TECHNOLOGY-ASSISTED INTERACTIVE READING ACTIVITIES IN EARLY CHILDHOOD EDUCATION: A SYSTEMATIC REVIEW OF LITERATURE

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ABSTRACT

With the increasing integration of technology into early years education, an expanding body of research is delving into how technological tools can effectively engage young children in reading activities. In order to comprehensively explore the landscape of this burgeoning field, the authors conducted a systematic review of the literature concerning technology-assisted interactive reading activities within early childhood education. Employing an inductive approach, the authors meticulously analyzed 37 articles to discern the prevailing characteristics and outcomes of existing research. Three primary thematic findings emerged from the analyzed research. First and foremost, a majority of the studies underscored how technology-supported reading activities bolster various skills among children, elucidating the benefits they yield. By providing expanded access to diverse resources, these activities facilitate the development of language skills such as comprehension, phonological awareness, and communication. Furthermore, they enhance motivation, engagement, autonomy, and independence, fostering multisensory behaviors within a collaborative learning environment through opportunities for access to various resources. Secondly, the studies shed light on the challenges of using technology in interactive reading activities. These challenges encompassed diminished adult-child interaction, issues of distraction and concentration, device operation, as well as time management concerns. Lastly, the research highlighted the potential efficacy of employing these activities for parents and teachers. This effective utilization underscored the significance of technology in augmenting interactive reading experiences, discussing the potential for technology-assisted interactive reading activities in supporting adult-child interaction. The authors delve into the implications of these discerned themes and propose novel avenues for future research in technology-assisted interactive reading activities within early years education.

Keywords: Technology, early reading, early childhood education.

INTRODUCTION

In recent years, the educational landscape has witnessed a paradigm shift with the integration of technology into early childhood learning environments (Chang et al., 2023; Hermansson & Olin-Scheller, 2022; Merritt et al., 2022). This technological wave has opened up new dimensions for interactive learning experiences, fundamentally reshaping the way children engage with educational content. While traditional read-alouds have received considerable attention for their positive effects on children's development (Barnyak & Myers, 2023; Kesler et al., 2020; McClure & Fullerton, 2017; Thompson & Melchior, 2019), the nuanced advantages and drawbacks of incorporating technology into these sessions remain an area of research and under-explored.

Numerous studies have probed the influence of technology, mainly digital and interactive media, on early childhood literacy development and reading instruction. For instance, the ethnographic study by Hermansson and Olin-Scheller (2022) dissected the transition from conventional paper-based books to electronic books in early childhood classrooms. Their findings unveiled various reading processes within ebook activities, showing how metacognitive strategies could foster detachment from the text while embodied sense-making established meaningful connections to digital narrative texts. Wang et al. (2019) also delved into the behaviors of kindergarten students during buddy reading with app-based books and revealed a correlation between monitoring behaviors and elevated scores in inference and critical thinking. In a randomized comparison of tablet ebooks and print books, Reich et al. (2019) unearthed that while children engaged comparably with both formats, they expressed more about the tablet when interacting with ebooks. Although posttest scores slightly favored print, this suggested that ebooks offer comparable educational affordances, potentially influenced by the allure of novelty in comprehension. In another study exploring multimedia story reading and questioning, Zhou and Yadav (2017) uncovered potential benefits in vocabulary learning and engagement for children's literacy skills. Conversely, Neuman et al. (2017) investigated the impact of digital and non-digital storybooks on oral language comprehension among low-income preschoolers, finding content supremacy over format with no significant differences observed between mediums. In addition, in a study by Korat et al. (2017), the focus shifted to the effects of repeated ebook reading on word learning in preschoolers, both with and without word explanation support. Results indicated that utilizing a dictionary within ebooks bolstered receptive word learning and explanation.

These studies collectively underscore the urgency of critically appraising the infusion of technology into early childhood education. While the outcomes hold promise, substantial areas necessitate deeper exploration to fully grasp the implications of technology-supported interactive read-aloud activities within this context. The intricate interplay between technology and traditional literacy practices demands a nuanced understanding of the optimal utilization of technology to maximize early childhood learning encounters. In a world where technology continues to reshape educational practices, maintaining a critical perspective becomes paramount to ensure that young learners' reading capabilities are effectively nurtured and advanced through technology-enriched experiences. Our objective in undertaking this critical analysis is to make a substantial contribution to early

childhood education. This endeavor equips educators and practitioners with an exhaustive comprehension of the latent benefits and consequences arising from the adept fusion of technology into read-aloud sessions. Furthermore, this review illuminates how technology-assisted interactive read-alouds can support children's development and cultivate a positive and engaging learning milieu for young learners. The implications of this research stretch beyond immediate applications, serving as a foundational stride towards future research and the establishment of evidence-based practices within early childhood education.

In the present study, the following questions will be addressed:

1) What technology tools can effectively facilitate interactive reading experiences for young children?
2) What are the benefits and challenges of technology-supported interactive read-aloud activities in early childhood education?
3) What methods and approaches can enhance the effective utilization of technology during interactive read-alouds, whether facilitated by educators or parents?

METHOD

Research Model

The research model employing a systematic review follows a rigorous and structured methodology that systematically identifies, evaluates, and synthesizes existing literature on technology-assisted interactive reading activities in early childhood, providing a comprehensive overview of the current state of knowledge and identifying key themes, trends, and research gaps (EPPI, 2019). This approach enables us to draw evidence-based conclusions and make informed recommendations for future studies and practical applications.

Population and Sampling

This review aimed to systematically identify and compile empirical articles from 2010 to 2023 that evaluated technology-based reading activities in early childhood within the context of home, school, or informal learning environments. Our initial step involved scrutinizing scholarly journals about reading to recognize those that featured articles or subjects pertinent to our research. After considering their focus areas, we compiled a roster of journals that we felt were suitable. Then, we examined their tables of contents to identify articles relevant to our research objectives from 2010 to May 2023: The Reading Teacher, Reading Research Quarterly, Journal of Research in Reading, Reading and Writing, Reading & Writing Quarterly, and Scientific Studies of Reading. Subsequently, we performed comprehensive keyword searches across academic databases such as the Web of Science and ERIC. We employed a set of predetermined search terms to conduct our literature search: technology + "reading," technology + "read-aloud," technology + "interactive read-aloud", technology + "reading activities," digital + "reading," digital + "read-aloud," digital + "reading activities, and digital + "interactive read-aloud." We identified 37 titles that displayed potential relevance to our research objectives (Table 1). To ensure the selection of appropriate articles for our study, we established a set of specific inclusion criteria:

1. *Publication date:* Articles published after 2010 are selected to ensure relevance to current research in the field.

2. *Peer-reviewed:* Only peer-reviewed articles are considered, ensuring the quality and validity of the research.

3. *Topic relevance:* Articles focused on early childhood education, specifically addressing aspects related to technology-based reading activities, are considered.

4. *Sufficient information:* Selected articles provided adequate information and substantial details regarding technology-based reading activities in early childhood. This includes descriptions of the technology tools, instructional strategies, participant characteristics, methodologies employed, outcomes measured, and results reported.

Table 1. The Selected Articles for the Systematic Review

Study	Year	Study Locations	Technology Tools	Participant Characteristics	Participant Backgrounds	Outcome Types	Theoretical Frameworks	Research Methods
1	2010	Israel	E-books	Age: 5-6 years/6-7 years	Middle SES	• Word meaning • Word reading • Story comprehension • Story production	-	Quantitative
2	2011	The US	Computer-asisted instruction for phonics-based reading	Age: 5 years	Diverse backgrounds	• Phonological awareness • Word reading	-	Quantitative
3	2012	The US	E-books, iPad, iPod	Age: 4-5 years	-	• Multisensory behaviors • Types of communication	-	Qualitative
4	2012	Israel	E-books	Age: 4-5 years/5-6 years	Low SES	• Word meaning • Word reading	The synergy theory	Quantitative
5	2013	Israel	E-books	Age: 3-4 years	Low SES	• Word comprehension • Phonological awareness	Sociocultural theory	Quantitative
6	2013	The US	E-books	Age: 3-5 years	Monolingual mid/high-SES English-speakers with normal hearing and language abilities	• Story comprehension	-	Quantitative
7	2013	The US	iPod, audio books	Kindergarten students	Diverse backgrounds	• Reading fluency • Motivation • Engagement • Sustained interest • Self-esteem • Study skills	-	Quantitative
8	2015	Taiwan	iRobiQ	Age: 2-3 years	-	• Reading literacy • Learning motivation • Learning effect • Reduced distraction • Peer Collaboration • Engagement • Active and interactive learning environment	-	Quantitative
9	2016	Israel	E-books	Age: 4-5 years/4 years/5-6 years	Low SES	• Word reading • Phonological awareness	-	Mixed methods

10	2016	Thailand	Interactive e-story	Age: 5-6 years	Ethnic minority children	• Word recognition • Story comprehension	Whole language approach	Quantitative
11	2016	The US	iPad	Age: 4 years	Diverse backgrounds	• Vocabulary	-	Quantitative
12	2017	Australia	Multimodal stories	Age: 5-6 years	-	• Sense of belonging • Participation • Engagement • Knowledge and understanding	Theories of materiality	Qualitative
13	2017	The US	E-books	Age: 4 years	Diverse backgrounds	• Story comprehension	-	Quantitative
14	2017	The US	Multimedia story reading	Age: 5 years	Diverse backgrounds	• Vocabulary • Interaction • Story comprehension • Engagement	Dual coding theory	Quantitative
15	2017	The US	Interactive story book apps	Age: 4-5 years	Middle and Low SES	• Word recognition • Story comprehension • Engagement	-	Quantitative
16	2017	Israel	E-books	Age: 5-6 years	Low SES	• Vocabulary	-	Quantitative
17	2018	The US	iPad	Age: 3-5 years	Diverse backgrounds	• Agency • Collaboration	Broad vision of story	Mixed methods
18	2018	The US	iPod	Age: 5-6 years	Diverse backgrounds	• Vocabulary • Reading Skills • Imagination • Listening • Independence • Sense of Accomplishment • Variety of stories • Excitement about reading • Focus enhancement • Attention span • Time constraints • Requiring assistance	-	Mixed methods
19	2019	Australia	Digital resources	Age: 8-11 years, 4-5 years	Diverse backgrounds	• Literacy learning • Interaction	Culturally specificity; Theories of materiality	Mixed methods
20	2019	The US	E-books	Age: 3-5 years	-	• Story comprehension	-	Quantitative

|								
						• Story sequencing • Vocabulary • Engagement • Child vocalizations • Engagement		
21	2019	The US	Interactive app books	Age: 5-6 years	-	• Monitoring behaviors • Critical thinking/inference • Vocabulary	Multimodal literacy theory; Sociocultural theory	Mixed methods
22	2019	The US	Educational apps	Age: 4 years & their primary caregivers	Diverse backgrounds	• Engagement • Parenting	-	Mixed methods
23	2019	The US	E-books	Age: 5 years	Diverse backgrounds	• Story retelling • Critical thinking/inference	Transactional theory of reading	Mixed methods
24	2019	The US	Blended Learning Program—Lexia Core5 Reading	Kindergarten students	Diverse backgrounds, Low SES	• Reading	-	Mixed methods
25	2020	Australia	Multimodal digital texts, using tablets, open-ended creative apps	Age: 5 years	Low SES	• Reading • Oral language • Writing	-	Mixed methods
26	2020	Israel	Digital spelling game	Age: 5 years	Low SES	• Spelling • Word decoding • Letter knowledge • Phonological awareness	Dual coding theory of cognition	Quantitative
27	2020	Brazil	Escribo play video games	Age: 4-5 years	-	• Reading	-	Quantitative
28	2020	The US	Tablets	Age: 4-5 years	Diverse backgrounds	• Phonological awareness	-	Quantitative
29	2021	Turkey	E-books	Age: 4-5 years	-	• Receptive and expressive language	-	Mixed methods
30	2021	The US	Augmented reality (AR)	Age: 3-6 years	-	• Letter naming skills • Motivation	Constructivist learning perspective	Mixed methods

31	2021	Portugal	Artificial grammar learning	Age: 5-6 years	-	• Learning to read	-	Quantitative
32	2021	Australia	E-books	Age: 3-5 years	-	• Parent-child interaction	-	Qualitative
33	2021	Turkey	E-books	Age: 5 years	-	• Executive function • Receptive vocabulary	Theory of Mind; Executive Function	Quantitative
34	2022	Sweden	E-books	Age: 6 years	-	• Metacognitive process • Embodied sense-making	Theory of affect; Langer's conceptual work on envisionments	Qualitative
35	2022	Sweden	Interactive touchscreens	Age: 2 years	-	• Communicative actions • Interaction	-	Mixed methods
36	2023	Taiwan	AR picturebooks	Age: 5 years	-	• Learning effectiveness • Cycle of behavioral changes	-	Mixed methods
37	2023	The US	E-books	Age: 2-5 years	-	• Language • Conversation quality • Equivalence in opportunities	-	Quantitative

After carefully reviewing the abstracts, our initial pool of 244 titles was narrowed down to 126 (Figure 1). However, due to insufficient information in the abstracts, it was challenging to determine the relevance of certain articles to our study. The first author meticulously examined these titles and excluded those that did not align with our criteria, resulting in a refined selection of articles. This rigorous process identified 35 articles that met our inclusion criteria. To ensure comprehensive coverage of the topic, the first author thoroughly examined the reference sections and utilized Google Scholar's citation feature to explore additional relevant sources. As a result, 2 articles were identified and deemed pertinent to our research. In the end, we compiled a final corpus of 37 articles that form the basis of our study. This collection forms the basis of our study, ensuring a comprehensive exploration of the topic while adhering to our exclusion criteria, in which we exclude articles related to special needs education, EFL education, primary or higher degrees, and meta-analyses or systematic reviews.
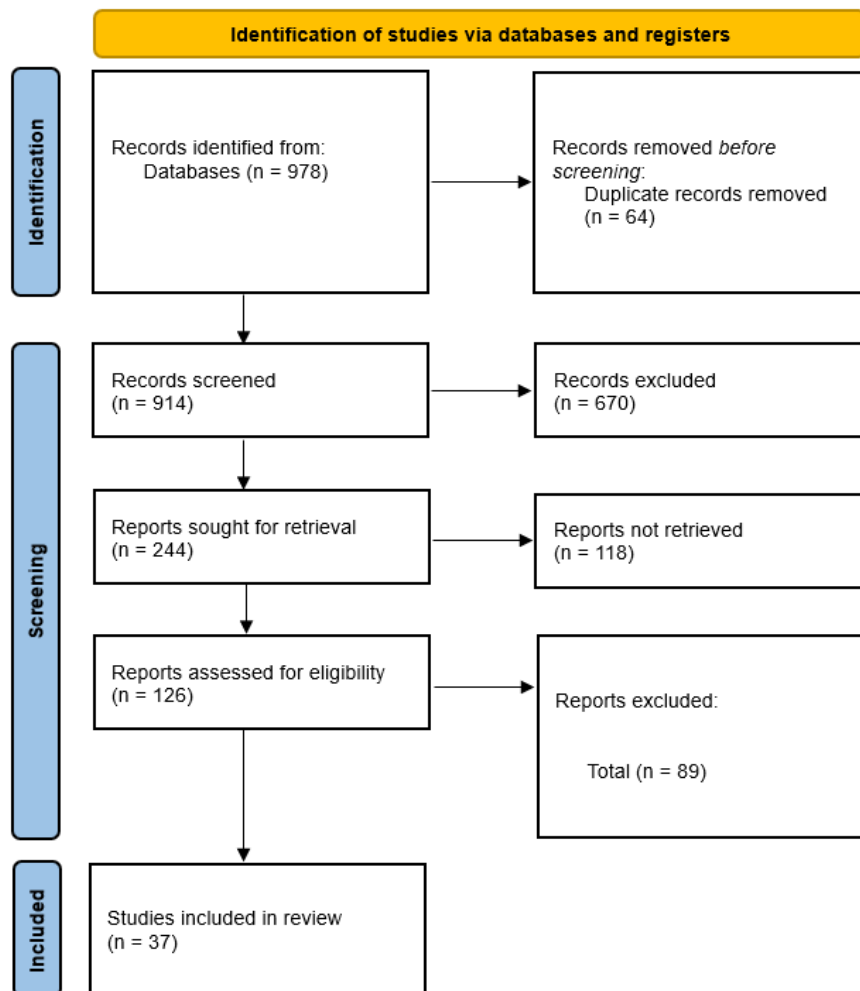
Figure 1. Identification of studies

Data analysis

The systematic review of technology-supported interactive read-alouds in this research employed a rigorous coding process. The coding process involved systematically applying a comprehensive framework encompassing several key categories relevant to the study, including study locations, technology tools, participant characteristics, outcomes, theoretical frameworks, and research methods. This framework was designed to ensure a comprehensive analysis of the selected articles.

Two researchers independently analyzed the selected articles. These researchers utilized the coding framework as a guide to systematically analyze and extract relevant information from each article. The coding process involved carefully examining the articles to identify and extract data related to the predefined categories within the framework. During the analysis, the researchers paid close attention to study locations, noting the geographic distribution of the research studies. They also coded the specific technology tools employed in each study, capturing the technological interventions that support interactive read-alouds, such as electronic books, iPads and iPods. Participant characteristics were also carefully coded, examining the diversity among participants in terms of socioeconomic status, cultural backgrounds, and prior experience. In addition, key findings from the selected articles were meticulously extracted and documented. Positive outcomes and benefits associated with technology-based interactive read-alouds were identified and summarized.

Additionally, challenges and limitations identified in the studies were acknowledged, providing a critical perspective on the existing research. The researchers also coded the theoretical frameworks used in each study, identifying the theoretical underpinnings that guided the research, such as Vygotsky's sociocultural theory, which provided a conceptual framework for understanding the educational benefits of interactive read-alouds. Lastly, the coding process involved identifying and categorizing the research methods employed in each study, such as quantitative, mixed-methods, or qualitative approaches.

In this sense, the data analysis involved a combination of descriptive and thematic approaches. Descriptive statistics were employed to summarize the characteristics of the selected articles, while thematic analysis was conducted to identify recurring patterns and themes within the coded data. The integration of qualitative and quantitative findings facilitated a comprehensive understanding of the research landscape in the field. Limitations and biases within the reviewed studies were critically examined and discussed to provide a nuanced evaluation of the existing literature. These considerations were taken into account during the interpretation and generalization of the findings, ensuring a balanced and rigorous analysis. To ensure the accuracy and reliability of the coding process, the two researchers conducted their analyses independently. Any discrepancies or disagreements in coding were resolved through discussion and consensus. This iterative and collaborative process enhanced the validity and reliability of the coding outcomes.

FINDINGS

The findings presented in this study are derived from a systematic review encompassing a collection of 37 articles published from 2010 to 2023.

Study locations and participant characteristics

Among the 37 studies examined, a notable proportion of 18 studies were focused on technology-supported interactive reading activities within the United States. Several other studies explored programs in various regions, including Israel (6), Australia (4), Taiwan (2), Sweden (2), Turkey (2), Brazil, Portugal, and Thailand.

The age range of participants encompassed a diverse spectrum. It included the following categories: 2-year-olds (1), 2-3 year-olds (1), 2-5 year-olds (1), 3-4 year-olds (1), 3-5 year-olds (4), 3-6 year-olds (1), 4 year-olds (3), 4-5 year-olds (5), 4/4-5/5-6 year-olds (1), 4-5/5-6 year-olds (1), 5 year-olds (7), 5-6 year-olds (6), 5-6/6-7 year-olds (1), 6 year-olds (1), 4-5/8-11 year-olds (1), and kindergarten students (2).

The participants in the selected articles showed a range of diverse backgrounds, with 12 studies encompassing participants from varied ethnic and socioeconomic backgrounds. One study specifically focused on ethnic minority children, while seven studies included participants from low socioeconomic backgrounds. Additionally, one study comprised participants from both middle and low socioeconomic backgrounds, while another study involved participants from middle socioeconomic backgrounds. Furthermore, one study specifically targeted monolingual mid/high-SES English-speaking individuals with normal hearing and language abilities, emphasizing the specificity of participant characteristics in that particular study.

Research methods

Out of the total number of studies examined, a considerable portion of twenty studies employed quantitative research methods to investigate the research questions. Additionally, thirteen studies adopted a mixed-methods approach, combining quantitative and qualitative data collection and analysis techniques. Four studies, on the other hand, utilized a qualitative methodology to delve into the intricacies of the phenomenon.

Publication years

The selected articles spanned a range of publication years, providing a comprehensive analysis of the topic over time, as shown in Figure 2.
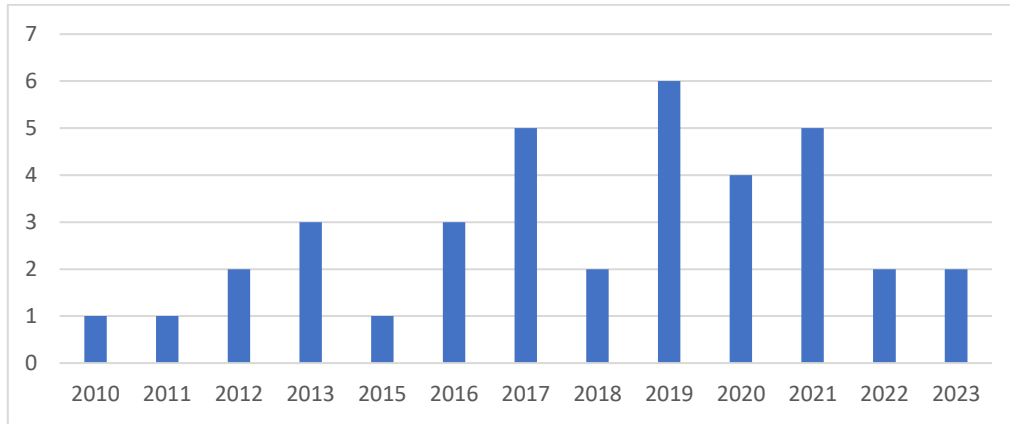
Figure 2. Number of the selected articles based on the publication year

Technology tools

The analysis of the selected articles revealed a diverse range of technological tools utilized in technology-supported interactive read-aloud interventions. Among these tools, ebooks emerged as the most widely studied, followed by AR picture books, artificial grammar learning, augmented reality (AR), blended learning programs like Lexia Core5 Reading, computer-assisted instruction for phonics-based reading, digital resources, digital spelling games, educational apps, Escribo play video games, iPads, audiobooks, iRobiQ, multimedia story reading, multimodal digital texts, and tablets. These findings highlight the rich technological resources that enhance interactive read-aloud experiences (Figure 3).
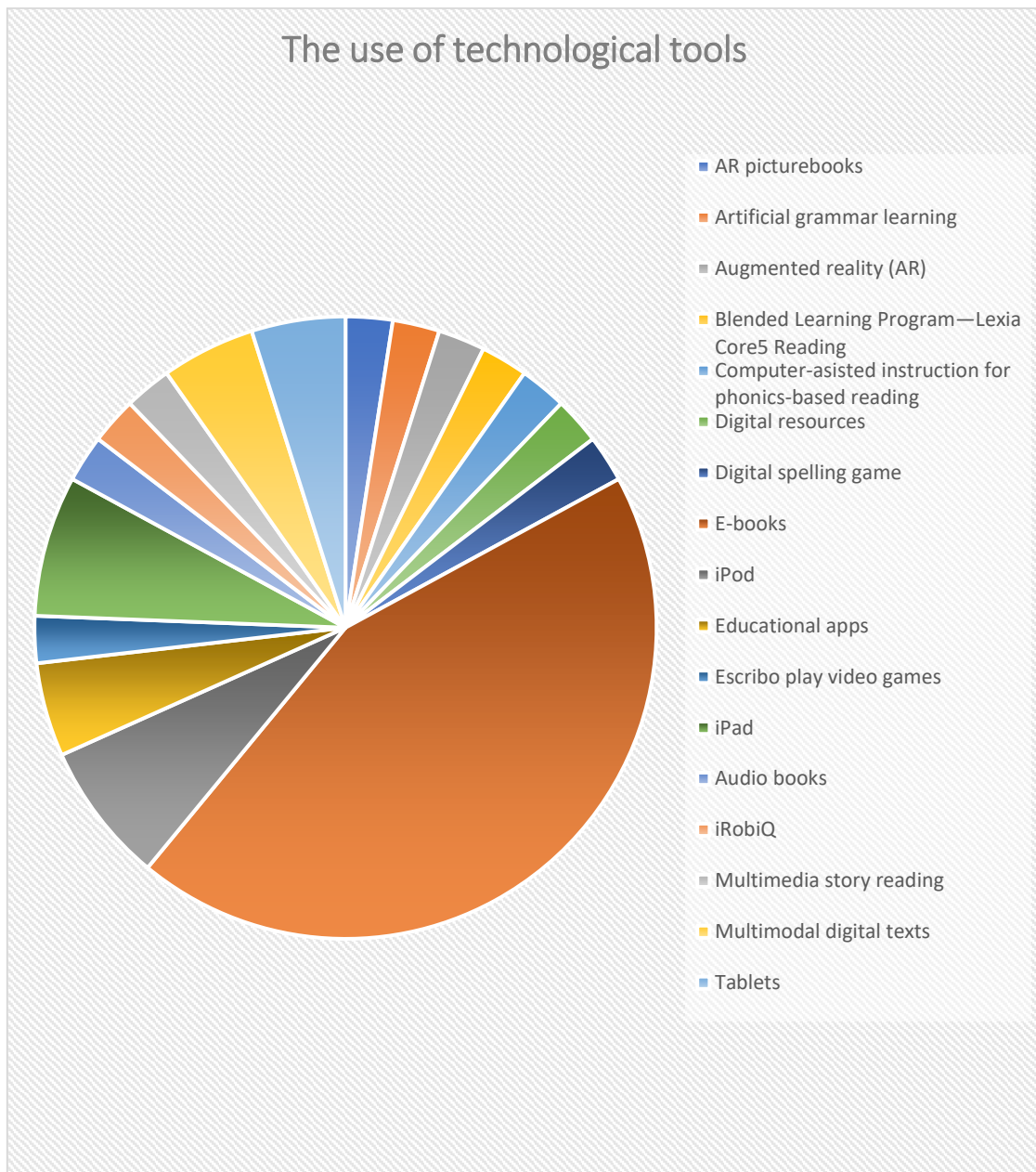
Figure 3. The use of technological tools in the selected articles

Theoretical frameworks

Table 2 provides a summary of the prominent theoretical frameworks described by the authors as guiding their approaches in the selected articles. These theoretical frameworks served as the foundation for our analysis, informing our interpretation of the results and facilitating the organization of program characteristics into overarching principles.

Table 2. Key Guiding Theories in The Selected Article

Theory (Authors)	Description	Authors referencing this theory
Theory of affect (Baruch de Spinoza & Brian Massumi 2015)	The Theory of Affect posits that affect refers to the intensity of bodily sensations and emotions, which influence human behavior and perception without being limited to specific cognitive processes or mental representations. It emphasizes the primacy of bodily experiences and their role in shaping individual experiences and actions.	Hermansson, C. & Olin-Scheller, C. (2022)
Langer's conceptual work on envisionments (2000; 2011)	Langer's conceptual work centers on the idea that human cognition and understanding are not solely based on fixed mental representations, but rather, they involve dynamic and evolving mental images or "envisionments" that continuously shape our interpretations, perceptions, and responses to the world around us. Envisionments allow for flexible and creative thinking, enabling individuals to construct meaning and make sense of complex situations and information.	Hermansson, C. & Olin-Scheller, C. (2022)
Constructivist learning perspective (Tynjala 1999)	The Constructivist learning perspective is an educational theory that emphasizes the active role of learners in constructing their knowledge and understanding through interactions with their environment. According to this perspective, learning is a process of meaning-making, where learners actively engage with new information, integrate it with their existing knowledge, and construct their own unique understanding of the subject matter.	Pan, Z., López, M. F., Li, C. & and Liu, M. (2021)
Culturally specificity (Heath 1983)	Culturally specificity refers to the idea that language, literacy, and learning practices are deeply influenced by the cultural context in which they occur. Heath's work highlights the diversity and richness of language and literacy practices across different cultural communities, emphasizing the importance of understanding and valuing these cultural variations in educational settings.	Kervin, L., Danby, S. & Mantei, J. (2019)
Theories of materiality (Burnett, Merchant, Pähl, & Rowsell, 2014)	The theories of materiality explore the significance of physical objects, artifacts, and digital technologies in shaping learning experiences and practices. These theories recognize that materiality plays a crucial role in mediating human interactions, cognition, and meaning-making, highlighting the need to consider the material aspects of educational contexts in understanding how learning takes place.	Kervin, L., & Mantei, J. (2017); Kervin, L., Danby, S. & Mantei, J. (2019)
Broad vision of story (Cuningham, 2015)	The broad vision of story expands the traditional notion of storytelling beyond mere narrative texts to encompass a wide range of multimodal and interactive forms of storytelling. This perspective emphasizes the integration of various modes, such as visual, auditory, and kinesthetic elements, to create rich and immersive storytelling experiences that go beyond traditional linear narratives.	Fantozzi, V. B., Johnson, C. & Scherfen, A. (2018)
Dual coding theory of cognition (Paivio, 1979; 2006; 2013)	The Dual Coding Theory of Cognition posits that human cognition involves two separate but interconnected mental representations: verbal and imaginal codes. According to this theory, information can be processed and stored in both linguistic and non-linguistic formats, enabling individuals to use multiple channels for encoding, retrieving, and representing knowledge, which can enhance learning and memory retention.	Elimelech, A. & Aram, D. (2020); Zhou, N. & Yadav, A. (2017)
Multimodal literacy theory (Jewitt & Kress, 2003; Kress, 2010)	The Multimodal Literacy Theory emphasizes the significance of multiple modes of communication, such as image, sound, gesture, and spatial arrangement, in contemporary literacy practices. This theory recognizes that communication and meaning-making extend beyond traditional textual forms, and individuals engage with and construct meaning using a combination of diverse semiotic resources, which are essential in understanding and navigating today's complex communication landscape.	Christ, T., Wang, X.C., Chiu, M. M. & Strekalova-Hughes, E. (2019)
Vygotskian sociocultural theory (Cobb, 1996; Cole & Wertsch, 1996; Vygotsky, 1978)	Vygotskian sociocultural theory focuses on the role of social interactions, cultural context, and historical development in shaping cognitive processes and learning. This theory emphasizes that learning occurs through collaboration and participation in social activities, and it highlights the importance of cultural tools and mediation in fostering cognitive development and knowledge acquisition.	Korat, O., Shamir, A., & Heibal, S. (2013); Christ, T., Wang, X.C., Chiu, M. M. & Strekalova-Hughes, E.(2019)

Rosenblatt's (1982, 1985) transactional theory of reading	Rosenblatt's transactional theory of reading emphasizes the dynamic interaction between the reader and the text during the reading process. According to this theory, reading is not a passive act but rather an active and reciprocal transaction, where the reader's background, experiences, and interpretations influence the meaning they derive from the text. Rosenblatt's theory highlights the importance of the reader's subjective response and personal engagement with the text in shaping the reading experience.	Christ, T., Wang, X.C., Chiu, M. M. & Strekalova-Hughes, E. (2019)
The synergy theory (Neuman, 1997)	The synergy theory suggests that the combined use of print and digital media can have a synergistic effect on children's literacy development. This theory emphasizes the potential benefits of integrating traditional print materials with digital technologies, as both mediums can complement and enhance each other, leading to more effective and enriching literacy learning experiences for young learners.	Korat, O., & Shamir, A. (2012)
Theory of Mind (Devine and Hughes 2016; Miller 2009; Stone et al. 1998)	The Theory of Mind refers to the ability to understand and attribute mental states, such as beliefs, intentions, and emotions, to oneself and others. This theory plays a crucial role in social interactions, communication, and empathy, as individuals with a well-developed theory of mind can better interpret and predict others' behavior and perspectives, leading to more sophisticated social cognition.	Altun, D. (2021)
Whole language approach (Goodman, 1991)	The Whole Language Approach is an instructional method that emphasizes the integration of all language skills, including reading, writing, speaking, and listening, in a meaningful and authentic context. This approach encourages students to engage in language-rich activities and real-world experiences to develop their literacy skills holistically, promoting a deeper understanding of language and literacy as a whole rather than isolated components.	Phadung, M., Suksakulchai, S. and Kaewprapan, W. (2016)

The skills and benefits that technology-supported interactive reading activities promote in early childhood

Technology-supported interactive reading activities have been found to promote language development and literacy skills in early childhood. They have demonstrated positive effects on vocabulary learning, motivation, and learning among young learners. These activities foster engagement, and children show a deeper connection to digital narrative texts compared to traditional methods, as shown in Table 3.

Table 3. Skills & Benefits That Technology-Assisted Interactive Reading Activities Promote

Skills and benefits	Findings of the studies	Authors (date)
Vocabulary development	• Children who read e-books exhibited significant progress in word meaning and word reading compared to control groups. In addition, kindergarten children showed more significant progress in word reading than first graders. • Children who read e-books supported directly by the computer showed progress in the meaning and reading of those words compared to the control group. There were no differences in progress between the two age groups or in the interaction between age and type of word support. • Tech-supported interactive read-alouds were found to have positive outcomes in expressive vocabulary, definition/examples measures, and the generalization of expressive and receptive knowledge of learned words.	Korat (2010); Korat & Shamir (2012); Dennis (2016)
Comprehension	• Both kindergarten children and first graders showed a good level of story understanding in less demanding tasks like answering true/false questions. However, first graders performed significantly better in more demanding tasks like story production. Kindergarten children and first graders who worked on the software individually were able to produce impressive stories similar to the e-books they read. • The form of the book (digital or print) did not significantly impact story comprehension. Both digital and traditional formats were equally effective in promoting comprehension, with the content of the book being a stronger predictor.	Korat (2010); Neumann, et al. (2017)
Phonological awareness	• Technology-supported interactive read-alouds have positive outcomes in phonological awareness. • Preschoolers and low-performing kindergartners benefit from intensive and systematic practice provided by computer-assisted instruction programs. • Children in intervention groups showed significant progress in word comprehension and phonological awareness compared to the control group. • Both children's initial knowledge and interventions contributed more to language progress than factors like maternal education, frequency of shared book reading, and computer use.	Macaruso & Rodman (2011); Korat, Shamil & Heibal (2013)
Multisensory behaviours	• Different formats and levels of behavioral regulation influence children's engagement with e-books. Teacher-led shared reading on touch screens affords less control for children compared to independent e-book browsing and reading. • Control influences the incidence of multisensory behaviors, with looking-touching-listening behaviors increasing with child control.	Roskos, Burstein & You (2012)
Communication	• The use of language in e-book interactions has implications for e-book design, suggesting the incorporation of prompts and cues to support language use.	Roskos, Burstein & You (2012)

Motivation and engagement	• Using devices like iPod Shuffle or interactive robots like iRobiQ resulted in greater motivation to read, increased engagement, sustained interest in stories, and improved self-esteem and study skills. • Tech-supported interactive read-alouds foster collaboration, reduce distractions, and promote better engagement and learning outcomes.	Boeglin-Quintana & Donovan (2013); Hsiao, et al. (2015); Pan, et al. (2021); Hover (2018)
Literacy development	• Technology-supported interactive read-alouds have shown significant gains in reading scores, writing scores, reading literacy, learning motivation, engagement, and learning effects. They have been particularly effective for children from low socioeconomic backgrounds and ethnic minority children. • Improvements in children's oral language and writing, as well as reading.	Zipke (2017); Elimelech & Aram (2020); Amorim et al. (2020); Phadung et al. (2016); Oakley et al. (2020)
Learning effectiveness	• Using technology tools like iPads or augmented reality (AR) can enhance learning effectiveness. • Careful design and consideration of instructional implications are necessary to ensure optimal learning outcomes.	Chang et al. (2023); Hsiao, et al. (2015); Phadung et al. (2016); Korat et al. (2017); Hover (2018); Kervin et al. (2019)
Autonomy and independence	• Technology tools, such as iPads or tablets, can promote independence and allow students to choose stories or interact with educational apps. • It empowers children in their learning process and provides opportunities for autonomous decision-making.	Hover (2018); Davidson et al. (2021); Samuelsson et al. (2022)
Access to resources and variety	• Technology, such as iPads or digital devices, offers access to a variety of appropriate and enjoyable stories, introduces books to children, and exposes them to materials they may not have at home. • It broadens the range of learning resources available to children.	Hover (2018); Kervin et al. (2019); Macaruso et al. (2019);
Collaborative learning environment	• Technology, such as bidirectional interactive robots or touch-based devices, can foster peer collaboration, competition, and create active and interactive learning environments. • It supports collaborative learning and diverse learning content.	Hsiao et al. (2015); Dennis (2016); Zhou & Yadav (2017); Fantozzi et al. (2018); Macaruso et al. (2019); Macaruso & Rodman (2011)

The potential challenge technology-supported interactive reading activities pose

While technology-supported interactive reading activities offer numerous benefits, some potential challenges have been identified. Studies indicate that there is a risk of over-reliance on the device, which may divert attention away from the content of the book. Concerns about screen time and its impact on young learners during these activities have also been raised, demonstrated in Table 4.

Table 4. Challenges That Technology Supported Interactive Reading Activities Pose

Challenges	Findings of the studies	Authors (Date)
Adult-child interaction	The presence of electronic features in e-books can negatively impact parent-child dialogic reading and the quality of interaction. Parents may spend more time talking about the child's behavior instead of relating the story to the child's life, leading to less content-focused and dialogical reading. In addition, the interaction between teachers and children and between children themselves may be limited during digital and traditional reading groups, resulting in insignificant increases in children's language scores.	Parish-Morris et al. (2013); Simsek & Isikoglu (2021)
Distraction and focus	Some students may struggle with listening and staying focused during digital read-alouds due to short attention spans or the presence of distractions. This can affect their ability to fully engage with the story and comprehend the content.	Hover (2018)
Limited interaction	Interactions between teachers and children or between children themselves may be limited during digital and traditional reading groups. Limited interaction during reading sessions can hinder the increase in children's language scores.	Simsek & Isikoglu (2021)
Device operation	Some students may have difficulty operating the devices used for tech-supported interactive read-alouds, requiring additional assistance from teachers or peers. This can disrupt the flow of the reading experience and affect engagement.	Hover (2018)
Matching audio and text	In some cases, it may be challenging to match the audio stories to the corresponding books, leading to confusion and difficulty for students in following the story.	Hover (2018)
Varying audio levels	Recorded stories may have different audio levels, requiring adjustments in volume before each story. This inconsistency can disrupt the reading experience and potentially affect comprehension.	Hover (2018)
Time management	Some students may need more time to complete activities or projects related to tech-supported interactive read-alouds, especially for English Language Learners (ELLs) or those who require additional support.	Hover (2018)
Nonstandard letter formations	Certain software or applications may not detect or address nonstandard letter formations made by students during early spelling activities. This lack of detection can impact the effectiveness of the learning experience.	Kervin et al. (2019)
Interactional dynamic	The use of touchscreens and other devices can lead to changes in communicative actions. While children may talk less during touchscreen sessions, they may display other types of communicative actions, potentially affecting the nature of interaction during the reading experience.	Samuelsson et. Al. (2022)
Individual Differences	Challenges can arise due to individual differences, such as short attention spans, difficulties in operating devices, or struggles in determining which stories have already been heard. It is important to address these challenges to ensure optimal participation and engagement.	Hover (2018)
Limited learning effectiveness	Not all digital resources or programs promote active and engaged literacy learning in meaningful and socially interactive contexts. The selection and use of digital resources require careful consideration to ensure better learning outcomes for all students.	Kervin et al. (2019)
Acquiring linguistic rules	First-grade students learning to read may experience difficulties in learning the rules underlying linguistic materials implemented with digital resources. This may hinder their ability to learn finite-state grammars implemented with linguistic materials.	Soares et al. (2021)

The effective use of technology in interactive read-aloud by parents and teachers

This study's findings point out that parents and teachers have shown the potential to use technology effectively in interactive read-alouds with young children. Parents have utilized technology to facilitate interactive reading experiences at home, while teachers have incorporated technology to enhance interactive read-aloud sessions in early childhood classrooms, as shown in Table 5.

Table 5. The Effective Use Of Technology In Interactive Read-Alouds By Parents And Teachers

Aspect	Findings of the studies	Authors (Date)
Adult-Child Interaction	• When parents engage in interactive read-alouds with their children using technology, it can positively impact children's language development. • Presence of electronic features in e-books may negatively affect parent-child dialogic reading; traditional books or e-books with electronic features turned off foster more dialogical and content-focused reading interactions. • E-books with adult support offer an efficient context for children's early language progress, enhancing word reading. • The level of adult support and considerate e-book context contribute to expanding talk and language development during shared reading. • When parents and teachers effectively use technology in interactive read-alouds, it can enhance language development, support vocabulary learning, promote engagement, and create interactive and collaborative learning environments. • By providing appropriate guidance, support, and meaningful interactions, parents and teachers can maximize the benefits of technology in fostering children's literacy skills.	Davidson (2021); Korat et al. (2013); Parish-Morris et al. (2013); Korat & Segal-Drori (2016); Griffith & Arnold (2019); Kervin et al. (2019)
Teacher-Led Shared Reading	• Teacher-led shared reading using touch screen devices may be less conducive to children's control and engagement compared to teacher-monitored independent e-book reading. • Teachers play a vital role in facilitating and guiding children's interactions with technology during read-aloud sessions, promoting better engagement and behavior regulation.	Roskos et al. (2012)
Language Use and Engagement	• Children's use of language during interactive read-alouds has implications for e-book design; assistants can prompt and cue language use, facilitating interactions in both teacher-led and child-led settings.	Roskos et al. (2012)
Effective Use of Multimedia	• Multimedia stories on touch-based devices can significantly improve preschool children's vocabulary and reading engagement. • Effective questioning techniques and multimedia elements enhance vocabulary learning and reading engagement. • Providing cues and prompts in multimedia stories aids children in learning to read and understanding story content.	Zhou & Yadav (2017); Roskos et al. (2012)
Read-Aloud Function and Autonomy	• The read-aloud function in digital storybooks supports children's word recognition and comprehension scores. • Allowing children to independently explore apps or operate devices during read-aloud sessions can lead to higher word recognition and story comprehension scores. • Technology provides children with autonomy and agency in their reading experiences.	Phadung et al. (2016); Zipke (2017); Fantozzi et al. (2018)
Instructional Implications	• Teachers can incorporate technology, such as interactive toys or touch-based devices, to create active and interactive learning environments for children. • Bidirectional interactive robots foster peer collaboration and competition, promoting a collaborative learning atmosphere and offering diverse learning content.	Hsiao et al. (2015); Christ et al. (2019)
High-Quality Shared Reading	• Carefully designed digital books with narration provide similar opportunities for engaging in high-quality shared reading as print books, promoting literacy development through high-quality shared reading experiences between parents or teachers and children.	Strouse et al. (2023)

CONCLUSION and DISCUSSION

The present study aimed to systematically identify and compile articles evaluating technology-based reading activities during the early childhood period between the years 2010-2023. Out of the 37 articles reviewed, 18 were found to have been conducted in the United States. Upon examining the age range categories of the participants in the studies, it was concluded that five-year-olds were the most prevalent. Based on the publication year, the highest number of selected articles was from the year 2019.

In the studies examined within the context of this research, it is underscored that technology-assisted reading activities foster various skills in children. Among these skills, emphasis has been placed on the development of vocabulary, phonological awareness, communication, and writing skills. The study reviewed by Turgut and Kışla (2015) discussed that the digital storytelling method enhanced students' creativity, problem-solving, writing, communication, higher-order cognitive thinking capacity, empathy-building skills, and motivation. In this regard, the present research shares similarities. The studies under examination have unveiled that, among the technological tools employed, electronic books (ebooks) emerged as the most frequently utilized. Korat (2010), Dennis (2016) and Korat and Shamir (2012) have indicated that children who read ebooks demonstrated progress in both the comprehension and reading of these words compared to the control group. In the study conducted by Çetinkaya, Öksüz and Öztürk (2018), it is asserted that interactive reading has favorable impacts on students' vocabulary and language proficiency. Research indicates that in environments where electronic storybooks are utilized, children's learning also advances (Akyol, 2011; Figa, 2004; Rule, 2005). According to Roskos, Burstein and You (2012), the interaction of children with ebooks in the examined studies affects the frequency of various behavioral patterns and levels of sensory behaviors in children. In digital and interactive books, the addition of sound, movement, playful elements, and touch to narrative texts can appeal to various senses of students.

Following ebooks, our study showed that other commonly used tools include picture books, iPads, audiobooks, interactive applications, digital resources, blended learning programs, tablets, and Escribo game videos. These findings shed light on the diverse technological resources that enrich the interactive read-aloud process. Notably, Gülbahar (2012) has noted that as technology continues to advance, the reading culture has undergone a noteworthy shift toward digital formats. This observation underscores the evolving landscape of reading practices in response to technological advancements. Furthermore, in the research conducted by Chen (2013), an interactive mathematical storybook specifically designed for the iPad was employed as an instructional tool. The study's findings demonstrated that this interactive mathematical storybook had a significant positive impact on children's learning performance and improved their attitudes toward mathematics. This exemplifies the potential of interactive technology in educational contexts, showcasing its ability to enhance learning outcomes and student attitudes.

In the studies examined, Korat (2010) and Neumann et al. (2017) revealed that the format of the book (digital or printed) did not significantly affect story comprehension. Collen (2007) employed both digital and printed stories in storytime sessions conducted in two preschool classrooms. In this study, the experimental group was presented with the story in a digital format, while the control group received the story in its printed form. In evaluating the children's comprehension based on the questions asked, it was found that the experimental group provided more accurate answers than the control group. Moreover, Hung (2014) found that students who utilized interactive electronic storybooks responded better to open-ended questions. In this respect, the studies examined within the research context do not align with the understanding encouraged by technology-assisted interactive reading activities. Macaruso and Rodman (2011) and Korat, Shamil, and Heibal (2013) have emphasized that technology-assisted interactive read-aloud yields positive results in phonological awareness. The present research suggests that the use of technological tools such as computers, tablets, and projectors in storytelling aids children in understanding the narrative, which is in line with the study (Kamil et al. 2000). Interactive reading not only fosters receptive and expressive language development but also, when compared to other reading methods, have a higher level of impact in areas like phonological awareness as stated in the literature Mol et al. (2008).

As a result of the examined studies, it has been concluded that technology-assisted interactive reading activities offer numerous benefits while giving rise to particular challenges. The presence of electronic features in ebooks can have a negative impact on the quality of parent-child interaction (Parish-Morris et al., 2013; Şimşek & Işıkoğlu, 2021). During technology-supported interactive reading, students might experience difficulties in maintaining interest and comprehending the story due to the influence of distracting factors (Şimşek & Işıkoğlu, 2021). In this regard, Başaran (2014) suggests that reading from a screen can strain the eyes and slow down reading speed. In such cases, it may become challenging to grasp the main idea of the text and can also make it difficult to engage in forward and backward reading as needed. Based on the research conducted by Özen and Ertem (2014) and Aydemir et al. (2013), it has been discussed that traditional reading is more effective than screen reading in terms of constructing meaning within the text. These research findings support the idea that challenges in comprehension arise due to distracting elements in ebooks.

The studies examined within the scope of the research, it has been observed that when parents and teachers effectively utilize technology in interactive read-aloud sessions, it supports vocabulary acquisition and facilitates collaborative learning environments (Davidson, 2021; Griffith & Arnold, 2019; Kervin et al., 2019; Korat et al., 2013; Korat & Segal-Drori, 2016; Parish-Morris et al., 2013). The research conducted by Zipke (2017), which argues that the effectiveness of digital reading activities increases when conducted with adult guidance, aligns with the study findings.

SUGGESTIONS

In line with the findings of the study, the following recommendations have been put forth:

- **Leveraging Children's Motivation and Interactive Reading Benefits**: Based on the findings of the present study, it is advisable to harness the high levels of motivation children typically exhibit towards technology. Simultaneously, given the advantages of the interactive reading approach, educators and parents should consider incorporating technology-assisted reading activities into classroom and home environments. By integrating technology into the reading experience, children can engage with literature in a dynamic and stimulating manner, potentially enhancing their comprehension and overall literacy skills.

- **Exploring the Affective Domain**: To further advance our understanding of the impact of technology-assisted interactive reading, it is recommended that future studies delve into the affective domain. Specifically, research efforts should focus on assessing the effects of technology-assisted interactive reading on various affective factors, such as reading motivation, attitude, interest, and anxiety. This exploration can provide valuable insights into how these emotional and attitudinal aspects influence reading outcomes, helping educators and parents tailor their approaches to better support children's reading experiences.

- **Development of User-Friendly Applications**: Recognizing that not all families and educators may be well-versed in technology-assisted interactive reading, there is a need to create user-friendly applications. These applications should cater to individuals with limited familiarity with technology but wish to engage in interactive reading experiences with children. By designing intuitive and accessible tools, more individuals can participate in this educational endeavor, fostering broader adoption of technology-enhanced reading practices.

- **Qualitative Exploration of Stakeholder Perspectives**: In addition to quantitative assessments, qualitative studies should be conducted to gain a deeper understanding of the emotions and thoughts of parents and teachers involved in technology-assisted interactive reading activities. Exploring their perspectives can unveil valuable insights into the benefits, challenges, and concerns of implementing technology in reading. This qualitative approach can inform the refinement of strategies and the development of resources that address these stakeholders' specific needs and experiences, ensuring a more holistic and practical approach to technology-assisted interactive reading.

ETHICAL TEXT

"This article adheres to journal writing guidelines, publication principles, research and publication ethics rules, and journal ethical standards. Any violations related to the article are the responsibility of the author(s)."

Since the literature on technology-supported interactive reading activities in early childhood education is systematically examined, it is a study that does not require an ethics committee.

Author(s) Contribution Rate: In this study, the contribution rate of the first author is 70% and the contribution rate of the second author is 30%.

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