awareness, decoding support, word-boundary recognition, and reading fluency	Auditory overload or passive dependence on narration	Allow learner control; synchronize audio with relevant text and provide replay options	Clinton-Lisell et al. (2023); Mayer (2024)
Text signaling and visual organization	Attention direction and construction of a coherent cognitive map	Improved navigation, recall, identification of central ideas, and comprehension	Excessive highlighting reduces signaling value	Use headings, underlining, bold type, and visual organization selectively	Shi et al. (2020)
Embedded retrieval prompts and feedback	Retrieval practice, comprehension monitoring, and metacognitive regulation	Stronger recall, identification of misunderstandings, and inferential processing	Frequent interruptions may fragment narrative flow	Place prompts after meaningful text segments or narrative transitions	Clinton-Lisell et al. (2023)
Branching narratives and hypermedia links	Choice, active decision-making, and contextualized problem solving	Agency, curiosity, inferential reasoning, and contextual vocabulary use	Spatial disorientation and fragmented text representation	Provide progress indicators, story maps, return paths, and limited meaningful choices	Haring (2024); Mayer (2024)
Digital social annotation	Social interaction, peer interpretation, and visible thinking	Reading motivation, collaborative comprehension, and critical response	Off-topic discussion, social pressure, and fragmented attention	Provide discussion prompts, annotation categories, and moderation	Fazzi et al. (2024)
Learner-generated digital storytelling	Generative learning, retrieval, multimodal authoring, and	Productive vocabulary, multiliteracies, creativity, mediation, and learner agency	Technical difficulty, unequal participation, and excessive	Use staged scripts, vocabulary requirements, assigned group roles,	Nami and Asadnia (2024); Fina et al. (2024);

	collaborative revision		attention to visual design	and language-focused rubrics	Yu and Wang (2025)
Decorative animations and interactive hotspots	Sensory stimulation without direct instructional function	May generate initial curiosity but provides limited linguistic benefit	Extraneous cognitive load, superficial clicking, and loss of narrative coherence	Remove features that do not clarify vocabulary, plot, structure, or comprehension	Clinton-Lisell et al. (2023); Mayer (2024)

The table reinforces the principle of feature congruence. A feature is congruent when it directly supports the linguistic, narrative, or comprehension objective. For instance, clicking on an unfamiliar word to hear its pronunciation is congruent with vocabulary learning. An animated object that produces an unrelated sound may attract attention but does not assist readers in constructing meaning.

This distinction helps explain why findings on interactive texts are not uniformly positive. Clinton-Lisell et al. (2023) reported an overall advantage for interactive e-text features, but the outcomes depended on the type and function of interactivity. Features that encouraged meaningful processing tended to be more beneficial than those that merely increased physical interaction.

Accordingly, the number of interactive elements is not an appropriate indicator of educational quality. A simple e-book with well-placed glosses, signaling, and learner-controlled audio may support learning more effectively than a visually elaborate application containing multiple animations, sounds, hyperlinks, and games unrelated to the reading objective.

Reading Engagement in Digital Environments

The synthesis indicates that digital storytelling and interactive e-books can support reading engagement, particularly when learners perceive the activities as relevant, manageable, and open to meaningful participation. However, reading engagement should not be reduced to enjoyment or time spent using a device. It includes behavioral persistence, emotional interest, cognitive investment, and agentic participation.

Interactive e-books can strengthen behavioral engagement by reducing obstacles that might otherwise cause learners to abandon a text. Immediate definitions, audio assistance, adjustable pacing, and visible progress indicators may help learners continue reading when linguistic difficulty increases. These supports are particularly relevant for reluctant readers and language learners who experience frustration when too many unfamiliar words interrupt comprehension.

Emotional engagement may arise from narrative relevance, aesthetic presentation, choice, collaboration, and a sense of progress. Nevertheless, multimedia novelty is likely to produce only temporary interest when it is not connected to meaningful reading. A learner may enjoy clicking animated features without engaging deeply with characters, ideas, vocabulary, or narrative relationships.

Fazzi et al. (2024) found that extensive digital social reading could contribute to motivation, comprehension, and deep reading among EFL learners, although mobile

reading also presented advantages and disadvantages. Their findings are important because they show that engagement was supported not merely by the digital platform but by the combination of text choice, structured pre-reading activities, during-reading interaction, and post-reading reflection.

Digital social reading can make interpretation visible. Annotations, comments, questions, and peer responses allow students to externalize their thinking and encounter alternative perspectives. Such interaction may encourage close reading when students are asked to justify interpretations with textual evidence. However, unstructured discussion can become superficial, socially distracting, or unrelated to the text. Therefore, social reading requires clear prompts and moderation.

The findings also suggest that young adult literature can enhance engagement when its themes connect with learners' experiences and contemporary concerns. Nevertheless, thematic relevance does not automatically guarantee deep reading. Students still require linguistic scaffolding, opportunities to discuss difficult issues, and tasks that require interpretation rather than factual recall.

From Reading Engagement to Learner Agency

Learner agency emerged most clearly when students moved from consuming digital content to producing and sharing their own multimodal texts. In interactive reading, agency may begin with relatively limited decisions, such as selecting a text, choosing when to activate audio support, annotating a passage, or determining a narrative path. Digital storytelling extends agency by positioning students as authors, designers, narrators, editors, and reviewers.

Haring (2024) presents digital storytelling as a scaffolded post-reading response to Young Adult Literature. In this approach, students interpret the source text, relate its themes to lived experience, and transform their response into a multimodal narrative. This is more educationally demanding than summarizing the plot because learners must make decisions about perspective, content, language, images, sound, and audience.

Fina et al. (2024) provide empirical support for this approach. Their analysis of digital stories created by upper-secondary EFL learners showed that students used different remix strategies to reinterpret themes from young adult novels. Learners valued collaboration and developed critical, creative, multiliteracy, and mediation skills. At the same time, they experienced difficulties in brainstorming, research, and editing.

These difficulties are theoretically and pedagogically important. They indicate that learner agency does not mean the absence of guidance. Students may be free to make meaningful decisions while still needing structure, modeling, language support, technological assistance, deadlines, and feedback. Agency is therefore better understood as supported autonomy.

Yu and Wang (2025) similarly reported that digital storytelling could promote language learning, digital skills, and collaboration among English pre-service teachers. Their findings reinforce the multidimensional character of digital storytelling. Students do not merely learn to operate software; they negotiate meaning, organize content, select linguistic forms, and coordinate contributions with others.

Based on the synthesized evidence, the progression from digital reading to learner agency can be organized into five stages:

1. Text selection and preparation: Learners select or are introduced to age-appropriate texts, activate prior knowledge, and identify reading purposes.
2. Scaffolded interactive reading: Learners read with access to relevant glosses, audio support, signaling, and comprehension prompts.
3. Social interpretation: Learners annotate passages, compare interpretations, discuss vocabulary, and respond to peers.
4. Multimodal production: Learners write scripts, use target vocabulary, record narration, select relevant visual and audio resources, and produce original digital stories.
5. Peer review and reflection: Learners evaluate linguistic accuracy, narrative coherence, multimodal congruence, and the effectiveness of vocabulary use.

This progression links receptive input with productive output. It also prevents digital storytelling from becoming an isolated technology project by maintaining a clear connection among source-text comprehension, target vocabulary, interpretation, and multimodal production.

Pedagogical Mediation as a Condition for Effective Learning

A major finding of the review is that teacher mediation is not peripheral to digital learning; it is one of its principal mechanisms. The availability of interactive features does not guarantee that learners will use them strategically. Students may ignore useful glosses, activate every animation, rely excessively on audio narration, move rapidly through hyperlinks, or focus on visual design at the expense of language.

Pedagogical mediation includes modeling how to use digital features, establishing reading purposes, asking dialogic questions, directing attention toward target vocabulary, providing feedback, organizing collaboration, and requiring meaningful language production. These practices help transform technological interaction into cognitive and linguistic engagement.

For vocabulary acquisition, teachers can select target words before reading, model how to interpret multimodal glosses, and require learners to retrieve the words after reading. During digital storytelling, teachers can provide vocabulary banks, script templates, pronunciation feedback, and language-focused assessment criteria.

For reading comprehension, mediation can include prediction, questioning, summarizing, inference tasks, and discussion of narrative perspective. Embedded prompts can support these processes, but automated feedback should complement rather than replace teacher explanation. A system may indicate that an answer is incorrect, whereas a teacher can diagnose whether the difficulty results from vocabulary, background knowledge, inference, or misunderstanding of the question.

Collaboration also requires mediation. Group digital storytelling may create opportunities for negotiation and peer learning, but it can also produce unequal participation. Technologically confident learners may dominate editing, while other students contribute little language. Assigning roles such as scriptwriter, vocabulary monitor, narrator, visual designer, and editor can distribute responsibility more equitably.

Thus, the educational value of digital tools depends partly on what occurs around the technology. Pre-reading preparation, guided interaction, communicative tasks, peer collaboration, and reflective follow-up are not supplementary activities; they determine whether learners process digital texts deeply or superficially.

Cognitive Load and the Digital Reading Paradox

The findings also clarify the apparent contradiction between the benefits of interactive digital reading and evidence of lower comprehension from screens. Research comparing paper and screen reading has documented a small screen disadvantage in particular conditions, especially when readers encounter lengthy or informational texts, work under time pressure, scroll extensively, or inaccurately monitor their understanding (Clinton, 2019).

This does not mean that digital reading is inherently inferior. Static screen reading may reproduce the content of print without preserving all of its spatial and tactile cues or providing additional instructional support. Interactive e-books, by contrast, can add signaling, lexical assistance, audio, feedback, and navigation tools. The relevant comparison is therefore not simply "screen versus paper" but poorly designed digital presentation versus cognitively supportive digital presentation.

Shi et al. (2020) demonstrated that signaling could reduce differences between paper and on-screen reading. In their study, readers performed better when important textual information was supported by physical or verbal signals, with physical signaling such as bolding and underlining proving particularly useful for on-screen reading. This supports the argument that digital reading problems can be mitigated through appropriate design.

From the perspective of Cognitive Load Theory, the interactive environment must manage three types of demand. The complexity of unfamiliar vocabulary and narrative structure contributes to intrinsic load. Navigation problems, irrelevant animations, competing audio, and poorly positioned glosses add extraneous load. Selecting relevant information, making inferences, connecting ideas, and constructing lexical representations constitute learning-relevant cognitive processing.

Effective digital design does not attempt to eliminate all cognitive effort. Learning requires effort, but the effort should be directed toward understanding and schema construction rather than managing a confusing interface. The objective is therefore to reduce unnecessary processing while supporting productive cognitive activity.

This interpretation explains why certain features may benefit one group while hindering another. Beginning readers may benefit from audio narration and translation, whereas advanced learners may find constant audio redundant. Students with limited prior knowledge may require more explicit scaffolding, while experienced readers may prefer greater control. Digital support should consequently be adaptive or at least learner-controlled.

Integrated Pedagogical Framework

The findings were integrated into a pedagogical framework illustrating how interactive e-books and digital storytelling can jointly support young adult literacy. Unlike a technology-centered progression, the proposed framework begins with learning processes and positions technology as a form of support.

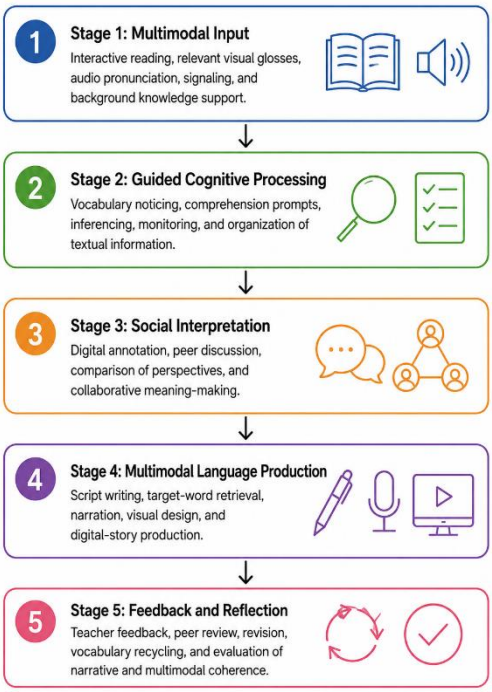

Figure 1. Integrated Framework for Interactive Digital Literacy Learning

Conditions operating across all stages:

Feature congruence, cognitive-load management, learner control, accessibility, pedagogical mediation, and alignment between learning outcomes and assessment.

The framework suggests that digital literacy learning should begin with coherent input but culminate in language use and reflection. Interactive e-books are especially valuable during the input and guided-processing stages, while digital storytelling is particularly valuable during productive and reflective stages.

This model also clarifies the complementary relationship between the two technologies. Interactive e-books provide scaffolded access to vocabulary and texts. Digital storytelling requires learners to retrieve, reorganize, and communicate what they have learned. The first supports comprehension and lexical access; the second creates conditions for productive use, creativity, and agency.

Theoretical Implications

The synthesis extends the Cognitive Theory of Multimedia Learning by emphasizing that the effectiveness of multiple representations depends not only on their presence but also on their narrative and pedagogical function. Verbal, visual, and auditory elements support learning when learners can identify their relationships and integrate them into a coherent representation.

The findings also support Cognitive Load Theory by demonstrating that interactivity may either reduce or generate extraneous processing. A relevant gloss can reduce the lexical burden of a difficult text, whereas an unrelated animation can increase attentional demands. Interactivity should therefore be conceptualized as a design property whose educational value depends on alignment with the task.

The review further suggests that cognitive theories alone cannot fully explain the benefits of digital storytelling. Learner agency, identity, collaboration, audience awareness, and social interpretation are also central. Digital storytelling is effective

partly because learners do not merely receive representations; they construct representations for communicative purposes.

Consequently, a comprehensive explanation of digital literacy learning requires the integration of cognitive processing and sociocultural participation. Learning occurs through the internal organization of verbal and visual information as well as through discussion, collaboration, authorship, and feedback.

Practical Implications

Several practical implications can be derived from the findings. First, educators should select digital platforms according to instructional relevance rather than the number of available features. Essential functions may include learner-controlled audio, concise glosses, annotation, accessible navigation, and opportunities for language production.

Second, interactive reading should be followed by tasks requiring target-word retrieval. These tasks may include oral summaries, short written responses, vocabulary journals, peer explanations, debates, or digital-story scripts.

Third, digital storytelling should be implemented as a staged instructional process. Students require support in selecting themes, developing scripts, integrating target vocabulary, recording narration, choosing media, revising language, and evaluating multimodal coherence.

Fourth, assessment should include both receptive and productive outcomes. Recognition-based vocabulary tests can identify initial learning, but oral or written production is needed to evaluate deeper mastery. Reading engagement should similarly be measured through more than enjoyment questionnaires by considering persistence, strategy use, interpretation, and learner contribution.

Fifth, teachers should explicitly address cognitive load. Students need guidance on when to use glosses, audio, hyperlinks, annotations, and other supports. Interfaces should minimize irrelevant animations and avoid presenting several competing sources of information simultaneously.

Finally, digital literacy instruction must account for differences in device access, connectivity, digital competence, language proficiency, and accessibility needs. Flexible formats and alternative participation routes are necessary to ensure that interactive learning does not create new educational inequalities.

Limitations of the Evidence

Although the synthesized evidence was generally favorable, several limitations should be acknowledged. Many studies involved relatively small samples, short interventions, or institution-specific contexts. Immediate post-tests were more common than delayed measures, limiting conclusions about long-term vocabulary retention.

The studies also employed diverse definitions and measures of reading engagement. Some equated engagement with motivation or enjoyment, whereas others examined participation, time on task, strategy use, or learner agency. These outcomes should not be treated as interchangeable.

Vocabulary assessments were similarly heterogeneous. Recognition, matching, translation, recall, sentence completion, and productive writing measure different dimensions of vocabulary knowledge. Consequently, apparently contradictory results

may reflect differences in assessment sensitivity rather than genuine differences in intervention effectiveness.

Another limitation is that positive learning outcomes were often produced by a combination of technology and teacher-designed activities. It is therefore difficult to isolate the independent effect of a platform from the effects of explicit teaching, collaborative tasks, feedback, and additional learning time.

Finally, the concentration of evidence in EFL and particular educational settings limits universal generalization. Future research should conduct longitudinal and multisite studies, compare specific interactive features, and report implementation procedures in sufficient detail to support replication.

Summary of the Discussion

Overall, the findings indicate that digital storytelling and interactive e-books can foster young adult learners' reading engagement and vocabulary acquisition, but their effectiveness is conditional rather than automatic. Interactive e-books are particularly useful for providing immediate lexical support, guiding attention, and facilitating receptive vocabulary learning. Digital storytelling complements these benefits by requiring retrieval, multimodal production, collaboration, and revision.

The strongest instructional model is therefore not passive digital consumption but a progression from scaffolded reading to social interpretation and multimodal creation. Relevant interactive features can reduce linguistic barriers and direct attention, while poorly aligned features may fragment processing and encourage superficial engagement.

Technology contributes most effectively when it is embedded in a structured pedagogical sequence, aligned with explicit literacy objectives, and supported by teacher mediation. Under these conditions, digital environments can move young adult learners beyond recognizing words and completing digital tasks toward interpreting texts, using vocabulary productively, and participating as active creators of meaning.

5. Conclusion

This systematic literature review demonstrates that digital storytelling and interactive e-books have considerable potential to enhance young adult learners' reading engagement and vocabulary acquisition. Their educational value is particularly evident when digital texts integrate relevant verbal, visual, and auditory elements that help learners recognize unfamiliar words, understand narrative content, and maintain interest during reading activities. Dynamic visual glossaries, synchronized audio narration, text highlighting, and embedded comprehension prompts can support lexical noticing, facilitate form–meaning connections, and encourage learners to monitor their own understanding. Nevertheless, the effectiveness of these features depends not simply on the availability of technology but on the extent to which the features are aligned with the linguistic and narrative objectives of the learning activity.

The findings also indicate that interactive digital reading is generally more effective in supporting receptive vocabulary knowledge than productive vocabulary mastery. Learners may become more capable of recognizing target words, recalling definitions, and understanding vocabulary in context after using interactive e-books. However, the ability to use newly learned vocabulary accurately in speaking and writing requires additional opportunities for retrieval, meaningful production,

revision, and feedback. Digital storytelling can address this limitation by encouraging learners to reuse target vocabulary in script writing, oral narration, peer discussion, and multimodal composition. Consequently, interactive e-books and digital storytelling should be understood as complementary instructional approaches. Interactive e-books provide scaffolded linguistic input, whereas digital storytelling creates opportunities for productive language use and learner-generated meaning.

Two principal conditions determine the success of these technologies. The first is feature congruence and cognitive optimization. Multimedia and interactive components must contribute directly to vocabulary learning, narrative comprehension, or reading engagement. Decorative animations, unrelated sounds, excessive hyperlinks, and unnecessary interactive hotspots may divide learners' attention and increase extraneous cognitive load. The second condition is pedagogical mediation. Technology cannot replace structured instruction, teacher guidance, dialogic interaction, peer collaboration, and communicative tasks. Learners require support in selecting relevant digital features, monitoring comprehension, navigating nonlinear texts, and transforming receptive vocabulary knowledge into productive use.

When integrated into task-based, multimodal, collaborative, and participatory learning environments, interactive e-books and digital storytelling can connect affective motivation with cognitive literacy development. These technologies can move learners beyond passive consumption by positioning them as active readers, interpreters, collaborators, and creators of digital texts. Their greatest contribution therefore lies not in technological novelty but in their capacity to support meaningful interaction with language, texts, peers, and diverse modes of communication.

The findings of this review have several implications for classroom educators. Interactive digital reading should not be used as an isolated activity or as a complete substitute for teacher-mediated language instruction. Educators are encouraged to combine interactive e-book reading with structured speaking, writing, discussion, summarization, and debate activities. Such integration can help learners transfer vocabulary knowledge from receptive recognition to productive language use. After encountering target words in digital texts, students should be provided with opportunities to retrieve and apply those words in new contexts, including oral presentations, reflective writing, collaborative discussions, and digital-story scripts.

Educators should also adopt participatory digital-authoring activities that gradually move learners from reading to interpretation and creation. Digital storytelling projects can be organized through stages involving text selection, guided reading, vocabulary identification, script development, narration, multimedia production, peer review, and reflection. This structured progression can strengthen language learning while supporting creativity, collaboration, critical literacy, and learner agency. When nonlinear stories, hypermedia texts, or branching narratives are used, teachers should provide visual story maps, graphic organizers, navigation guidelines, and progress indicators to prevent spatial disorientation and fragmented comprehension.

Software developers and digital-content designers should prioritize pedagogical relevance and cognitive accessibility in the design of interactive e-books. Multimedia elements should be included only when they clarify vocabulary, strengthen narrative understanding, guide attention, or facilitate learner interaction with the text. Decorative animations, unrelated audio effects, and non-functional hotspots should be

minimized because they may distract learners and increase unnecessary cognitive processing. Dynamic glossaries, illustrations, definitions, and pronunciation support should be positioned close to the relevant words so that learners can access assistance without losing the surrounding textual context.

Digital-learning platforms should also provide learner-controlled and adaptive support. Audio narration, visual glosses, highlighting, and feedback should be available when needed rather than imposed continuously. Automated comprehension prompts can support metacognitive monitoring, but they should be placed at meaningful narrative transitions to avoid interrupting reading flow. Digital systems should also provide accessible navigation, adjustable text and audio functions, alternative representations, and flexible forms of participation in accordance with Universal Design for Learning principles.

Future researchers should investigate the long-term influence of interactive e-books and digital storytelling on productive vocabulary retention. Many existing studies rely on immediate post-tests and recognition-based measures, making it difficult to determine whether learners can retain and independently use vocabulary after several months. Longitudinal studies should therefore incorporate delayed assessments, productive writing and speaking tasks, and repeated observations over periods ranging from six months to one year. Researchers should also distinguish clearly between receptive and productive vocabulary outcomes, as these dimensions require different cognitive processes and assessment procedures.

Further research is needed to examine which specific interactive features are most effective for learners with different proficiency levels, prior knowledge, digital competence, and accessibility requirements. Comparative studies could investigate learner-controlled and system-controlled audio, textual and multimodal glosses, linear and branching narratives, or individual and collaborative digital storytelling. Research should also document the instructional role of teachers more explicitly so that the effects of technological design can be distinguished from those of pedagogical mediation.

Institutional leaders should evaluate digital literacy platforms according to their pedagogical quality, accessibility, data security, and compatibility with learning objectives rather than their novelty or quantity of gamified features. Equal access to devices, internet connectivity, technical assistance, and accessible digital materials should be considered before implementing technology-enhanced literacy programs. Without adequate institutional support, interactive learning may increase rather than reduce educational inequalities.

Finally, teacher professional development should become an integral component of digital-literacy implementation. Secondary and tertiary educators require training in selecting cognitively appropriate digital materials, guiding dialogic reading, managing cognitive load, designing multimodal production tasks, and assessing student-generated digital stories. Professional development should address not only technical skills but also instructional planning, inclusive design, formative feedback, collaborative learning, and the assessment of receptive and productive vocabulary. Through sustained institutional support and pedagogically informed implementation, digital storytelling and interactive e-books can contribute more effectively to meaningful, equitable, and learner-centered literacy education.

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