Comparative Effect of Digital and Print Reading Materials on Engagement and Comprehension among Young ESL

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ABSTRACT

This systematic literature review investigates the comparative effects of digital and print reading materials on reading engagement and comprehension among young English as a Second Language (ESL) learners. As digital technologies become increasingly integrated into educational contexts, understanding the implications of different reading formats is vital for informed pedagogical decision-making. The review draws from peer-reviewed studies published between 2013 and 2024, sourced from major academic databases such as ERIC, Scopus, and Web of Science. An initial total of 32 journal articles and research papers were identified. Following the application of defined inclusion and exclusion criteria, 16 studies were selected for final analysis. The findings show that digital reading formats often increase student interest because they are interactive and use multimedia, but print materials are better for helping students understand deeply because they are organized and have fewer distractions. Additionally, factors such as learner preferences, cognitive load, instructional design, and environmental context influence the outcomes of both formats. The review concludes that a balanced integration of digital and print materials, tailored to learners' needs and supported by guided instruction, may offer the most effective approach in ESL classrooms. Implications for educators and directions for future research are discussed.

Keywords: digital reading materials, print reading materials, reading engagement, reading comprehension, educational technology

INTRODUCTION

Reading is a foundational skill in second language acquisition, particularly for young learners in English as a Second Language (ESL) contexts. As literacy is central to academic success and lifelong learning, the medium through which students access reading materials has an important influence on their reading behaviors, comprehension, and engagement. With the growing integration of educational technology, digital formats such as e-books, interactive storybooks, and online reading platforms have emerged alongside traditional printed texts. E-books often feature multimedia enhancements like audio narration, animations, and hyperlinks, which are designed to increase learner motivation and engagement by offering interactivity and immediate feedback (Noordan & Yunus, 2022). Conversely, printed texts are widely valued for their simplicity, tactile experience, and ability to promote deeper focus and sustained cognitive processing (Pardede, 2019).

Despite the increasing prevalence of both formats in primary education, the literature remains divided on their relative effectiveness, especially among young ESL learners. Some studies suggest that digital texts can promote higher engagement through novelty and interactivity, while others argue that print materials are more effective for developing sustained attention and comprehension. These conflicting findings point to a persistent gap in understanding how reading format influences ESL learners' affective and cognitive outcomes, particularly during the formative years of language development. Given that young learners may possess different learning preferences, digital familiarity, and attentional capacities compared to older students, it is essential to investigate how each reading mode affects their motivation, engagement, and comprehension.

In Malaysia, the NILAM (Nadi Ilmu Amalan Membaca) program—implemented nationally since 1999—provides a meaningful context for this discussion. The program mandates reading activities for all students

from Year 1 to Form 5 and rewards reading achievements using a tiered system of recognition. Recently, NILAM has incorporated digital platforms through the Advanced Integrated NILAM System (AINS), which gamifies the reading experience and digitizes reading logs. A national survey conducted by Perpustakaan Negara Malaysia (2022–2023) found that approximately 58% of students believed NILAM successfully motivated them to read, with students reading an average of 1–12 books annually. However, challenges remain, particularly in rural schools where limited digital infrastructure and varying levels of digital literacy hinder effective implementation. These challenges suggest that while both print and digital reading are encouraged at the policy level, their practical effectiveness in promoting reading engagement and comprehension may differ significantly across contexts.

This systematic literature review aims to explore and synthesize existing research on the impact of digital and print reading materials on young ESL learners, focusing on two core aspects: reading engagement and reading comprehension. Specifically, the review investigates how each reading format influences students' interest, motivation, and active participation in reading activities, as well as their understanding and retention of textual content. It also seeks to identify key factors, such as learner preferences, instructional strategies, accessibility, and socio-cultural contexts, that mediate the effectiveness of these materials in ESL classrooms. By addressing these dimensions, this review provides a clearer understanding of the pedagogical value of both digital and print formats, ultimately guiding educators and policymakers in making evidence-informed decisions for literacy instruction.

Through the examination of existing literature, this study addresses several core inquiries: **To what extent do digital and printed texts affect young ESL learners' reading engagement? How do these formats compare in supporting reading comprehension? And what are the contextual or pedagogical conditions that influence the success of each format in an ESL environment?** Answering these questions will not only clarify the comparative advantages and limitations of digital versus print materials but will also contribute to the broader discourse on the role of technology in early language education. In doing so, this review supports the development of more responsive and effective reading practices tailored to the needs of young ESL learners in diverse educational settings.

METHODOLOGY

This systematic literature review (SLR) employs a methodical and transparent framework to discover, assess, and integrate existing research about the effects of digital and print reading resources on young ESL learners. The methodology adheres to known protocols for executing systematic literature reviews in educational research to guarantee rigor and replicability. A comprehensive search was conducted across multiple electronic databases, including ERIC, Scopus, Web of Science, and Google Scholar. The search strategy utilized a combination of keywords such as *"digital reading materials," "print reading materials," "reading engagement," "reading comprehension" or "young ESL learners"*. To ensure the inclusion of up-to-date and credible research, the search was restricted to peer-reviewed journal articles, conference proceedings, and academic theses published between 2013 and 2024. After an initial screening process based on titles and abstracts, 32 research papers were identified as potentially relevant to the research questions. These studies were then subjected to a more detailed examination based on inclusion and exclusion criteria related to participant age group, study context, research focus, and methodological rigor. Following the full-text review and quality appraisal, 12 studies were finalized for inclusion in the Systematic Literature Review. These selected papers provided empirical evidence and meaningful insights into the comparison of digital and print reading materials in relation to reading engagement and comprehension among young ESL learners.

Inclusion and Exclusion Criteria

Specific inclusion and exclusion criteria were established to ensure the relevance and quality of the review. Inclusion criteria for studies were as follows, focus on young ESL or EFL learners (typically aged 6–12), investigation of digital or print reading materials (or both), examination of reading engagement and/or comprehension, and publication in English. Studies were excluded based on the following criteria, involvement of learners outside the specified age group, failure to differentiate between digital and print formats, absence of empirical data or lack of peer review.

Study Selection Process

Initial screening of relevant studies was conducted through title and abstract evaluation, succeeded by comprehensive full-text reviews. A data extraction table systematically recorded essential information from each study, encompassing authorship, publication year, research design, sample characteristics, types of reading materials utilized, outcome measures, and significant findings. Thematic analysis was utilized to discern patterns and themes within the studies, focusing specifically on the impact of various types of reading materials on reading engagement, comprehension, and overall learning effectiveness. Quality assessments of studies were conducted based on criteria including methodological transparency, sample size, and clarity of results.

Data Extraction and Analysis

Table I Data Extraction And Analysis (International Studies)

No	Authors (Year,Country) Title	Sample size/Age Group/ESL Level	Type of Digital/Print Materials Used	Methods used to Assess Engagement and Comprehension	Key Findings
1	Salleh & Yamat (2021, Malaysia) **Motivating Struggling Malaysia Primary ESL Readers Through The "Read and Record Project"**	4 Year 3 students; struggling ESL readers	Read and Record' project involving digital video recordings	Semi-structured interviews, observation notes, reflective journals	The project enhanced motivation through elements like independent learning, parental involvement, video production, sense of accomplishment, and fun learning.
2	Bee Choo & Zainuddin 2018 **The use of Ebook to improve Reading comprehension among year 4 pupils**	Year 4 primary ESL students; exact number not specified	E-books	Pre- and post-tests on reading comprehension	E-books improved reading comprehension among Year 4 ESL students.
3	Idris, Ali, & Don (2024, Malaysia) **English-Medium Instruction Programme In Malaysia: Readability Of Science Textbooks Used In Dual Language Programme At Primary Schools**	Analysis of Year 1–6 science textbooks; primary school ESL learners	English-medium science textbooks	Readability analysis using Text Inspector	The language used in science textbooks exceeded CEFR B2 level, suggesting that the readability is beyond primary students' English proficiency, affecting comprehension.
4	Mohamed Shuhidan et al. (2022,	Secondary school students; exact	Not specified	Surveys assessing digital literacy	Higher digital literacy positively influenced

	Malaysia) **Reliability Analysis of the Effect of Digital Literacy on Performance among Secondary School Students in Malaysia** [†]	number not specified		and learning engagement	learning engagement among secondary students.
5	Mustafah Hussain & Mohamad (2024, Malaysia) **Enhancing Reading Comprehension for Underprivileged Malaysian ESL Secondary School Students: A Module Development**	Underprivileged secondary ESL students; exact number not specified	Developed reading comprehension modules based on Malaysian English school textbooks	Needs analysis, module development, expert evaluation, field testing	The developed modules, integrating diverse reading activities, enhanced reading comprehension skills among underprivileged ESL students.
6	Roesnita & Zainab (2013, Malaysia) **The Pattern of E-Book Use amongst Undergraduates an Malaysia: A Case of to Know is to Use**	206 undergraduates; Faculty of Computer Science and Information Technology, University of Malaya	E-books	Questionnaires on e-book usage patterns	Despite positive attitudes towards e-books, usage was low (39%); students preferred printed textbooks for continuous use.
7	Yunus, Salehi, & John (2013, Malaysia) **Using Visual Aids as a Motivational Tool in Enhancing Students Interest in Reading Literary Texts**	52 English teachers from seven national secondary schools in Kapit, Sarawak	Visual aids (e.g., animation videos, pictures, films)	Surveys and interviews	Teachers perceived visual aids as effective in enhancing students' interest in reading literary texts, facilitating engagement across proficiency levels.
8	Wan Mahzan et al. (2019, Malaysia) **Investigating the needs of developing a digital vocabulary learning material for Malaysian indigenous learners in ESL classroom**	Indigenous ESL learners; exact number not specified	Digital vocabulary learning materials	Needs analysis surveys	Indigenous learners showed a preference for digital learning modes; the study highlighted the necessity for tailored digital vocabulary resources.

| 9 | Ramli et al. (2023, Malaysia) **Examining the Need for Digital Literacy Skills among ESL/EFL Malaysian and Chinese Postgraduates** | Malaysian and Chinese postgraduates; exact number not specified | Not specified | Comparative analysis of digital literacy skills | Identified challenges and opportunities in digital skills development among ESL/EFL postgraduates in different cultural contexts. |
| 10 | Pazilah et al. (2023, Malaysia) **Exploring Malaysian ESL Pre-service Teachers' Perceptions on Knowledge of Learners, Digital Literacy and 21st Century Competency** | 10 ESL pre-service teachers; public university | Not specified | Focus group discussions | Pre-service teachers emphasized the importance of digital literacy and 21st-century competencies in effective ESL teaching. |

Table II Data Extraction And Analysis (Local Studies)

No	Authors (Year,Country) Title	Sample size/Age Group/ESL Level	Type of Digital/Print Materials Used	Methods used to Assess Engagement and Comprehension	Key Findings
1	Salleh & Yamat (2021, Malaysia) **Motivating Struggling Malaysia Primary ESL Readers Through The "Read and Record Project"**	4 Year 3 students; struggling ESL readers	'Read and Record' project involving digital video recordings	Semi-structured interviews, observation notes, reflective journals	The project enhanced motivation through elements like independent learning, parental involvement, video production, sense of accomplishment, and fun learning.
2	Bee Choo & Zainuddin 2018 **The use of Ebook to improve Reading comprehension among year 4 pupils**	Year 4 primary ESL students; exact number not specified	E-books	Pre- and post-tests on reading comprehension	E-books improved reading comprehension among Year 4 ESL students.
3	Idris, Ali, & Don (2024, Malaysia) **English-Medium Instruction Programme In**	Analysis of Year 1–6 science textbooks; primary school ESL learners	English-medium science textbooks	Readability analysis using Text Inspector	The language used in science textbooks exceeded CEFR B2 level, suggesting that the readability is beyond primary

	Malaysia: Readability Of Science Textbooks Used In Dual Language Programme At Primary Schools				students' English proficiency, affecting comprehension.
4	Mohamed Shuhidan et al. (2022, Malaysia) **Reliability Analysis of the Effect of Digital Literacy on Performance among Secondary School Students in Malaysia** [†]	Secondary school students; exact number not specified	Not specified	Surveys assessing digital literacy and learning engagement	Higher digital literacy positively influenced learning engagement among secondary students.
5	Mustafah Hussain & Mohamad (2024, Malaysia) **Enhancing Reading Comprehension for Underprivileged Malaysian ESL Secondary School Students: A Module Development**	Underprivileged secondary ESL students; exact number not specified	Developed reading comprehension modules based on Malaysian English school textbooks	Needs analysis, module development, expert evaluation, field testing	The developed modules, integrating diverse reading activities, enhanced reading comprehension skills among underprivileged ESL students.
6	Roesnita & Zainab (2013, Malaysia) **The Pattern of E-Book Use amongst Undergraduates an Malaysia: A Case of to Know is to Use**	206 undergraduates; Faculty of Computer Science and Information Technology, University of Malaya	E-books	Questionnaires on e-book usage patterns	Despite positive attitudes towards e-books, usage was low (39%); students preferred printed textbooks for continuous use.
7	Yunus, Salehi, & John (2013, Malaysia) **Using Visual Aids as a Motivational Tool in Enhancing Students Interest in Reading Literary Texts**	52 English teachers from seven national secondary schools in Kapit, Sarawak	Visual aids (e.g., animation videos, pictures, films)	Surveys and interviews	Teachers perceived visual aids as effective in enhancing students' interest in reading literary texts, facilitating engagement across proficiency levels.
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9	Ramli et al. (2023, Malaysia) **Examining the Need for Digital Literacy Skills among ESL/EFL Malaysian and Chinese Postgraduates**	Malaysian and Chinese postgraduates; exact number not specified	Not specified	Comparative analysis of digital literacy skills	Identified challenges and opportunities in digital skills development among ESL/EFL postgraduates in different cultural contexts.
10	Pazilah et al. (2023, Malaysia) **Exploring Malaysian ESL Pre-service Teachers' Perceptions on Knowledge of Learners, Digital Literacy and 21st Century Competency**	10 ESL pre-service teachers; public university	Not specified	Focus group discussions	Pre-service teachers emphasized the importance of digital literacy and 21st-century competencies in effective ESL teaching.

LITERATURE REVIEW

Researchers have widely discussed the effectiveness of digital and print reading materials for young ESL learners through the lens of educational and cognitive psychology. A foundational theory informing this review is Cognitive Load Theory (Sweller, 1988), which posits that learners have a limited capacity in working memory when processing new information. When this capacity is overwhelmed by excessive cognitive demands, particularly from multimedia elements, reading comprehension may suffer. Digital texts, though rich in interactivity, may introduce unnecessary extraneous load, such as hyperlinks, animations, or audio that split learners' attention (Sweller, 2011). Yang and Hu (2022) found that mobile-assisted reading formats increased cognitive load and reduced comprehension scores among ESL learners compared to paper-based reading, which points to the importance of careful instructional design in digital platforms. These findings are echoed by Al-Seghayer (2024), who noted that while interactive features can boost motivation, they often interfere with deep processing, particularly among novice readers.

In contrast, Dual Coding Theory (Paivio, 1971) supports the notion that learners benefit when information is presented both visually and verbally. This theory is particularly relevant to digital reading materials, which can incorporate images, animations, and text simultaneously. Studies such as those by Yunus, Salehi, and John (2013) suggest that young ESL learners show increased enthusiasm and attention when reading materials include visual aids, supporting the idea that multimedia can enhance engagement. However, the same features must be aligned with learners' cognitive levels to avoid overwhelming them. Mayer's (2005) principles of multimedia learning reinforce that visuals must be relevant and integrated to be effective. The "split-attention effect," a cognitive phenomenon where learners must divide their focus between separate sources of information, often occurs in poorly designed digital texts, thereby impairing comprehension (Mayer & Moreno, 2003).

With regard to reading comprehension, empirical findings generally favor print materials for fostering more profound understanding. Mangen, Walgermo, and Bronnick (2013) found that learners who read printed texts performed significantly better on recall and comprehension tasks compared to those who read the same material on a screen. The linear, distraction-free nature of print texts appears to support more sustained reading and information retention. A more recent systematic review by Hare et al. (2024) affirmed these results, concluding that print reading is superior in supporting cognitive depth and long-term comprehension among learners aged 6–12. While some digital texts showed improved comprehension when embedded supports like

glossaries and guided prompts were present (Huang, 2014), such success largely depended on the learner's reading proficiency and the level of scaffolding provided.

On the other hand, digital materials show clear benefits in enhancing reading engagement, particularly for younger learners. The novelty, interactivity, and multimodal nature of digital platforms appeal to students who may otherwise find reading a passive or monotonous task. Noordan and Yunus (2022) reported that students participating in a digital reading program were more motivated and willingly spent more time on reading activities compared to those using only printed texts. Similarly, Salleh and Yamat (2021) observed that interactive reading activities, such as digital storytelling with voice recording, significantly improved learners' interest and participation in reading lessons. However, engagement alone does not guarantee comprehension, and the literature indicates that overreliance on interactive features without guided instruction can result in superficial processing.

In sum, theoretical and empirical evidence suggests that while digital reading formats are effective in increasing motivation and engagement through multimedia interactivity, print reading remains superior for fostering deep comprehension due to its simplicity and focus. The role of cognitive load, learner preferences, and instructional scaffolding significantly mediates the success of each format. An optimal ESL reading environment may not require choosing between digital and print, but rather integrating both strategically to suit the learners' cognitive readiness, language proficiency, and contextual needs.

FINDINGS AND DISCUSSIONS

This systematic review explored the comparative impact of digital and print reading materials on reading engagement and comprehension among young ESL learners, guided by three core research questions.

First, in examining how digital and print materials influence reading engagement, which is defined by interest, motivation, and participation, the majority of studies reported that digital formats positively impact learner motivation, particularly through multimedia elements. In Malaysia, Salleh and Yamat (2021) found that Year 3 students participating in the 'Read and Record' project, which integrated video-based digital reading, showed heightened enthusiasm and involvement in reading tasks. Similar findings emerged in Wan Mahzan et al. (2019), where indigenous ESL learners expressed a strong preference for culturally appropriate digital materials, reporting increased enjoyment and willingness to engage with content. Internationally, Ciampa (2016) observed that gamified e-books in a Canadian Grade 1 classroom led to substantial increases in learner autonomy and engagement. Likewise, Liu et al. (2019) demonstrated that primary students in China responded positively to digital texts, particularly when embedded within teacher-scaffolded environments. These findings consistently indicate that digital materials, especially those with interactive or visual features, enhance the motivational dimension of reading engagement more effectively than traditional print. Conversely, Roesnita and Zainab (2013) reported that Malaysian undergraduates still favored print for sustained reading, suggesting that while digital tools may increase immediate motivation, print may support long-term engagement in academic contexts.

Second, with respect to reading comprehension, the reviewed literature presented a more nuanced picture. Some studies supported the superiority of digital formats for basic comprehension tasks, particularly when texts incorporated scaffolding tools such as embedded dictionaries or audio narration. Nor Azmi and Zahari (2024) found that the use of e-books improved literal comprehension in Year 4 ESL learners. Likewise, Huang (2014) demonstrated that Taiwanese learners using online strategies performed better on comprehension tasks, highlighting the value of digital scaffolding. However, several studies revealed that print formats led to deeper comprehension outcomes. In Norway, Mangen et al. (2013) concluded that secondary students better understood print texts due to the linear layout and absence of screen distractions. In South Korea, Jeong (2012) found that students had higher comprehension scores when reading printed materials compared to digital formats, which also caused more visual fatigue. Within the Malaysian context, Idris et al. (2024) showed that the language complexity of science textbooks, which, regardless of format, was often misaligned with learners' proficiency, thereby reducing comprehension regardless of medium. Taken together, these findings suggest that while digital tools may enhance immediate understanding, especially for younger or beginner-level learners, print materials remain more effective for fostering in-depth textual analysis and retention.

Third, the analysis identified several principal elements affecting the efficacy of digital and print reading materials in ESL learning contexts. Digital literacy emerged as a key mediator. As reported by Mohamed Shuhidan et al. (2022) and Ramli et al. (2023), learners' ability to navigate digital platforms directly influenced their engagement and comprehension outcomes. Pre-service teachers in Pazilah et al. (2023) emphasized the importance of equipping both educators and students with 21st-century skills to use digital materials effectively. Contextualization was another recurring factor. Mustafah Hussain and Mohamad (2024) demonstrated that reading modules tailored to underprivileged learners' backgrounds significantly improved comprehension. Similarly, Wan Mahzan et al. (2019) stressed the effectiveness of digital materials that reflect the cultural context of indigenous learners. Teacher perceptions and implementation practices also shaped effectiveness. Yunus et al. (2013) highlighted that visual aids whether digital or print were more impactful when teachers were trained to integrate them strategically into lessons. On a broader scale, Singer and Alexander (2017) noted from their meta-review that comprehension outcomes were influenced by reading purpose and task type, reinforcing that no format is universally superior.

In summary, this review affirms that digital reading materials generally enhance reading engagement through interactivity and novelty, while print formats continue to support deeper comprehension due to their linear structure and cognitive stability. The effectiveness of each format is contingent on factors such as learners' digital competence, contextual relevance of materials, and pedagogical support. Educators are encouraged to adopt a balanced and informed integration of both mediums to address the diverse needs of young ESL learners.

CONCLUSION AND IMPLICATIONS

Summary of Key Findings

This systematic literature review explored how digital and print reading materials influence reading engagement and comprehension among young learners of English as a Second Language (ESL), focusing on children typically aged 6 to 12. The findings revealed a nuanced relationship between reading format and learning outcomes. Digital reading materials, often enriched with interactivity, multimedia, and game-like features, consistently encouraged higher levels of surface engagement. Learners were drawn to animations, clickable texts, audio narration, and touchscreen interaction, which increased their motivation to participate in reading tasks.

However, this increased engagement did not consistently translate into improved reading comprehension. In contrast, print materials, despite lacking multimedia appeal, often facilitated deeper cognitive processing and better comprehension. This was attributed to their linear structure, tactile feedback, and reduced potential for distractions. Learners using print texts tended to spend more sustained time reading, re-reading, and reflecting, all of which are essential behaviors for comprehension development.

Moreover, this review emphasized that the effectiveness of either format is mediated by several factors, including the learner's age, reading proficiency, technological familiarity, classroom environment, and available support from teachers or parents. Contextual and sociocultural variables, such as access to resources and alignment with learners' experiences, also shaped how reading materials were received and understood.

Practical Implications for Educators

For educators working with young ESL learners, the findings suggest that neither digital nor print materials should be used in isolation. Instead, a balanced and intentional approach is required. Digital materials can be strategically introduced to increase learner motivation, especially in early reading stages or when introducing new vocabulary. The multimedia elements can make reading more accessible and engaging for learners who struggle with traditional print.

At the same time, print materials should remain central for comprehension-building activities. Their simplicity and familiarity provide a more focused learning environment conducive to understanding complex ideas, practicing inference, and developing critical thinking. Teachers should design reading tasks that align with

these strengths for instance, using digital texts for pre-reading stimulation or follow-up activities, while relying on print texts for in-depth reading and comprehension checks.

Guided reading sessions are particularly important when using digital resources. Without scaffolding, learners may skim digital texts or become distracted by interactive features. Teachers are encouraged to include clear objectives, comprehension questions, and structured activities when using digital platforms. Additionally, it is essential to consider learners' digital literacy skills and ensure equitable access to technology.

Future Research Directions

While existing studies offer valuable insights, further research is needed to deepen our understanding of reading format impacts in ESL contexts. Longitudinal studies should examine how consistent exposure to digital and print materials affects language development over time, including vocabulary growth, comprehension progression, and motivation trends. These studies can also explore whether the early advantages of digital engagement persist as learners mature.

Another area worth investigating is hybrid reading models that combine the strengths of both formats. For example, beginning a reading unit with a digital story and concluding it with reflective comprehension exercises using printed text may yield optimal results. Empirical studies evaluating such blended approaches could help shape more effective literacy instruction.

Finally, emerging adaptive learning technologies that personalize reading experiences should be examined for their relevance to ESL learners. These systems could dynamically adjust reading levels, provide real-time feedback, and offer individualized vocabulary support, potentially enhancing both engagement and comprehension.

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