

Cognitive Attention Among Generation Alpha: A Psycholinguistic Study Based on Mayer's Cognitive Theory of Multimedia Learning

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ABSTRACT

Generation Alpha has grown up in a digital environment where screen-based devices play a central role in early literacy development. This study investigates how screen-based reading influences children's cognitive attention and language processing based on Mayer's Cognitive Theory of Multimedia Learning. A descriptive quantitative approach supported by qualitative observations was employed. Data were collected through classroom observations and semi-structured interviews with 15 kindergarten students at TK Kartika IX-18, East Jakarta, after they viewed a short digital animated story. The findings reveal that although children showed positive emotional engagement with digital media, printed books remained the preferred medium for reading comprehension and story recall. Interactive multimedia elements, such as animations and navigation features, increased extraneous cognitive load by dividing attention between visual stimuli and linguistic processing, resulting in more superficial reading and weaker narrative comprehension. The findings partially support Mayer's multimedia learning principles and suggest that children's responses to digital reading are also shaped by learning environments, cultural contexts, and prior digital exposure. This study highlights the importance of designing child-friendly digital reading materials that minimize cognitive overload and promote meaningful language processing in early childhood education.

Keywords: *Generation Alpha, screen-based reading, cognitive attention, psycholinguistics, multimedia learning, early childhood education.*

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1. Introduction

The rapid advancement of digital technology has fundamentally transformed literacy practices, shifting reading activities from traditional printed materials to screen-based media. Reading is no longer confined to books and printed texts but increasingly occurs through smartphones, tablets, computers, and other digital devices. This transformation has altered not only how information is accessed but also how readers process, interpret, and retain textual information (Amaliah, 2026). As digital environments become the dominant medium for learning and communication, understanding their cognitive implications has become an increasingly important concern in educational and psycholinguistic research.

Among contemporary generations, **Generation Alpha**—children born from 2010 onward—represents the first cohort to grow up entirely within a digitally connected environment. Unlike previous generations, who gradually adapted to digital technologies, Generation Alpha has been exposed to touchscreen devices, multimedia applications, and internet-based communication since early childhood. Consequently, their literacy experiences differ substantially from those of earlier generations, particularly in terms of reading behavior, attention patterns, and language acquisition. Their interaction with written language occurs predominantly through digital interfaces, raising important questions regarding how continuous exposure to screen-based reading influences cognitive development and language processing.

From a psycholinguistic perspective, reading is a highly complex cognitive activity involving the interaction of visual perception, attention, working memory, linguistic decoding, semantic integration, and comprehension processes (Steinberg, 2013). Successful reading requires readers to allocate cognitive resources efficiently while simultaneously constructing meaning from written symbols. Research has shown that printed texts generally encourage **deep reading**, characterized by sustained attention, critical reflection, inference making, and semantic integration. In contrast, digital reading environments tend to be nonlinear, multimodal, and interactive, often containing hyperlinks, animations, notifications, and multimedia elements that may interrupt sustained cognitive engagement. Such environments frequently promote **hyperreading**, skimming, or fragmented reading behaviors that potentially increase cognitive load and reduce comprehension (Wolf, 2018).

These differences become particularly significant during early childhood, when cognitive and linguistic systems are still developing. According to the **Cognitive Theory of Multimedia Learning (CTML)** proposed by Mayer (2021), learning occurs most effectively when verbal and visual information are integrated without exceeding learners' limited cognitive capacity. Although multimedia can facilitate learning, excessive visual stimulation and irrelevant information may produce **extraneous cognitive load**, reducing attention and limiting comprehension. This theoretical perspective is particularly relevant for understanding how Generation Alpha processes digital texts because young

learners must simultaneously manage visual information, verbal content, and interactive digital features while constructing linguistic meaning.

Recent studies have investigated digital reading behaviors among children and adolescents, demonstrating both the educational potential and cognitive challenges of screen-based literacy. For example, Raharja (2025) reported that digital reading environments influence students' reading engagement and learning experiences. Similarly, Mustafaoğlu et al. (2018) highlighted the relationship between prolonged screen exposure and children's cognitive and developmental outcomes. Nevertheless, much of the existing literature has focused on adolescents, university students, or Generation Z, while relatively limited attention has been given to **Generation Alpha during the early stages of literacy development**. Moreover, previous studies have generally examined digital reading from educational or technological perspectives, with fewer investigations integrating **psycholinguistic processes, cognitive attention**, and **Mayer's Cognitive Theory of Multimedia Learning** into a unified analytical framework. This represents an important research gap, considering that early literacy experiences strongly influence subsequent language development and academic achievement.

Addressing this gap, the present study investigates how screen-based reading influences the cognitive attention of Generation Alpha from a psycholinguistic perspective. Specifically, the study examines whether verbal–visual interactions presented on digital screens facilitate or hinder children's language processing when interpreted through Mayer's Cognitive Theory of Multimedia Learning. The research focuses on kindergarten students aged six to seven years at **TK Kartika IX-18, East Jakarta**, who represent Generation Alpha during a critical period of language and literacy development. By combining psycholinguistic perspectives with multimedia learning theory, this study seeks to contribute to a deeper understanding of children's digital reading behavior and provide practical implications for designing digital literacy environments that support cognitive development and effective language learning in the digital era.

2. Literature Review

2.1 Psycholinguistic Perspectives on Reading Development

Reading is widely recognized as a complex psycholinguistic process that extends beyond the mechanical decoding of written symbols. Rather, it involves the integration of visual perception, language comprehension, working memory, attention, and semantic processing that enables readers to construct meaning from written texts (Steinberg & Sciarini, 2013; Rahman & Amir, 2019; Tammassé et al., 2022). From this perspective, learning to read does not require children to acquire a new language system; instead, reading represents a transition from processing spoken language through auditory input to processing written language through visual input. Consequently, children's reading comprehension is fundamentally constrained by the level of their oral language competence (Lanta et al., 2022; Suma et al., 2026; Sujoko et al., 2023).

Steinberg and Sciarini (2013) propose the **Meaning-Based Approach to Reading Acquisition**, arguing that semantic understanding precedes phonological decoding during early literacy development. According to this view, children naturally establish stronger associations between written words and their meanings than between written symbols and isolated phonetic sounds. Therefore, effective reading instruction should prioritize meaningful language experiences rather than emphasizing abstract letter recognition at the earliest stages of literacy. This perspective challenges traditional phonics-centered approaches by suggesting that reading develops most successfully when children interact with meaningful linguistic contexts.

Recent evidence further supports this argument by demonstrating that early reading readiness depends less on chronological age than on children's cognitive maturity and exposure to rich language environments (Angulo-Chavira et al., 2025). Children who experience meaningful interactions with spoken and written language tend to develop stronger literacy skills because they establish semantic representations before formal decoding instruction begins. These findings reinforce the psycholinguistic assumption that reading is fundamentally a process of meaning construction rather than symbol recognition alone.

From this perspective, digital reading environments introduce new psycholinguistic challenges. Unlike printed texts, digital interfaces require children to divide their attention between linguistic processing and interactive visual elements. As a result, understanding how children allocate cognitive resources during digital reading has become an important issue in contemporary psycholinguistic research.

2.2 Cognitive Load and Multimedia Learning in Digital Reading

The transition from printed texts to digital media has fundamentally changed how children process written information. While digital platforms provide rich multimedia experiences, they also increase cognitive demands by requiring readers to process multiple visual, verbal, and interactive stimuli simultaneously. This phenomenon is best explained through **Cognitive Load Theory (CLT)** proposed by Sweller (2020).

According to Sweller, working memory possesses a limited processing capacity that must accommodate three types of cognitive load: **intrinsic load**, which arises from the inherent complexity of learning materials; **germane load**, which supports schema construction and meaningful learning; and **extraneous load**, which originates from ineffective instructional design. Among these, extraneous cognitive load is particularly relevant to digital reading because unnecessary interface elements may consume cognitive resources without contributing to comprehension.

Digital reading environments often contain hyperlinks, animations, notifications, advertisements, and interactive buttons that require continuous decision-making (Tenrisanna et al., 2024; Suheri et al., 2025; Andini et al., 2026). Every encounter with these elements forces readers to engage in **micro-decision making**, such as deciding whether to click a hyperlink or ignore a notification. Although each decision appears

trivial, the accumulation of these decisions increases extraneous cognitive load and reduces the cognitive resources available for text comprehension.

Complementing Sweller's theory, **Dual Coding Theory** proposed by Paivio (2014) explains that information is processed through two independent cognitive systems: the verbal channel and the visual channel. Learning becomes more effective when these channels complement one another rather than compete for limited working-memory capacity. This theoretical perspective provides an important foundation for understanding why appropriately designed multimedia materials can facilitate learning while poorly designed multimedia environments may overload children's cognitive systems.

Building upon these ideas, Mayer (2021) developed the **Cognitive Theory of Multimedia Learning (CTML)**, which proposes that meaningful learning occurs when learners actively select, organize, and integrate verbal and visual information within the limits of working memory. Mayer identifies several multimedia principles that are particularly relevant to digital reading. The **coherence principle** recommends removing irrelevant multimedia elements that distract learners. The **spatial contiguity principle** suggests that related text and images should be presented together to minimize split attention. The **redundancy principle** discourages presenting identical information simultaneously through multiple visual formats, while the **signaling principle** emphasizes guiding learners' attention toward essential information. Finally, the **segmenting principle** advocates presenting information in manageable units that learners can process at their own pace.

Collectively, these theories explain why digital reading environments may either enhance or hinder children's comprehension depending on how multimedia elements are designed. Well-designed interfaces can facilitate cognitive processing, whereas excessive visual stimulation may overload working memory and reduce reading comprehension.

2.3 Cognitive Attention in Generation Alpha's Digital Reading

Generation Alpha represents the first generation born into a fully digital environment, where screen-based interaction constitutes an integral part of daily life. Unlike previous generations, these children encounter written language primarily through smartphones, tablets, and other touchscreen devices from early childhood. Consequently, their reading experiences differ substantially from traditional print-based literacy, creating new challenges for psycholinguistic research.

Reading comprehension requires sustained cognitive attention that enables readers to decode linguistic forms, integrate semantic information, monitor comprehension, and generate inferences. In printed books, physical affordances such as page turning, linear text organization, and stable layouts generally facilitate sustained attention and deep reading. By contrast, digital environments often encourage **hyperreading**, characterized by skimming, scanning, multitasking, and fragmented

attention (Wolf, 2018). Such reading behaviors may reduce opportunities for deep semantic processing and long-term memory consolidation.

Recent studies indicate that prolonged screen exposure influences children's attention regulation, executive functioning, and reading performance (Mustafaoğlu et al., 2018). Similarly, Raharja (2025) reported that digital reading environments affect students' engagement and learning experiences, although the effects vary depending on interface design and instructional context. Nevertheless, empirical evidence specifically examining **Generation Alpha** from an integrated **psycholinguistic and multimedia learning perspective** remains limited.

This study therefore adopts Steinberg's Meaning-Based Reading Theory, Sweller's Cognitive Load Theory, Paivio's Dual Coding Theory, and Mayer's Cognitive Theory of Multimedia Learning as complementary theoretical foundations. Together, these frameworks explain how children's linguistic comprehension, working memory, visual-verbal processing, and cognitive attention interact during digital reading. Integrating these perspectives provides a comprehensive framework for investigating whether screen-based reading supports or hinders language processing among Generation Alpha in early childhood education.

3. Method

3.1 Research Design

This study employed a **qualitative descriptive case study** to investigate how screen-based reading influences the cognitive attention and language processing of Generation Alpha from a psycholinguistic perspective. A case study design was considered appropriate because it enables an in-depth exploration of children's authentic reading experiences within their natural learning environment. Although the primary approach was qualitative, simple descriptive quantitative analysis was incorporated to summarize the frequency of students' responses and observable reading behaviors.

3.2 Participants and Research Setting

The study was conducted at **TK Kartika IX-18, East Jakarta, Indonesia**. The participants consisted of kindergarten students aged **6–7 years**, representing **Generation Alpha**, who are routinely exposed to digital devices in their daily learning activities. A total of **XX students** participated in the study. Classroom teachers and parents were also involved as facilitators during data collection to ensure that children understood the research activities and responded comfortably during the interview sessions.

Participants were selected using **purposive sampling**, with the inclusion criteria that they (1) belonged to Generation Alpha, (2) were enrolled as kindergarten students, and (3) had previous experience using smartphones, tablets, or other digital devices for learning or entertainment.

3.3 Data Collection

Data were collected through **classroom observation**, **semi-structured interviews**, and **simple descriptive questionnaires** following students' exposure to a short Indonesian animated folktale presented on a digital screen. The animated story was selected because it integrates visual, verbal, and auditory information, making it suitable for examining children's cognitive processing based on **Cognitive Load Theory** and **Mayer's Cognitive Theory of Multimedia Learning**.

Following the viewing session, each child participated in an individual interview using age-appropriate questions designed to explore their reading comprehension, cognitive attention, and language processing. The interview protocol focused on four main aspects:

1. children's recognition of spoken and written words through audiovisual stimuli;
2. the influence of visual elements such as colors, animations, and interactive buttons on attention;
3. children's ability to reconstruct the sequence of events presented in the story; and
4. children's comprehension of the main ideas after interacting with screen-based reading materials.

Throughout the activity, observational field notes were also recorded to document students' reading behaviors, attention shifts, responses to multimedia elements, and interactions with the digital learning environment.

3.4 Data Analysis

Qualitative data were analyzed using the interactive model proposed by **Miles, Huberman, and Saldaña (2019)**, consisting of **data condensation**, **data display**, and **conclusion drawing/verification**.

During the **data condensation** stage, interview transcripts and observation notes were transcribed, coded, and organized according to recurring themes related to cognitive attention, multimedia interaction, and language processing. Irrelevant information was removed to focus on the research objectives.

The **data display** stage involved organizing the coded data into descriptive narratives, thematic matrices, and representative quotations that illustrated children's cognitive responses during digital reading activities.

Finally, **conclusion drawing and verification** were conducted by interpreting the emerging themes through the theoretical perspectives of **Steinberg's Meaning-Based Reading Theory**, **Sweller's Cognitive Load Theory**, **Paivio's Dual Coding**

Theory, and **Mayer's Cognitive Theory of Multimedia Learning**. These theories were used to explain how multimedia elements influenced children's attention allocation, working memory, and comprehension during screen-based reading.

To complement the qualitative findings, descriptive quantitative analysis was performed by calculating the frequency and percentage of students' responses to selected interview questions. The quantitative summaries were not intended for statistical inference but rather to support the qualitative interpretation and provide a clearer overview of observed behavioral patterns.

4. Results and Discussion

A simple descriptive quantitative approach was employed to systematically describe the observed phenomena using basic descriptive statistics, such as frequencies and percentages, without testing hypotheses or examining causal relationships among variables (Sugiyono, 2019).

This section presents the quantitative summary of qualitative data collected through interviews with kindergarten students regarding their digital reading habits, extraneous cognitive load, navigation decision-making during digital reading, reading comprehension, and their perceptions of innovative digital learning media design. The qualitative responses obtained from **15 participants** were categorized and quantified to facilitate data interpretation.

4.1 Quantitative Results for Each Interview Question

4.1.1. Initial Condition: Reading Habits

Table 1. Preferred Reading Medium at Home

Response Category	Frequency	Percentage
Printed books	7	47%
Smartphone/Tablet/Laptop	6	40%
Both printed and digital media	2	13%
Total	15	100%

Table 2. Daily Time Spent Using Smartphones or Tablets

Response Category	Frequency	Percentage
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Before going to school	2	13%
After returning from school	11	73%
Before bedtime	2	13%
Total	15	100%

4.1.2. Extraneous Cognitive Load

Table 3. Children's Emotional Responses While Reading Animated Stories on Smartphones or Tablets

Response Category	Frequency	Percentage
Happy	9	60%
Neutral	6	40%
Bored/Unhappy	0	0%
Total	15	100%

Table 4. Indicators of Cognitive Fatigue During Digital Reading

Response Category	Frequency	Percentage
Wanted to switch immediately to a game before the story ended	4	27%
Preferred listening to the story until the end but was tempted to press other buttons	5	33%
Preferred holding and reading a printed storybook rather than reading on a smartphone or tablet	6	40%
Total	15	100%

4.1.3. Navigation Decision-Making During Digital Reading

Table 5. Preferred Reading Strategy

Response Category	Frequency	Percentage
Read or watched the story from beginning to end (linear reading)	12	80%
Finished one story and then switched to another episode	2	13%
Both approaches	1	7%
Total	15	100%

4.1.4. Reading Comprehension

Table 6. Medium That Made the Story Easier to Retell

Response Category	Frequency	Percentage
Printed book	10	67%
Smartphone/Tablet	5	33%
Total	15	100%

Table 7. Frequency of Rereading Before Retelling the Story

Response Category	Frequency	Percentage
Once	11	73%
Twice	3	20%
Never retold the story to friends	1	7%
Total	15	100%

4.1.5. Perceptions of Digital Learning Media Design

Table 8. Children's Evaluation of the Text Display in the Digital Story

Response Category	Frequency	Percentage
The text was appropriate and required no modification	10	67%
The text should be improved	5	33%
Total	15	100%

4.2 Data Visualization

The following bar chart presents a visual summary of the students' responses across the eight question categories discussed above. The chart illustrates the frequency distribution for each response category, providing a clearer overview of students' digital reading habits, cognitive load, navigation behavior, reading comprehension, and perceptions of digital learning media design.

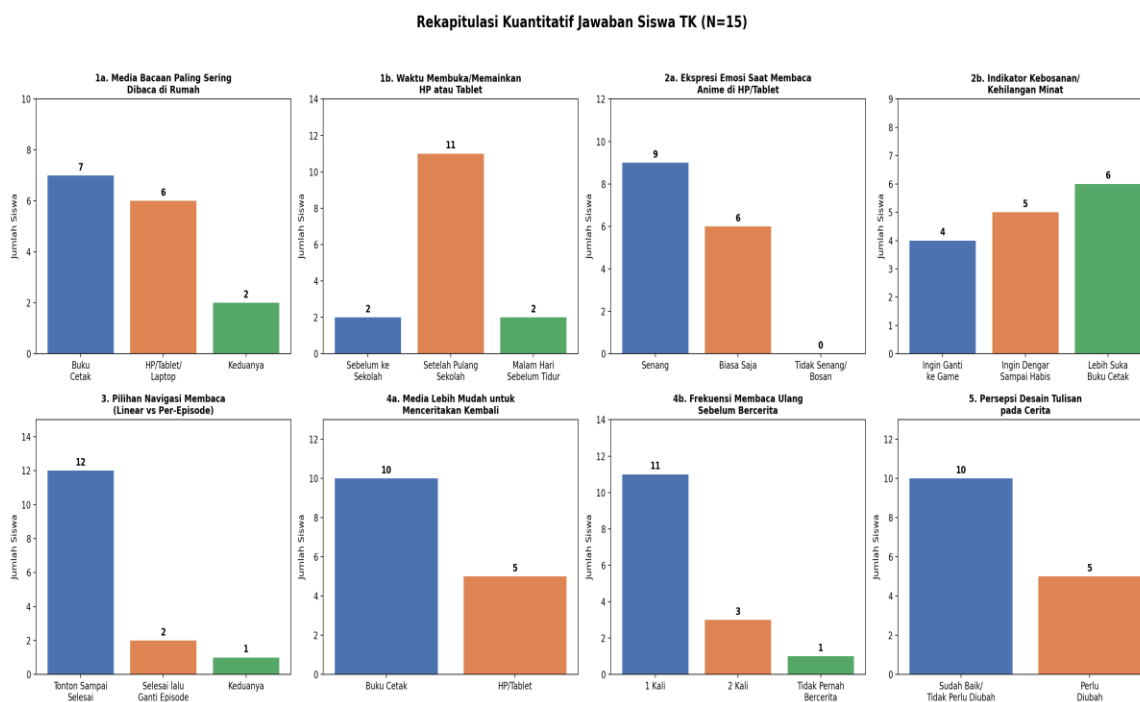


Figure 1. Quantitative Summary of Kindergarten Students' Responses (N = 15)

4.3 Discussion

The findings indicate that, with regard to **initial reading habits**, children's reading preferences at home were relatively balanced between printed and digital

media. Nearly half of the participants (47%) reported reading printed books more frequently, while 40% primarily used smartphones, tablets, or laptops, and the remaining 13% reported using both printed and digital media equally. Regarding daily device usage, most children (73%) accessed smartphones or tablets after returning from school, whereas only 13% used these devices before school and another 13% before bedtime. These results suggest that the after-school period represents the primary opportunity for Generation Alpha to interact with digital devices.

With respect to **extraneous cognitive load**, children's emotional responses toward reading digital stories or watching animated stories on smartphones and tablets were generally positive. Sixty percent of the participants reported feeling happy, while the remaining 40% expressed neutral feelings; none reported feeling bored or unhappy. However, indicators of cognitive fatigue revealed a more nuanced pattern. Approximately 27% of the children wanted to switch to digital games before the story had finished, 33% preferred listening to the story until the end but were simultaneously tempted to press other interactive buttons, and 40% stated that they preferred reading printed storybooks rather than using smartphones or tablets. These findings suggest that although digital media successfully engage children's emotions, interactive interface elements may simultaneously compete for cognitive attention and increase extraneous cognitive load.

Regarding **navigation decision-making**, the majority of children (80%) preferred to read or watch the story from beginning to end without interruption, whereas only 13% preferred switching to another episode after completing the story and 7% reported using both approaches. This finding indicates that kindergarten children naturally favor linear reading patterns and demonstrate limited self-directed navigation during digital reading activities.

In terms of **reading comprehension**, printed books remained the preferred medium for recalling and retelling stories. Approximately 67% of the participants reported that printed books made it easier to retell the story to their peers, whereas only 33% preferred smartphones or tablets. Similarly, 73% of the children required only one reading before they could successfully retell the story, 20% needed to reread the text twice, and only one participant (7%) reported never retelling stories to classmates. These findings suggest that printed reading materials continue to support deeper comprehension and more effective information retention among young learners than screen-based reading.

Regarding **digital learning media design**, most children (67%) considered the text presentation in the digital story appropriate and requiring no modification. Nevertheless, one-third of the participants (33%) believed that the text should be improved. This result highlights the importance of optimizing typography, visual layout, and interface design to better accommodate the cognitive characteristics of early childhood learners.

The classroom observations and interviews were structured around **Mayer's Cognitive Theory of Multimedia Learning (CTML)**, particularly its five multimedia design principles. The findings provide empirical support for these principles in the context of digital reading among Generation Alpha.

First, the **coherence principle** suggests that children learn more effectively when irrelevant multimedia elements are removed from instructional materials. Although almost equal numbers of children regularly read printed books and digital media at home, printed books were still preferred for comprehension and story recall, indicating that simplified reading environments facilitate more focused cognitive processing.

Second, the **spatial contiguity principle** proposes that learning is enhanced when related text and visual elements are presented close together. In digital environments, hyperlinks and interactive navigation may separate information spatially, producing a **split-attention effect** that divides children's working memory between understanding the story and navigating the interface. This finding may explain why fewer children preferred digital devices for reading comprehension despite their frequent exposure to digital technology.

Third, the **redundancy principle** emphasizes that excessive combinations of text, graphics, animations, audio, and interactive elements can overload working memory. During the interviews, several children demonstrated greater reliance on oral narration than on simultaneously processing multiple visual features, suggesting that overly complex multimedia presentations may reduce comprehension rather than enhance learning.

Fourth, the **signaling principle** states that learners benefit from clear visual cues that direct attention toward important information. However, digital environments often contain multiple competing signals, including colorful hyperlinks, animated icons, and navigation buttons. Although most children reported that one reading was sufficient to retell the story, classroom observations indicated that prolonged exposure to screen-based reading resulted in visible signs of visual fatigue and reduced sustained attention, suggesting that excessive visual signaling may unintentionally distract young readers from the primary narrative.

Finally, the **segmenting principle** proposes that information should be presented in manageable units that learners can control independently. The preliminary questions regarding children's reading habits demonstrated that Generation Alpha has developed cognitive attention patterns shaped by continuous exposure to digital devices at home. Children who regularly interacted with smartphones and tablets appeared accustomed to rapidly shifting visual stimuli, highlighting the importance of presenting digital reading materials in short, well-organized segments that minimize cognitive overload while supporting sustained comprehension.

5. Conclusion

This study examined the influence of screen-based reading on the cognitive attention of Generation Alpha from a psycholinguistic perspective by integrating **Steinberg's Meaning-Based Reading Theory**, **Sweller's Cognitive Load Theory**, **Paivio's Dual Coding Theory**, and **Mayer's Cognitive Theory of Multimedia Learning**. The findings indicate that although Generation Alpha is highly familiar with digital devices and demonstrates positive emotional engagement with digital reading materials, screen-based reading environments do not necessarily facilitate deeper language processing or reading comprehension.

The results reveal that interactive multimedia elements, including animations, hyperlinks, and navigational features, increase **extraneous cognitive load**, thereby dividing children's attention between processing linguistic information and responding to visual stimuli. As a consequence, children tend to engage in more superficial reading behaviors, demonstrate weaker chronological recall, and experience greater difficulty reconstructing story sequences after reading digital texts. In contrast, printed books provide a more stable reading environment that supports sustained attention, deeper semantic processing, and stronger memory retention. The linear organization and physical affordances of printed materials appear to reduce cognitive distractions, allowing children to allocate more working-memory resources to comprehension rather than navigation.

The findings also reinforce Mayer's multimedia learning principles, suggesting that digital reading materials for young learners should minimize unnecessary visual distractions, integrate verbal and visual information coherently, and present content in manageable segments that reduce cognitive overload. Consequently, the educational value of digital media depends not only on technological sophistication but also on the quality of instructional design and its alignment with children's cognitive characteristics.

This study contributes to the growing body of psycholinguistic and digital literacy research by demonstrating that children's reading performance is influenced not merely by the reading medium itself but by the interaction between multimedia design, cognitive attention, and language processing. The findings provide practical implications for educators, instructional designers, and digital content developers in designing child-friendly digital reading environments that balance engagement with cognitive efficiency.

Nevertheless, this study is limited by its relatively small sample drawn from a single kindergarten, which restricts the generalizability of the findings. Future research should involve larger and more diverse participant groups, compare different age levels within Generation Alpha, and incorporate objective measures such as eye-tracking, reading-time analysis, or cognitive load assessment to provide a more comprehensive understanding of children's digital reading processes. Such investigations will further advance psycholinguistic research and support the development of evidence-based digital literacy practices for early childhood education.

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