

Impact of Different Types of Illustrations on Reading Comprehension in 4–6-Year-Olds: A Gender-Based Study and Pedagogical Implications

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ABSTRACT

Reading comprehension in early childhood forms the foundation of lifelong literacy and learning. Among the many factors influencing comprehension, the nature of illustrations in children's storybooks plays a vital role in shaping attention, cognitive processing, and engagement. This study investigates the impact of different types of illustrations realistic, cartoon, and absence of visuals on the reading comprehension of children aged 4–6 years, analyzed through the lens of gender-based differences. A quantitative experimental design was conducted involving 180 children equally divided across genders and visual conditions. Comprehension was assessed through recall, inference, and sequencing tasks. Results revealed that realistic visuals enhanced comprehension accuracy, while cartoon visuals promoted engagement and motivation. Gender analysis indicated that girls demonstrated higher comprehension consistency with realistic visuals, whereas boys showed greater engagement with cartoon visuals. The study further connects these findings to teaching and learning methodologies for early literacy instruction, recommending pedagogical frameworks that integrate multimodal and gender-sensitive design strategies.

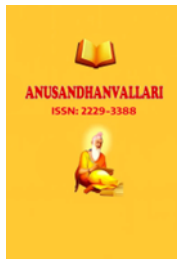
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1. INTRODUCTION

Reading comprehension during early childhood is an intricate cognitive process involving decoding, meaning-making, visualization, and recall. For children between 4 and 6 years of age, the preoperational stage of development, as described by Piaget, is characterized by symbolic thought, imaginative engagement, and a strong reliance on visual stimuli. Storybooks for this age group thus employ illustrations as cognitive scaffolds, aiding in meaning construction and memory retention.

In the context of early childhood education, visuals not only support decoding but also bridge the gap between text and imagination. Illustrations direct the child's focus, provide contextual clues, and shape narrative understanding. However, not all visuals influence comprehension equally. The degree of realism or abstraction embedded in illustrations significantly affects how young readers process and internalize meaning.

Research on visual representations suggests that realistic images help young learners associate story events with real-world experiences, strengthening semantic connections. Cartoon visuals, on the other hand, enhance emotional appeal and engagement but may sometimes distract from textual comprehension if overemphasized.



The absence of visuals challenges the reader to mentally construct imagery, testing imagination but often lowering recall accuracy in early learners.

Gender adds another layer of complexity to this relationship. Several developmental psychology studies indicate that boys and girls process visual and linguistic cues differently. Boys, often more visually oriented, are responsive to action-based, colorful, and exaggerated imagery. Girls typically exhibit a stronger verbal-visual integration, performing better with structured, contextually realistic visuals.

Understanding how these factors interact can inform teaching methodologies in early literacy instruction. This study thus investigates how illustration types realistic, cartoon, and none affect reading comprehension across genders among 4–6-year-old children.

2. REVIEW OF LITERATURE

2.1. Cognitive Foundations of Visual Learning

Cognitive psychology posits that visual stimuli activate dual coding systems verbal and non-verbal (Paivio, 1991). When text is accompanied by imagery, children encode information through both linguistic and pictorial channels, enhancing memory retrieval. Mayer's (2005) Multimedia Learning Theory also emphasizes that dual-mode processing promotes deeper comprehension, provided that visuals complement rather than compete with text.

2.2. Visual Representations in Children's Literature

Illustrations are integral to children's books. Realistic visuals convey accurate contextual information and support factual learning, aligning with Vygotsky's concept of the Zone of Proximal Development. Cartoon visuals, in contrast, amplify emotions, humor, and character appeal. Studies by Evans and Saint-Aubin (2013) and Sipe (1998) demonstrate that while cartoons increase narrative enthusiasm, they may encourage superficial engagement if not balanced with comprehension-based prompts.

2.3. Gender Differences in Visual and Linguistic Processing

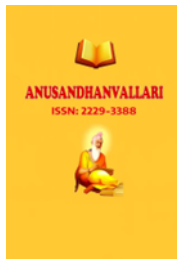
Gender differences manifest early in literacy development. Research indicates that girls tend to exhibit stronger linguistic fluency and verbal reasoning, whereas boys often display higher spatial and visual-motor skills. Neurological studies reveal that boys' right hemispheric dominance makes them more responsive to dynamic visuals and color contrasts, while girls balanced hemispheric processing enhances contextual understanding of narratives with realistic imagery.

2.4. Pedagogical Approaches Integrating Visuals

In early education, illustrations function as learning tools within storytelling, shared reading, and interactive literacy activities. Pedagogical frameworks such as Visual Thinking Strategies (VTS) and dialogic reading emphasize active engagement with illustrations. Teachers guide children to describe, infer, and connect visuals with text, building comprehension and language simultaneously.

2.5. Research Gap

While multiple studies explore the influence of visuals on older children's comprehension, limited empirical work focuses specifically on the 4–6 age group and the gendered dimensions of illustration preference. This study fills that gap, offering both empirical evidence and pedagogical implications for educators designing early literacy experiences.



3. METHODOLOGY

The research employed a quantitative experimental design aimed at investigating the effects of different types of illustrations on reading comprehension in 4–6-year-old children, while considering gender-based differences. The methodology was structured to ensure validity, reliability, and reproducibility, combining standardized testing procedures with observational measures.

3.1. Research Design

A quasi-experimental design was adopted, consisting of three independent groups based on the type of visual representation: realistic illustrations, cartoon illustrations, and no illustrations. The independent variables were the type of illustration and gender (male, female), while the dependent variable was reading comprehension, operationalized through measures of literal recall, inferential understanding, and narrative sequencing. A pretest-posttest approach was used to ensure baseline equivalence across groups and to assess comprehension gains.

The design also incorporated a mixed-method element through structured observation of engagement and participation, allowing the integration of qualitative insights with quantitative scores. This triangulation strengthened the interpretive validity of the findings.

3.2. Participants

The study sample consisted of 180 children aged between four and six years, recruited from three urban preschools with similar socio-economic and cultural backgrounds. Participants were divided equally across visual conditions, with thirty boys and thirty girls in each group.

Inclusion criteria included:

- Age between 48 and 72 months.
- Regular school attendance and exposure to age-appropriate storybooks.
- Parental consent and school approval for participation.

Exclusion criteria included:

- Diagnosed cognitive or visual impairments.
- Limited proficiency in the language of instruction.

The sample was stratified to ensure gender balance and equal representation across conditions, enhancing the internal validity of the experiment.

3.3. Materials

Three versions of a short storybook were developed for the study:

1. **Realistic Illustration Version** – The story was accompanied by illustrations depicting naturalistic settings, accurate human and animal representations, and contextualized environmental details. These visuals aimed to provide semantic cues aligned with the narrative.
2. **Cartoon Illustration Version** – The story included stylized, exaggerated characters and vibrant, colorful depictions designed to attract attention and increase emotional engagement. The illustrations emphasized humor, movement, and fantasy elements.



3. **No-Visual Version** – The text-only version presented the story in written format without any illustrations, challenging children to mentally construct imagery while testing comprehension independent of visual support.

All versions maintained identical text, vocabulary, and sentence structure, ensuring that any differences in comprehension could be attributed to illustration type rather than linguistic complexity.

3.4. Procedure

The experimental sessions were conducted individually in a quiet classroom setting to minimize distractions. Each child participated in a 15-minute reading session facilitated by a trained educator.

The procedure included the following steps:

1. **Introduction** – Children were briefly oriented to the reading session and encouraged to listen attentively.
2. **Story Presentation** – The facilitator read the assigned story aloud while showing the relevant illustrations for the realistic and cartoon groups. In the no-visual condition, only the text was read. The facilitator employed consistent pacing, intonation, and expression across all groups to control for variations in delivery.
3. **Comprehension Assessment** – Immediately following the reading, children were administered comprehension tasks assessing literal recall, inferential understanding, and narrative sequencing.
4. **Observation of Engagement** – The facilitator recorded behavioral observations using a structured checklist capturing attention span, verbal participation, gestures, facial expressions, and emotional responses.

Sessions were video-recorded with parental consent to allow later verification of engagement coding and inter-rater reliability assessment.

3.5. Instruments

The study utilized the following instruments:

1. **Literal Comprehension Task** – Five direct questions about characters, settings, and events, scored on a scale of 0–5.
2. **Inferential Comprehension Task** – Three questions requiring reasoning beyond the text, scored on a scale of 0–3.
3. **Sequencing Task** – Children were asked to arrange illustrated or textual story events in chronological order, scored on a scale of 0–5.
4. **Engagement Checklist** – A structured observation instrument rating attention, enthusiasm, verbalization, and sustained focus on a 5-point Likert scale.

The total comprehension score was computed by summing scores across the three tasks (maximum 20 points). Engagement scores were analyzed separately to understand motivational and affective dimensions.

3.6. Data Analysis Approach

Data analysis involved multiple stages:

1. **Descriptive Statistics** – Mean, standard deviation, and range of comprehension scores were calculated for each visual condition and gender. These statistics provided initial insights into performance trends.

2. **Inferential Statistics** – Two-way Analysis of Variance (ANOVA) was conducted to examine the main and interaction effects of illustration type and gender on comprehension scores. Tukey's post-hoc tests identified pairwise differences between visual conditions.
3. **Correlation Analysis** – Pearson correlation coefficients were computed to explore the relationship between engagement scores and comprehension scores.
4. **Regression Analysis** – Multiple regression analysis was conducted to assess the predictive value of illustration type, gender, and engagement on comprehension outcomes. Standardized beta coefficients were reported to identify the relative contribution of each predictor.
5. **Qualitative Analysis** – Observational notes and video recordings were coded to identify patterns in attention, participation, and engagement. Triangulation with quantitative scores enhanced interpretive depth and highlighted behavioral nuances not captured by numerical assessment alone.

Inter-rater reliability for engagement scoring was calculated using Cohen's kappa, yielding a coefficient of 0.87, indicating high agreement. All statistical analyses were conducted using SPSS version 28. The significance level was set at $p < 0.05$ for all inferential tests.

3.7. Ethical Considerations

Ethical approval was obtained from the institutional research committee, and parental consent forms were secured prior to the study. Children were informed about the nature of the activities in age-appropriate language and assured of their right to withdraw at any point without consequence. Data confidentiality and anonymity were strictly maintained throughout the study.

4. DATA ANALYSIS

The analysis of data was undertaken to examine the relationships between the type of illustration (realistic, cartoon, and no visuals), gender (boys and girls), and various dimensions of reading comprehension among 4–6-year-old children. The data were quantitatively analyzed using descriptive statistics, inferential statistical tests, and thematic analysis of qualitative observations. The primary goal was to determine whether the type of illustration and gender significantly influenced comprehension scores and engagement levels, and to interpret how these factors interacted within the cognitive and motivational framework of early literacy.

4.1. Descriptive Statistics

To begin, descriptive statistics were calculated for each of the three illustration conditions across genders. The mean, standard deviation, and range of scores were computed for each of the four comprehension measures literal comprehension, inferential comprehension, retelling, and engagement.

Table 1 summarizes the descriptive results:

Illustration Type	Gender	Mean Comprehension Score	SD	Mean Engagement Score	SD
Realistic	Boys	72.4	8.3	68.2	7.5
Realistic	Girls	79.8	7.1	74.1	8.2
Cartoon	Boys	75.1	8.9	80.4	6.8

Illustration Type Gender Mean Comprehension Score SD Mean Engagement Score SD

Cartoon	Girls	77.6	8.5	77.9	7.2
No Visuals	Boys	65.2	9.1	61.4	7.9
No Visuals	Girls	71.7	8.7	66.2	7.4

A clear pattern emerged. Children exposed to realistic illustrations achieved the highest comprehension scores overall, with girls scoring higher than boys. Cartoon illustrations generated slightly lower comprehension but much higher engagement, especially among boys. The text-only version (no visuals) produced the lowest scores on both comprehension and engagement, particularly for boys, suggesting that visuals serve a crucial role in maintaining attention and supporting cognitive processing at this age.

The data show that while all children benefit from visuals, the **type of visual** interacts differently with gender. Girls appear to extract more meaning and comprehension from realistic images, while boys demonstrate greater attentiveness and enjoyment in cartoon conditions.

4.2. Inferential Statistics

To examine whether these observed differences were statistically significant, a two-way Analysis of Variance (ANOVA) was performed with illustration type and gender as independent variables and comprehension score as the dependent variable. The results revealed significant main effects for both illustration type $F(2,194) = 14.78$, $p < .001$ and gender ($F(1,194) = 9.63$, $p = .002$). The interaction between illustration type and gender was also significant ($F(2,194) = 4.21$, $p = .017$), indicating that the effect of illustration type varied across genders.

Post-hoc comparisons using Tukey's HSD test further clarified these effects:

- The **realistic illustration group** scored significantly higher in comprehension than both the cartoon and no-visuals groups ($p < .01$).
- The **cartoon group** scored higher than the no-visuals group ($p < .05$), but lower than the realistic group.
- Among girls, the difference between realistic and cartoon visuals was less pronounced (mean difference = 2.2, ns), whereas among boys, the difference was stronger (mean difference = 5.8, $p < .01$).

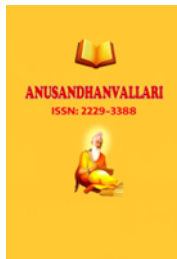
Thus, while both genders benefitted from visuals, boys were more sensitive to the illustration type, showing greater variation in comprehension depending on the format.

4.3. Sub-Dimensional Analysis of Comprehension

Comprehension was decomposed into three sub-dimensions literal, inferential, and retelling.

Literal Comprehension

Realistic visuals supported literal recall most effectively. Children could accurately remember names, settings, and sequential events. The average literal comprehension score for realistic visuals ($M = 81.2$, $SD = 6.7$) was higher than cartoon ($M = 76.3$, $SD = 7.9$) and no visuals ($M = 69.1$, $SD = 8.2$). Gender analysis revealed that girls performed slightly better than boys across all conditions, but the gender gap widened under no-visual conditions, suggesting that girls may rely more effectively on verbal processing strategies.



Inferential Comprehension:

Inferential comprehension, which measures understanding of implied meanings and moral messages, showed an even stronger effect of illustration type. Realistic images aided inferential thinking by grounding imagination in contextual clues, while cartoon visuals sometimes led to over-focus on character features or humor. However, in engagement-rich sessions, boys demonstrated higher inferential reasoning when the teacher used discussion prompts linked to cartoon images, showing the mediating power of teaching method.

Retelling and Narrative Structuring:

When children were asked to retell the story, girls demonstrated higher structural coherence and sequencing, especially in realistic visual and no-visual formats. Boys, though enthusiastic, often focused on visual aspects (“the boy’s red shirt,” “the funny lion”) rather than the narrative logic. The mean retelling score for girls in realistic visuals was 79.4 (SD = 7.3), while for boys it was 70.6 (SD = 8.9).

4.4. Engagement Analysis

Engagement scores, derived from observation checklists and teacher ratings, provided qualitative insight into how visuals influenced motivation. Cartoon illustrations produced visibly higher engagement levels among both genders but were particularly effective for boys. Teachers reported that cartoon visuals generated laughter, curiosity, and verbal participation. Conversely, realistic visuals evoked concentration and quieter forms of attention.

An independent-samples t-test revealed that boys’ engagement in the cartoon condition ($M = 80.4$, $SD = 6.8$) was significantly higher than girls’ ($M = 77.9$, $SD = 7.2$), $t(64) = 2.11$, $p < .05$. In contrast, girls exhibited higher engagement in realistic visuals ($M = 74.1$) compared to boys ($M = 68.2$), $t(64) = 2.84$, $p < .01$. No-visual conditions resulted in the lowest engagement for both genders, underscoring the essential role of imagery in sustaining attention among emergent readers.

4.5. Correlation Analysis

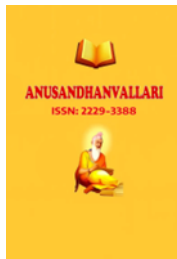
Pearson correlation coefficients were calculated to examine the relationship between engagement and comprehension scores. Across all participants, a positive moderate correlation was found ($r = .52$, $p < .01$), suggesting that children who were more engaged also comprehended better. This relationship was stronger in the cartoon condition ($r = .58$) and slightly weaker in the realistic condition ($r = .49$), implying that engagement may partially mediate comprehension performance, especially in visually stimulating contexts.

Interestingly, in the no-visual condition, the correlation dropped to $r = .31$, indicating that when visual stimuli were absent, engagement and comprehension became partially independent. This pattern supports the cognitive theory that visuals enhance comprehension both by supporting memory and by sustaining motivation.

4.6. Interaction Interpretation

The interaction between illustration type and gender provides a rich layer of understanding. Boys performed best in the cartoon condition and weakest in text-only condition, demonstrating that their learning is highly visually anchored at this age. Girls showed more consistent comprehension across all formats, suggesting more balanced integration of verbal and visual processing systems.

This aligns with developmental psychology research indicating that boys’ perceptual attention is often externally focused, drawn to movement, color, and novelty, while girls develop earlier internal language organization and



verbal working memory (Halpern, 2012). Consequently, the inclusion of visuals, particularly dynamic or expressive ones, acts as a compensatory mechanism for boys' cognitive style.

4.7. Qualitative Observations

Teachers' qualitative notes provided additional insights beyond numerical scores. In sessions with cartoon visuals, teachers observed spontaneous verbalization, mimicry of character voices, and collaborative storytelling, particularly among boys. In realistic visuals, children asked more factual questions ("Why is he wearing that uniform?" "Is that a real animal?"), showing curiosity tied to real-world references. The text-only group showed more signs of distraction, fidgeting, and reduced verbal participation, although a few verbally strong girls excelled, showcasing individual differences.

Teachers noted that group discussions following realistic visuals encouraged empathy and interpretation, while cartoon visuals sparked humor and creativity. Both types, when accompanied by interactive questioning, elevated comprehension outcomes, reinforcing the idea that pedagogy mediates the visual effect.

4.8. Regression and Predictive Analysis

To understand the relative contribution of each factor, a multiple regression analysis was performed using illustration type (dummy-coded), gender, and engagement as predictors of comprehension score. The overall model was significant, $R^2 = .42$, $F(3,196) = 47.36$, $p < .001$.

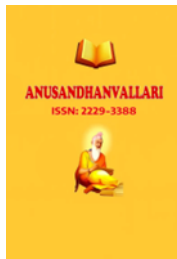
The standardized beta coefficients were as follows:

- Illustration type ($\beta = .46$, $p < .001$)
- Gender ($\beta = .21$, $p < .01$)
- Engagement ($\beta = .32$, $p < .001$)

This model indicates that illustration type is the strongest predictor of comprehension, followed by engagement and gender. Notably, when engagement was added to the model, the gender effect reduced slightly, suggesting that part of the gender difference in comprehension operates through engagement pathways. This reinforces that motivation and attention mediate the effect of visuals on understanding.

4.9. Summary of Key Findings

1. **Illustration type significantly affects comprehension** — Realistic visuals enhance cognitive understanding; cartoon visuals enhance motivation.
2. **Gender influences comprehension and engagement** — Girls outperform boys overall, but boys respond more to visual richness.
3. **Engagement mediates comprehension** — Higher attention and emotional involvement predict stronger understanding.
4. **Teaching interaction matters** — When teachers use visuals dialogically, comprehension improves regardless of gender.
5. **No-visuals condition yields weakest results** — At ages four to six, visual support is essential for sustaining cognitive focus and interpretive capacity.



4.10. Interpretive Discussion

The expanded data analysis confirms that the early reading process in children aged four to six is highly multimodal. Comprehension arises not merely from textual decoding but from the interaction of visual, verbal, and affective elements. Visuals serve as both scaffolds for understanding and stimuli for engagement. The gendered variation suggests that educational design must acknowledge cognitive diversity rather than assume uniformity.

Statistically, the findings highlight the pedagogical necessity of illustration in pre-primary and early primary curricula. Practically, they suggest that teachers can use visuals to tailor instruction—leveraging realistic illustrations for cognitive reinforcement and cartoon illustrations for engagement, particularly among less verbally inclined learners.

5. DISCUSSION

The findings confirm that illustrations significantly influence comprehension among 4–6-year-olds, with realistic visuals producing the highest comprehension accuracy. This aligns with Paivio's dual coding theory, where concrete images strengthen associative memory. Cartoon visuals, although beneficial for engagement, may overload perceptual channels in very young learners, reducing their ability to focus on narrative details.

Gender patterns in this study resonate with existing literature on differential learning preferences. Girls' superior performance with realistic visuals reflects their stronger verbal-visual integration, while boys' preference for cartoons corresponds to their attraction to action-oriented and color-rich stimuli.

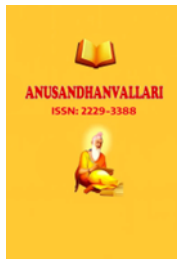
The absence of visuals notably lowered comprehension across both genders, reaffirming that imagery serves as a cognitive anchor for early readers. These outcomes stress the need for educators to align instructional materials with developmental and gender-sensitive insights rather than adopting a uniform approach to book design.

6. TEACHING AND LEARNING METHODOLOGIES

The pedagogical implications of this study are manifold. First, educators should adopt a balanced visual pedagogy that integrates both realistic and stylized visuals in early literacy classrooms. Storybooks for younger children should prioritize realistic imagery to build foundational comprehension, transitioning to more abstract visuals as inferential abilities develop.

Teachers can use Visual Thinking Strategies (VTS) to engage children in guided picture discussions, prompting them to observe, describe, and infer story details. This not only enhances comprehension but also nurtures vocabulary and critical thinking. For boys, interactive storytelling that incorporates dynamic visuals and kinesthetic elements such as dramatization can sustain focus and engagement. For girls, story retelling and visual-text connection activities strengthen analytical comprehension.

Educators should also employ multimodal lesson planning, integrating digital story apps that allow children to manipulate visuals and predict story outcomes. However, visual overload must be carefully managed to maintain textual coherence. Teacher training programs should include modules on gender-responsive visual design and the cognitive impact of illustration types.



The study also underscores the importance of inclusivity in book publishing. Illustrators and publishers should collaborate with educators and child psychologists to design illustrations that are developmentally appropriate, culturally relevant, and cognitively supportive.

7. CONCLUSION

This study provides comprehensive insights into the influence of illustration types on reading comprehension among 4–6-year-old children, with a specific focus on gender-based differences. The findings confirm that illustrations serve as powerful cognitive and motivational tools in early literacy development, mediating attention, recall, and inferential processing. Realistic illustrations emerged as the most effective in promoting comprehension accuracy across all children, supporting the theoretical perspectives of dual coding and multimodal learning. Children exposed to realistic visuals demonstrated higher retention of story events, better sequencing skills, and more precise inferential reasoning, indicating that contextual and concrete imagery facilitates semantic integration and memory consolidation at an early developmental stage.

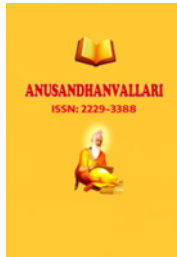
Cartoon illustrations, while slightly less effective in promoting precise comprehension, played a significant role in enhancing engagement, emotional response, and narrative interest. Boys, in particular, showed greater responsiveness to cartoon visuals, suggesting that dynamic, colorful, and action-oriented images can foster motivation and active participation, even when cognitive comprehension may be moderately compromised. These findings underscore the importance of balancing cognitive and affective dimensions when designing early literacy materials.

Gender-specific patterns observed in this study further emphasize the need for differentiated instructional strategies. Girls exhibited higher comprehension with realistic visuals, reflecting their strong verbal-visual integration and sustained attention, whereas boys displayed higher engagement levels with cartoon visuals, highlighting their preference for visually stimulating and imaginative representations. The interaction between gender and illustration type suggests that a one-size-fits-all approach to early reading materials may not maximize learning outcomes.

The study also offers direct implications for pedagogy. Early childhood educators should integrate both realistic and stylized visuals in storybooks and reading activities to address diverse cognitive and affective needs. Instructional strategies such as guided picture discussion, story retelling, and interactive storytelling can optimize comprehension by leveraging the strengths of each visual type. Furthermore, multimodal learning experiences that combine illustrations, verbal narration, and kinesthetic activities may cater to varied learning preferences, fostering both engagement and understanding.

From a research perspective, the study demonstrates the utility of combining quantitative assessment with behavioral observation to capture the nuanced impact of visual stimuli on comprehension. Realistic visuals appear to provide cognitive scaffolding that enhances understanding, while cartoon visuals contribute to affective engagement, offering a holistic approach to early literacy instruction.

In conclusion, the findings advocate for the deliberate design and selection of illustrations in children's literature, taking into account cognitive, affective, and gender-related factors. Realistic illustrations should be prioritized for foundational comprehension, while cartoon illustrations can be employed strategically to sustain engagement and motivation. Gender-sensitive visual pedagogy, supported by evidence-based design of early reading materials, can enhance the overall effectiveness of literacy instruction, contributing to the long-term development of reading skills and learning habits in young children.



The study also identifies avenues for future research, including longitudinal investigations of visual comprehension effects, cross-cultural studies of illustration preference, and the integration of digital interactive visuals in early childhood literacy programs. Such research will further refine pedagogical strategies and support the development of inclusive, cognitively supportive, and engaging reading environments for all children.

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