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Designing AI-Assisted Visual English Reading Instruction for Deaf Learners: Breaking Phonocentric Deadlock

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Abstract. English reading instruction for Deaf Learners (DLs) is often influenced by phonocentric practices that prioritize sound-based pathways. Such practices may create barriers because DLs primarily access language through visual channels. This study investigated how special education teachers utilized generative AI to design visual-conceptual reading instruction and explored the trends observed in DLs' reading comprehension scores during routine classroom evaluations. A multiple-case study design was employed involving 15 teachers from five institutions. Data were collected through interviews, artifact analysis, and three phases of reading comprehension evaluations. The qualitative data were analysed using pattern matching, while the quantitative data were analysed using descriptive statistics. The findings revealed a three-phase instructional design sequence consisting of text preparation, digital prompting, and artifact evaluation. Positive trends were also observed in DLs' reading comprehension scores across the three evaluation phases overall. The average post-test scores consistently increased from Phase 1 to Phase 3 across the beginner (50.0 to 53.0), pre-intermediate (57.5 to 60.0), and intermediate (69.0 to 72.5) proficiency levels. Future studies in reading instruction should employ longitudinal or experimental designs with larger participant cohorts to further examine this AI-assisted model.

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1. Introduction

English reading instruction for Deaf Learners (DLs) in Indonesia remains constrained by phonocentric deadlock, in which reading instruction continues to rely on sound-based approaches (Alqraini, 2022, 2025). For years, sound-based practices have become a routine in the teaching-learning process despite the fact that DLs process reading differently from their hearing peers. Most DLs access language primarily through visual pathways rather than consistent sound-to-letter connections, while hearing learners commonly rely on auditory phonological awareness to connect spoken and written language (Alasim & Alqraini, 2020; Couvee et al., 2022; Tunmer & Hoover, 2019).

This condition makes reading development particularly demanding because DLs must simultaneously learn vocabulary, syntax, and contextual meaning through limited language exposure (Aldemir et al., 2023; Dirks & Wauters, 2018; Zhao et al., 2021). As a result, reading instruction for DLs requires approaches that accommodate visual language processing rather than conventional sound-based practices (Andrews et al., 2016; Domagała-Zyśk & Podlewska, 2019; Domagała-Zyśk & Kontra, 2016).

This problem can be found across approximately 2,366 special education schools registered in the National Education Database (Pusat Data dan Teknologi Informasi, 2025). In many classrooms, particularly in Frontier, Outermost, and Least Developed areas, reading instruction relies heavily on flashcards, picture prompts, and isolated vocabulary drills. Although visual materials are frequently used, conventional visuals often function as static label-matching tools to scaffold sentence-level syntax and semantic processing. Consequently, reading instruction often remains focused on rote memorization and isolated word drilling (Alqraini, 2022; Alqraini & Paul, 2020; Kang et al., 2022; Lund et al., 2020) and difficult in comprehending connected texts (Alasim, 2018; Antia et al., 2020).

Similar challenges have been documented in other Asian contexts. In Thailand, auditory-oriented English reading instruction remains insufficiently aligned with DLs' visual learning strengths, while in China, sound-based systems such as *Pinyin* continue to shape reading instruction despite persistent comprehension difficulties among DLs (Wang & Andrews, 2021; Watanapokakul & Sitajalabhorn, 2023). These patterns indicate the continued dominance of sound-oriented instructional practices that overlook DLs' actual learning needs (de Diego-Lázaro et al., 2019).

The core mismatch hinders reading development, where DLs natural reliance on visual-spatial processing is paired with speech-based phonocentric instruction and isolated word drills. To address this, more suitable reading instruction is critically needed. Appropriate reading instruction should not only provide visual support but also help DLs understand sentence relationships and contextual

meaning within texts. According to Alasim and Alqraini (2020), reading interventions for DLs often produce inconsistent outcomes because visual representation is not always integrated with meaningful language processing. As a result, reading instruction should move beyond isolated word recognition and support how learners organize, interpret, and connect visual information during reading activities (Cawthon & Garberoglio, 2021). To break the limitations of existing instructional, a more constructive framework is required. The limitations are mainly relied on phonocentric approaches, static isolated word drills, and the failure to integrate visual aids with sentence-level semantic process, a more constructive framework is required.

Research within the Visual Language and Visual Learning (VL2) framework provides a promising direction. This VL2 framework confirms that interactive visual media and visual storytelling can help DLs connect printed language with meaningful visual representations and improve text comprehension (Herzig & Allen, 2023). Such visual support also enables DLs to retell story contexts more effectively rather than relying on isolated word recognition. In parallel, generative AI and text-to-image technologies provide teachers with practical opportunities to create visual reading materials and structured reading activities without relying on oral repetition (Alqraini, 2025; Andrews et al., 2016). Furthermore, utilizing digital materials can help dismantle traditional reading barriers in inclusive environments (Fälth & Selenius, 2024; Karger, 2020). However, little is known about how teachers actually utilize generative AI when designing reading instruction for DLs in everyday classroom settings in Indonesia.

To address these instructional mismatches, this study investigated the following questions: 1) How do teachers utilize AI to design step-by-step visual-conceptual reading instructions that alter traditional sound-based reading routines for DLs? 2) What trends are observed in DLs' reading comprehension scores across the routine classroom evaluations that utilize AI-generated visual reading passages along with the reading instruction?

2. Literature Review

This part will discuss two key points which play an important role. The first one is the phonocentric deadlock. The second one is Designing Visual-Conceptual Reading Instruction via Generative AI.

2.1 The Phonocentric Deadlock

Reading is essentially a silent cognitive process. For DLs, text comprehension often relies directly on visual rather than sound codes due to limited auditory input. Their potential to read and build knowledge through text is comparable to their hearing peers when they receive early visual language exposure and visual-based instruction (Mayer & Trezek, 2019). This positive outcome is proven by literacy research on Japanese deaf students (Takahashi et al., 2023) and early schooling programs (Scott et al., 2019). However, a simple approach is inappropriate. In contrast, many classrooms still impose a heavily sound-based, phonocentric model in teaching reading. This mismatch is evident because traditional early phonological tests are fundamentally inaccurate for DLs (Webb

et al., 2018). Forcing DLs to connect speech sounds with written words will disrupt visual focus (Zhang et al., 2021). Even deaf children with cochlear implants struggle with sound-based instruction because their hearing levels vary greatly (Nitttrouer et al., 2018). Ultimately, it slows them down and ruins text comprehension. Table 1 displays the comparison between Visual language and instruction, and Phonocentric approach.

Table 1: Comparison Between Visual Language, Instruction, and Phonocentric

Aspect	Visual Language & Instruction	Phonocentric
Main processing pathway	Visual (eyes) – through sight	Auditory (ears) – through sound
Way of understanding words	Direct route: Print → Meaning + Sign Language	Indirect route: Print → Sound → Meaning
Most suitable for	Profoundly deaf learners, especially sign language users	Students with good auditory access
Cognitive change	More natural, lower cognitive load, less visual fatigue	Often causes visual fatigue and higher cognitive load
Focus of instruction	Visual patterns, sign language, finger spelling, dynamic images	Sounding out, lip reading, vocalization, phonics
Alignment with deaf learning processing	Highly aligned with natural visual language processing	Often mismatched with deaf students' processing

As shown in the table above, the phonocentric approach is fundamentally misaligned with how DLs process language. Conversely, the visual language and visual-based instruction align closely with the DLs' visual processing strengths. The Visual Language and Visual Learning (VL2) framework from Gallaudet University strongly supports this alignment (Herzig & Allen, 2023). However, this shift is difficult because many teachers misunderstand how DLs learn visually (Rodrigues et al., 2022).

The Framework of VL2 focuses on early exposure to visual language blended with print to build a strong foundation for bilingual literacy (Herzig & Allen, 2023). In the Indonesian context, this involves English and Indonesian sign language. VL2 offers suitable strategies that harness the DLs' visual strengths. It includes dynamic visual storytelling, fingerspelling, chaining techniques, and interactive multimodal materials. When DLs engage with bilingual visual materials, their reading comprehension is enhanced considerably. They also show higher engagement and performance better at retelling meaningful stories, rather than simply recognizing isolated words (Herzig & Allen, 2023).

Another example in inclusive language tools of using generative AI and text-to-image systems gives more room for teachers to bypass traditional reading barriers for online and classroom DLs (Fälth & Selenius, 2024; Karger, 2020). With these tools, special education teachers can use assistive digital applications to reduce reading difficulties in inclusive classrooms (Nordström et al., 2019).

These results challenge the deep-rooted phonocentric deadlock in teaching reading for DLs. Teachers can benefit from this shift, moving away from static flashcards and oral repetition toward visual-based approaches under the VL2 framework (Herzig & Allen, 2023). In designing reading instruction, educators can move beyond rote memorization and isolated drills towards fostering text comprehension (Karger, 2020), especially when equipped with advanced digital media and generative AI. Removing these instructional barriers creates a proper learning path that matches what DLs need (Andrews et al., 2016). This visual design also fulfils the Universal Design for Learning (UDL) principle of providing multiple means of representation (Meyer & Rose, 2025).

2.2 Designing Visual-Conceptual Reading Instruction via Generative AI

The design of reading instruction for DLs requires an instructional sequence grounded in established literacy models, such as the Simple View of Reading (SVR). It posits that reading comprehension is the mathematical product of two components: (D) word decoding (word recognition) and (LC) language comprehension (understanding of meaning) (Hwang et al., 2023; Tunmer & Hoover, 2019). To get good results, teachers must stop using traditional speech-to-print methods (Ingvalson et al., 2020). Standard language test scores are often low simply because deaf children lack sound access, not intelligence (Ingvalson et al., 2023).

Thus, these learners need orthographic mapping, which allows them to connect printed words directly to meaning using their eyes. Rather than relying on auditory phonological recoding, this framework shows that DLs develop reading comprehension by focusing on direct visual-orthographic connections between printed words, visual concepts (Alasim & Alqraini, 2020). In reading instruction designs, the SVR model assumes a multiplicative relationship, formulated as:

$\text{Reading Comprehension (RC)} = \text{Decoding (D)} \times \text{Language Comprehension (LC)}$

Because the relationship is multiplicative, if either component scores a zero, the overall outcome is also zero, regardless of how high the other score might be (Mayer & Trezek, 2019).

This formula explains why sound-based reading instruction often fails to develop actual comprehension in phonocentric classrooms. The first scenario occurs when a teacher designs reading text along with the instruction based on sound-to-letter correspondences, here, DLs cannot access the auditory code due to reduced acoustic input. The result is the instructional design drops the decoding score to zero ($D = 0$). Many studies consistently prove that speech-based phonics does not fully help DLs master reading (Luft, 2018).

The second scenario occurs when reading instruction relies strictly on static flashcards of isolated words. DLs successfully memorize that the standalone printed word 'Apple' matches a picture of fruit. They achieve a temporary visual decoding match ($D = 1$). The instructional design stops at the single-word level and does not guide students toward sentence-level meaning. As a result, DLs gain

no understanding of the text's contextual meaning. Therefore, the instructional outcome for connected text remains zero ($LC = 0$). When calculated, the reading instructions prove not suitable ($RC = 1 \times 0 = 0$). DLs simply end up in memorization stage. To move forward, teachers can utilize tools such as technology and digital media (Connor et al., 2022). This support allows them to design customized reading instruction and digital materials, along with assessment beyond simple word drills (Connor, 2019).

As a solution, teachers can employ AI text-to-image tools within the VL2 framework. This framework claims that dynamic visuals such as storytelling activities help DLs connect printed text with the meaning (Herzig & Allen, 2023). Through Generative AI, teachers can create innovative dynamic visual stories for reading passages along with reading activities. This AI-driven visual support allows DLs to skip sound-based barriers and understand text meaning through their sight (Algraini, 2025). While these AI tools have huge potential for deaf education (Paul, 2025; Paul & Hasanbegovic, 2026), integrating them requires careful teaching strategies. Teachers must combine digital tools with clear visual scaffolds (Kang & Scott, 2021). Providing this visual support at the word level is crucial as it helps turn word mastery into full sentence comprehension (Kang et al., 2022; Lund et al., 2020).

The practical application of this innovative AI visual storytelling puts SVR into motion. First, when DLs encounter a running text printed on a card, such as "The girl bought a monkey-cover notebook in the antique bookstore", traditional sound-based decoding cannot keep up, resulting in a failed reading attempt. Second, when the same sentence is designed using generative AI to produce a sequence of running pictures to visualize the storyline, DLs do not need sound to follow the plot and understand the meaning. This innovative AI visual storytelling allows them to achieve a decoding match ($D = 1$).

The innovative AI visual storytelling reaches far beyond the limitations of isolated word or sound-based approaches. Generative images display all necessary characters, actions, expressions, and settings that connect syntactically and semantically across the context. This complete visual package helps DLs grasp sentence meaning ($LC = 1$). This visual-conceptual clarity helps DLs develop word recognition and vocabulary, which are crucial when they read silently (Aldemir et al., 2023; Zhao et al., 2021). Employing innovative AI visual storytelling within the VL2 framework improves reading instruction design and allows teachers to create leveled stories with engaging reading comprehension activities. As DLs read silently, the robust confirmation between visual language and the reading passage provides valuable opportunities for them to comprehend both sentence-level syntax and the whole context meaning. This silently active learning process meets the natural principle of providing multiple means of engagement (Meyer & Rose, 2025).

$$RC = D \times LC \rightarrow 1 = 1 \times 1$$

3. Methodology

This section describes the research design, data collection procedures, research instruments and data analysis techniques employed in this study.

3.1 Research Design

This study adopted a multiple case study design by Yin (2017) to address RQ1, supported by quantitative data for RQ2. Yin's design focuses on investigating "how" and "why" questions regarding a contemporary and real-world phenomenon. There are two structural components of Yin's design: theoretical propositions and pattern matching. This study's proposition posits a critical shift from phonocentric approaches toward innovative AI visual instructional design.

The quantitative approach addressed two RQ2 datasets: AI artifact analysis using a validated visual checklist and DLs' routine reading assessment scores. No researcher-imposed intervention was conducted; teaching, time allocation, and assessment procedures remained unchanged. The pre-test and post-test scores were analyzed descriptively to examine reading comprehension trends across three evaluation periods. Each period included routine teaching sessions between the two assessments. A typical 25-item test used teacher-generated AI visuals, including picture matching, text-image sequencing, image reordering, and contextual visual-clue tasks. Teachers followed the same special education curriculum and local working-group agreements.

3.2 Participants and Context

The 15 participants were special education teachers recruited through a criterion-based selection process. The criteria required a minimum of three years of professional experience in teaching DLs and demonstrated practice of integrating generative AI tools in teaching reading. The recruitment process was initiated by sending formal request letters to the intended schools with established DL enrollment. Eligible teachers sign informed consent forms before participation. Their geographical locations and personal identities were anonymized for institutional privacy. Their institutions were labeled as L, S, B, M and K. Additionally, this study employed reading comprehension test scores of 39 DLs from these five institutions. The tests were normally administered by the teachers as a part of standard classroom evaluation. DLs were categorized into beginner, pre-intermediate and intermediate reading levels.

3.3 Data Collection, Instrument and Techniques

Data collection was structured around multiple sources of evidence to achieve data triangulation (Yin, 2017). There were two primary types of data. The first involved the steps in designing reading instruction (RQ1). The research instruments were developed based on the theoretical intersection of the SVR framework and VL2 principles. The initial draft underwent expert validation from three reviewers specializing in inclusive education, deaf literacy instruction and curriculum and program development. Additionally, the instruments were field-tested through a pilot phase. The second data type included the artifacts of the generated AI visual and the reading comprehension scores of the pre-test and post-test (RQ2). Table 2 displays the structural details of the data collection.

Table 2: Data, Instruments, Techniques, and Purposes

Data Type	Instrument	Technique	Purposes
Teachers' step-by-step procedures in reading instructional designs	Semi-structured interview guide	In-depth interview (In-person and online via zoom, lasting 40-50 minutes per session, conducted 5 times for each participant)	To analyze how they utilize AI platforms and compose the reading instructions, and the reasons behind it (Answer RQ1)
Artifact of AI generated reading instruction and DLs reading comprehension test score	Validated matching visual checklist and reading comprehension pre-test and post-test score sheets	Systematic review of text-visual matching (prompt-image outputs) and descriptive analysis of DLs reading comprehension scores	To examine the syntactic and semantic alignment of the AI visuals and evaluate the trends on the SVR components. (Answer RQ2)

3.4 Data Analysis

This study employed the pattern matching logic, a qualitative case study analytic technique by Yin (2017). The analysis focused on comparing the empirical patterns found in the field with the predicted theoretical propositions. The procedures for RQ1 were: 1) Establishing the theoretical pattern based on the SVR framework and VL2 principles; 2) Empirical pattern coding to identify how teachers operationalized visual syntax and semantic accuracy in reading passages and instructional design; 3) Cross-pattern matching to compare actual teaching practice with the predicted SVR components and examine their alignment. To address two datasets of RQ2, this study employed descriptive statistical analysis: 1) Artifacts analysis checklist: the data were analyzed using descriptive statistics (frequency and percentages); and 2) the pre-test and post-test scores across three phases were analyzed descriptively by tracking mean scores to evaluate reading comprehension trends.

4. Results and Findings

This section presents the results and findings from RQ1 and RQ2. The details are organized in tables and explained in the following sections.

4.1 Research Question 1

Based on the data from RQ1, teachers followed three phases when designing AI-assisted visual-conceptual reading instruction for DLs. These phases consisted of text preparation, digital prompting, and artifact evaluation. Each phase contained specific actions taken by the teachers before the AI-generated visuals were used in reading activities. Table 3 presents the overall structure of the procedures.

Table 3: Structural Breakdown for RQ1

Phase	Operational Breakdown
Text preparation	Phonocentric stripping, syntactic alignment, visual-semantic conversion
Digital prompting	Minimalist prompt formulation, visual noise control
Artifact evaluation	Visual-syntactic accuracy, semantic distortion detection

The three phases were presented separately for clarity. In practice, teachers carried them out sequentially. Revised reading texts were transformed into prompts, and the generated visuals were reviewed before being used in the reading activities.

4.1.1 Phase 1: Text Preparation

The first phase involved preparing and modifying reading passages before they were entered into AI platforms. Teachers reported three recurring practices during this stage: phonocentric stripping, syntactic alignment, and visual-semantic conversion. These modifications helped teachers generate visuals that better represented the meaning of the reading passages for DLs.

Table 4: Text Preparation Strategies Employed by Teachers

Domain	Actions	Frequency (f)	Percentage
Phonocentric Stripping	Elimination of onomatopoeia	13	86.7%
	Removal of auditory-reliant directives	11	73.3%
	Modification of sound-dependent settings into visual settings	9	60.0%
Syntactic Alignment	Converting passive voice into active SVO structures	14	93.3%
	Dividing long sentences into shorter sentences	12	80.0%
	Removing excessive adjoining clauses	10	66.7%
Visual-Semantic Conversion	Replacing abstract descriptions with concrete details	12	80.0%
	Converting emotional states into observable actions	11	73.3%
	Removing decorative adverbs	8	53.3%

A. Phonocentric Stripping

Table 4 shows that the highest percentage was the elimination of onomatopoeia (86.7%). This was followed by the removal of auditory-reliant directives (73.3%) while the modification of sound-dependent descriptions accounted for 60.0%. For example, auditory information was changed into visual descriptions, like a shouting crowd was revised into people buying and selling in a crowded traditional market. One teacher said:

"The reading text has 'meow meow in the garden', so I deleted it to make it simpler for DLs, as they have not input the sound of cat." (Teacher L)

Teachers avoided auditory input because they often produced inaccurate visual outputs.

B. Syntactic Alignment

The second strategy focused on syntactic alignment, which is restructuring sentence forms before generating visuals. The most common practice was converting passive voice into active voice Subject-Verb-Object structures (93.3%). The next one was dividing long sentences into simpler and shorter sentences

(80.0%). Additionally, teachers removed the unnecessary adjoining clauses (66.7%). As one teacher stated:

"The sentence 'That skinny post officer was chased by the dog' is confusing, because the logic us a dog always does the chasing. In simple reading passage for beginner, it is better if the sentence is in active and simple form." (Teacher S)

Teachers explained that simplified sentence structures produced clearer image outputs and visual sequence. Teachers had good strategy for this phase.

C. Visual-Semantic Conversion

The third strategy was adapting abstract language into visually representable forms. As shown in Table 4, 80.0% of teachers replaced abstract descriptions with concrete details. It was followed by 73.3% converted emotional states into observable actions. More than half of the teachers (53.3%) also reported removing decorative adverbs. One participant explained:

"AI tends to draw European classic buildings, but what I want is local-looking old building, like dilapidated building." (Teacher M)

This statement shows that AI generated images became more accurate when abstract concepts were transformed into concrete visual cues. This implies that concrete visual cues improve AI image accuracy.

4.1.2 Phase 2: Digital Prompting

After completing text preparation, teachers moved to the digital prompting phase. This phase focused on translating revised texts into AI commands. Two dominant strategies emerged: the use of minimalist prompts and the control of visual noise. As shown in Table 5, most teachers preferred minimalist prompts written in L1 (80.0%). Teachers reported that shorter prompts were easier to compose and generated results more quickly.

Table 5: Teachers' Responses and Actions on Digital Prompting

Actions	Frequency (f)	Percentage
Using minimalist L1 prompts	12	80.0%
Controlling visual noise through contextual parameters	10	66.7%

This strategy involved controlling visual noise through contextual parameters such as background settings, visual style, and environment familiarity. According to one teacher:

"Familiar background settings help DLs to guess the context and the plot of the passages." (Teacher K)

Teachers actively controlled visual characteristics to maintain readability and contextual clarity.

4.1.3 Phase 3: Artifact Evaluation

The final phase involved evaluating the quality of AI-generated visual before they were used as instructional materials. Teachers opted two main evaluation criteria: visual-syntactic accuracy and semantic distortion detection. As presented in Table 6, checking visual-syntactic accuracy was the most common evaluation practice (86.7%).

Table 6: Teachers' Responses and Actions on Artifact Evaluation

Actions	Frequency (f)	Percentage
Checking visual-syntactic accuracy	13	86.7%
Detecting semantic errors and distortions	11	73.3%

Teachers examined whether image sequences reflected the order of event in the reading passage and reviewed images for semantic inaccuracies and visual anomalies. One teacher stated:

"AI sometimes skips the details such as the skin color of Asians is light brown, but the images I got have white skin. So, I need to check the details." (Teacher B)

Teachers reviewed AI-generated visual before classroom use to ensure alignment with the storyline, context, and instructional goals.

4.2 Research Question 2

The findings for RQ2 consisted of AI artifact evaluation, and DLs' reading comprehension scores. Table 7 presents the structure of both datasets.

Table 7: Structural Breakdown for RQ2

What data is collected	Operational breakdown
AI-generated visual artifact evaluation	Text-visual alignment and cognitive load reduction
DLs' reading performance scores	Reading score trends across three phases

4.2.1 AI-generated visual artifact evaluation

Based on the artifact analysis checklist completed by the teachers, the analysis focused on the alignment between the text-to-image outputs, the reading passages and the reading instructions. Table 8 shows that 'not aligned' represents the lowest percentage, while the dominant indicator was 'aligned.' It means that the alignment is not flawless.

Table 8: Artifact Analysis Checklist Results for AI-Generated Visuals (N = 15)

Evaluation Dimensions	Indicators		
	Aligned	Partially Aligned	Not Aligned
Text-Visual Alignment			
a. Evaluating text-to-image alignment based on SVO passages	11/73.3%	3/20.0%	1/6.7%
b. Examining prompt fidelity in translating action verbs into clear visuals	10/66.7%	4/26.7%	1/6.6%
Cognitive Load Reduction			
a. Checking how silent settings prevent sensory distraction.	9/60.0%	5/33.3%	1/6.7%
b. Checking sequential alignment (D = 1) to relieve working memory density	12/80.0%	2/13.3%	1/6.7%

These findings displayed that most AI-generated visuals were categorized as aligned across all evaluation dimensions. The highest percentage was found in the sequential alignment between the image series and the storyline (80.0%). This was followed by text-to-image alignment based on SVO passages (73.3%), and the prompt fidelity in translating action verbs into visuals (66.7%). The silent settings for reducing sensory distraction reached 60.0%. Across all dimensions, the percentage of not aligned visuals remained low at 6.7%. Although several outputs required revision, the generated visuals generally matched the reading materials.

4.2.2 DLs' Reading Comprehension Score Trends

The second data focused on DL's reading comprehension scores obtained from routine classroom evaluations. The data were collected from the reading comprehension scores of 39 DLs from five participating schools. They were grouped into beginner, pre-intermediate, and intermediate reading levels. The reading test commonly consisted of 25 items, and the scores were converted into a 100-point scale before the mean score were calculated. The analysis was based on the comparison of mean pre-test and post-test scores across three evaluation phases. The details are displayed in Table 9.

Table 9: DLs' Reading Comprehension Scores Trends Across Three Phases

Reading Level	Phase 1		Phase 2		Phase 3	
	Pre-test	Post-Test	Pre-test	Post-Test	Pre-test	Post-Test
Beginner	44.0	50.0	49.0	51.0	52.5	53.0
Pre-intermediate	56.0	57.5	55.5	58.0	59.0	60.0
Intermediate	68.5	69.0	70.0	71.5	72.0	72.5

Table 9 shows that post-test scores were consistently higher than pre-test scores across the three evaluation phases. Similar patterns were observed across the beginner, pre-intermediate, and intermediate groups. Although the score differences varied across reading levels, the overall trend remained positive throughout the evaluation period. The beginner group showed increases from

50.0 in Phase 1 to 53.0 in Phase 3. Similar trends were observed in pre-intermediate group, where post-test scores increased from 57.5 to 60.0. The intermediate group also demonstrated positive trends, with post-test scores increasing from 69.0 to 72.5 across the three phases. Figure 1 displays the positive trends of DLs' scores. These results suggest a gradual improvement in DLs' reading comprehension across the evaluation phases.

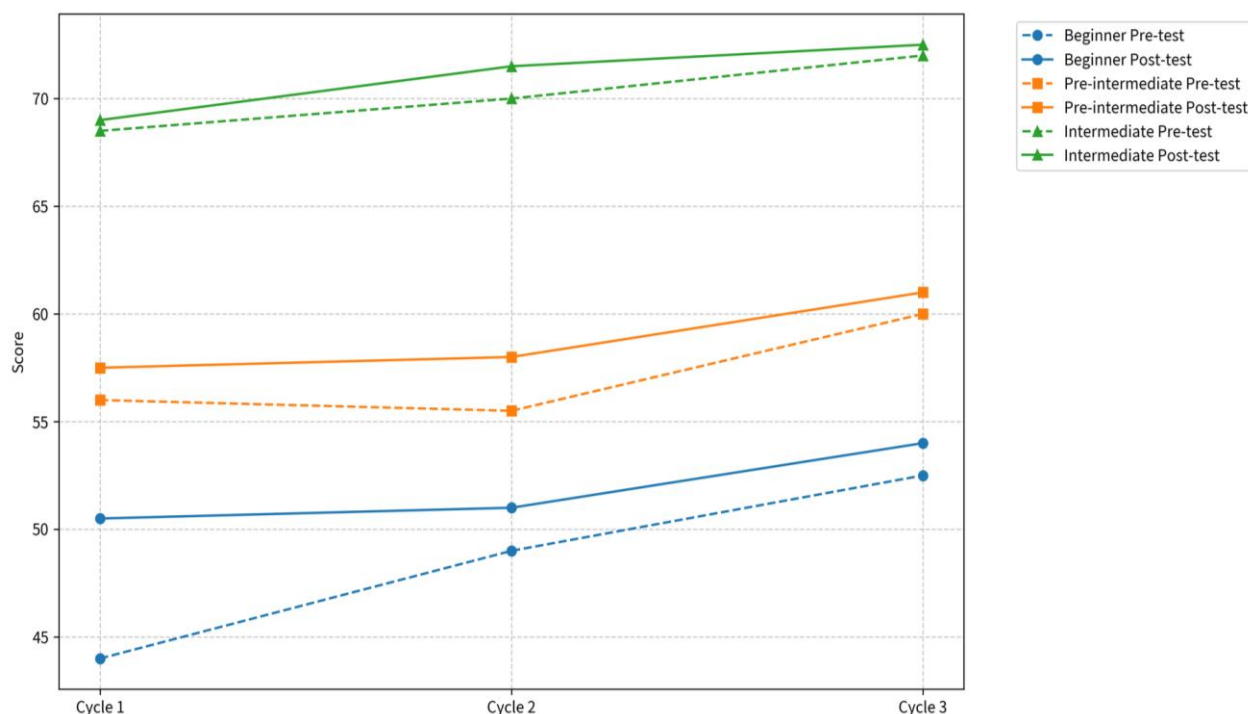


Figure 1: Trends in DLs' Reading Comprehension Scores across Three Phases

These modest but consistent gains were noteworthy considering the challenges in special education setting in Indonesia. Only small number of DLs enrol and continued until senior secondary level.

5. Discussion

The findings showed that teachers did not directly enter reading passages into AI platforms. Instead, they first modified the passages through text preparation, digital prompting, and artifact evaluation. This sequence was important because the purpose of the instruction was not just to generate images. Rather, it was to ensure that the generated visuals could represent the meaning of the reading passages for DLs.

The first phase, text preparation, reflected the need to move away from phonocentric reading practices. Teachers frequently removed onomatopoeia, auditory-reliant directives, and sound-dependent descriptions before generating visuals. These modifications are consistent with previous studies arguing that sound-based pathways often create barriers for DLs because access to auditory information is limited and highly variable (Alasim & Alqraini, 2020; Nitttrouer et al., 2018). When auditory descriptions were converted into observable actions and

settings, the reading passages became more visually accessible. This process demonstrates how teachers adapted the reading materials to match the visual language processing characteristics of DLs.

The syntactic alignment strategies also supported the assumptions of the SVR framework. Teachers frequently converted passive voices into active SVO structures and divided long sentences into shorter units. These modifications reduced syntactic complexity and make the storyline easier to represent visually. According to the SVR framework, reading comprehension requires both decoding and language comprehension (Tunmer & Hoover, 2019). If DLs struggle to identify actions, actors, and relationships within a sentence, comprehension becomes difficult even when individual words are recognized. Therefore, simplifying sentence structures was not merely a linguistic adjustment but also an instructional strategy to support meaning construction. The visual-semantic conversion strategies further support the VL2 framework.

Previous studies have shown that DLs benefit from visual representations that help them connect printed text with meaning (Herzig & Allen, 2023). In this study, teachers transformed abstract descriptions into concrete visual details and converted emotional states into observable actions. These modifications enabled AI platforms to generate visuals that more closely reflected the intended meaning of the reading passages. As a result, the generated images functioned not only as illustrations but also as visual supports for comprehension.

Another important finding was that teachers remained central throughout the instructional design process. The digital prompting and artifact evaluation phases showed that AI did not replace teacher decision-making. Teachers controlled prompt construction, adjusted contextual parameters, and reviewed the generated outputs before classroom use. The finding was important because discussions of AI integration often focus on technological capabilities rather than instructional design. The findings of this study indicated that the quality of AI-generated visuals depended on how teachers prepared the text, formulated the prompts, and evaluated the outputs.

The artifact analysis supported this interpretation. Most generated visuals were categorized as aligned with the reading passages, particularly in terms of sequential alignment and text-to-image correspondence. However, partially aligned and non-aligned outputs were still identified. This finding explains why teachers consistently reviewed the generated materials before using them in reading activities. Although AI assisted the visual generation process, teacher evaluation remained necessary to maintain semantic and contextual accuracy.

The reading comprehension score trends provided additional support for the instructional design. Across the three evaluation phases, post-test scores were consistently higher than the pre-test scores across the beginner, pre-intermediate, and intermediate group. Although the score differences were relatively modest, the pattern remained positive throughout the three phases. In contexts where DLs often face limited resources, inconsistent language exposure, and persistent

phonocentric practices. Thus, even small consistent gains can indicate meaningful progress.

The positive score trends also helped explain why the three-phase instructional sequence matters. Within the SVR framework, reading comprehension depends on decoding and language comprehension working together (Tunmer & Hoover, 2019). In this study, teachers simplified sentence structures, reduced auditory-dependent elements, and transformed abstract descriptions into concrete visual details. These modifications helped make the reading passages easier to represent visually. At the same time, the generated visuals supported DLs in connecting printed text with contextual meaning.

These findings also supported the assumptions of the VL2 framework. Previous studies suggest that visual language and visual storytelling can strengthen literacy development among DLs (Herzig & Allen, 2023). The teachers in this study applied similar principles when designing AI-generated visual reading materials. Rather than using AI as a replacement for instruction, they used it as a tool to create visual representations that matched the storyline and meaning of the text. This study therefore contributes a practical example of how SVR and VL2 principles can be applied together in everyday reading instruction for DLs.

Finally, the findings indicated that breaking the phonocentric deadlock requires more than adding visual materials into reading lessons. The visual materials must be systematically designed to represent actions, relationships, and contextual meaning contained in the text. Through text preparation, digital prompting, and artifact evaluation, teachers transformed AI platforms into tools that supported visual-conceptual reading instruction. This process demonstrates a practical pathway for aligning reading instruction with the visual learning characteristics of DLs.

6. Conclusion

This study examined how teachers utilized generative AI to design visual-conceptual reading instruction for DLs. The findings revealed a three-phase instructional design sequence consisting of text preparation, digital prompting, and artifact evaluation. Teachers did not directly use AI-generated outputs in the classroom. Instead, they modified reading passages, controlled prompt construction, and reviewed the generated visuals before integrating them into reading activities. These practices enabled the generated visual to represent the storyline, actions, and contextual meaning contained in the reading passages. The findings also showed that teachers frequently removed auditory-dependent elements, simplified sentence structures, and transformed abstract descriptions into visually meaningful representations. These modifications helped align reading instruction with the visual language processing characteristics of DLs. Moreover, breaking the phonocentric deadlock requires more than adding visual materials into reading lessons. The visual materials need to be systematically designed.

7. Limitations

Several limitations should be acknowledged. The study involved five institutions and focused on routine classroom practices within a specific education context. In addition, the quantitative data were limited to descriptive trends obtained from scores and were not intended to establish causal relationships. Future studies may involve larger participants, different educational settings, and longitudinal or experimental designs to further examine the role of AI-assisted visual reading instruction in supporting reading comprehension among DLs.

Conflict of Interest

There is no conflict of interest.

8. Acknowledgements

ChatGPT (OpenAI) and Gemini were used for language editing, grammar refinement, and readability improvement. No AI tool was used for data analysis, interpretation, or generation of research findings.

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