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Evidence from a Systematic Literature Review on Digital Games and Language Learning in Childhood

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ABSTRACT

Over the last few years, scholars have shown increasing interest in using digital game-based learning in early childhood and primary education. It is a systematic literature review that adhered to PRISMA 2020 to integrate empirical research studies published 2020-2025, and used Scopus as the primary database. Originally, 70 studies were found in the search. Duplicate removal and eligibility screens for abstracts and full texts enabled the inclusion of 24 studies in this review. The methodological attributes and substantive findings were taken into account during data extraction. DGBL was observed to enhance sustained motivation in children, which triggered a quantifiable increase in language and literacy. Its effects were positive on vocabulary learning, phoneme-grapheme mapping, grammar reinforcement, and productive sharing, also in children with developmental challenges. Digital not only supports executive functions but also fosters computational literacy, transcending linguistic boundaries. The mediating variables were L1 orthographic transparency, intervention duration, adult scaffolding, and cultural correspondence. Though this synthesis addresses a gap in the inherited consolidation of new evidence, several limitations remain due to the insufficient length or time of most interventions and a skills-focused orientation. To achieve this, future research should adopt longitudinal designs, multi-dimensional literacy scales, and culturally sensitive methods.

ARTICLE INFORMATION

Keywords:
children; digital game-based learning; language development; literacy; systematic literature review

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INTRODUCTION

Digital technologies have established themselves in the early childhood space, changing children's literacy and language practices (McCausland, 2022). At the end of the twentieth century, educators and researchers worldwide began to note that children's language development could no longer be separated from the technological spaces where they spent their daily lives (Horgan et al., 2018). The difficulty is that we are to make technological improvements that are learning- and pedagogically valid and affordable (Adeoye et al., 2024). Digital game-based learning (DGBL) has been established as a pedagogical mediator between children's digital cultures and literacy development (Yoestara & Ismail, 2023). This gap is important because the language and literacy skills developed in early development contribute to further academic success. Weak backgrounds can easily impede reading comprehension, academic discussion, and effective self-expression. DGBL has therefore been empirically found to facilitate vocabulary and phonological awareness (Wang et al., 2010),

communication skills, and self-regulation among children (Gram, 2011; Holden et al., 2021). Still, there is divided opinion about the effectiveness of different kinds of games, in what circumstances, and in what language situations.

To the researchers, it is a promise - and practice problem. Even after the research, many teachers and parents consider digital games as distractions (Lin, 2012). To a large extent, the existing work is also context-dependent and has been done in linguistically transparent orthographies or high-resource school environments, which restricts its cross-linguistic and cultural generalisability. Thus, this paper aims to conduct a systematic literature review (SLR) of empirical research on digital games and the development of language, literacy, and communication in children (Lee & Tu, 2016). The review aims to sieve, evaluate, and integrate the findings of a mixed bibliographical corpus to compile a worldwide perspective on trends, effects, and conceptual gaps yet to be filled. This study is significant in at least two ways. For example, the inferences from these findings can inform teachers, as well as curriculum designers and policy-makers, on the best ways to use digital games to teach early language and literacy better (Suwadini et al., 2025). The theoretical contribution of the review to the academic discussion is that it incorporates findings from various environments and provides a research platform sensitive to linguistic and cultural variation (Crowe et al., 2017).

This problem has already been discussed in some earlier research. An example is Maassen et al. (2025), who reviewed GraphoLearn and found it to be an effective program for early intervention in reading difficulties, but were influenced by factors such as the transparency of the target language orthography. According to Lilles (2021), repeated use of the ALPA Kids app by children in both Estonia and Russia improved their performance on a grammar task, but this effect varied depending on the children's first language. Khadijah et al. (2023) developed a digital literacy game in Aceh, Indonesia, and found that pre-schoolers showed increased reading motivation and emergent literacy. The New Zealand version of the Red Light Purple Light intervention, implemented on their computers, led to statistically significant improvements in EF and SR in 2020. In the meantime, the meta-analysis of GraphoGame by McTigue et al. (2019) also concluded that interventions based on computer games are most effective when facilitated by adults. Although these destinations are educational, they are also a common constraint. Most online games remain quite drill-and-kill, with a focus on rote, rather than inquiry and creativity (Nurdin et al., 2023; Baikulova et al., 2024). Nonetheless, the long-term impact of DGBL on literacy has been studied only longitudinally (Gabrito et al., 2023); therefore, more evidence is needed to sustain literacy gains. Moreover, how children's behavior regarding digital games is shaped by local culture and language variety has received less attention. This indicates a gap in the theory: DGBL studies should proceed beyond constrained experiments to more cross-contextual information.

Past meta-analyses have been dedicated exclusively to particular programs or cognitive outcomes. However, the innovation presented in the review is the unique opportunity to integrate studies across various fields, languages, and cultures, providing a more comprehensive view of how digital games can support literacy and communication among children. Instead of considering each of them separately, app or country-wise, the research tries to generalize the findings to find patterns on a more generalized level and identify gaps. In so doing, it seeks to contribute to the literature on digital play and child language through theoretical insights. This is why the SLR research question is: "How effective is digital game-based learning in supporting children's language, literacy, and communication development, and what theoretical gaps remain in the existing literature?"

METHOD

The conduction of these procedures followed the overall concepts of the systematic literature review as per the PRISMA 2020 approach. We also selected Scopus as the sole database because it

provides extensive and consistent coverage of peer-reviewed studies in education, linguistics, psychology, and digital learning. Since online game-based learning is an interdisciplinary field, using a single database that has handled related fields ensured that the same indexing standards were applied, minimizing duplication and providing a searchable interface that offers coherence and repeatability. The Boolean search query to find the latest research on that area was the following: digital game-based learning OR language game OR children's game AND literacy OR communication OR language development AND child OR preschool OR primary school OR early grade. These keywords were digital games, language and literacy, and learning in children. The strategy thus ensured that search results focused on the intersection of digital games and language learning in early childhood and primary education.

Primary search yielded 70 distinct articles that met the criteria. Evaluation of these papers was then conducted, and 40 papers were eliminated for failing the title and abstract screening. After eliminating duplicates, 30 articles remained for full-text review. At this point, six articles were eliminated due to their lack of reporting the language as the target of their intervention: two were mainly about mathematics games, one was about music education, and three were about offline, traditional, non-digital games only. Among them, 24 were considered to be relevant and included in the review. Four general principles guided the inclusion of studies. The children were between the ages of three and twelve, mostly in preschool or primary school. The interventions involved were to be based on digital games or game-based interventions that were language, literacy, or communication-based. Research had to present strong outcome measures, such as vocabulary growth, phonological awareness, grammar proficiency, literacy growth, or communication proficiency. We have considered only peer-reviewed journal articles and conference papers indexed in Scopus. Control studies focused on adults; studies that focused on pure (analog) games and studies whose outcomes were not language-related were excluded. In this case, the review, conceptual papers, and editorials that lacked empirical findings were excluded.

Data were extracted in a structured manner, and the clarity of the procedures associated with data extraction and synthesis was evaluated in this study. Information on the features and results of the studies, details about the author(s), year, participants, type of gameplay intervention design, research methodology/language elements, and results were systematically retrieved. Two complementary matrices were made. The first author extracted the data, which a second reviewer checked, and the problem was resolved by consensus. The research questions, methodological rigor, data collection methods, and analytical transparency evaluation were evaluated in this research. The quality of the studies was divided into high, moderate, or low. The Mixed Methods Appraisal Tool (MMAT) version 2018 was used to conduct the quality assessment. In other words, the MMAT involves five criteria for each of the three study designs (qualitative, quantitative, and mixed-methods). Switching to the yes/no dichotomy of each criterion. The purpose of the synthesis was to categorize research based on four or five characteristics as high quality, two, three, or one criteria as moderate quality, and one criterion as low quality. Two reviewers measured quality. Negotiations over disagreements continued until a consensus was reached.

In this review, a systematic synthesis was conducted using two effective analytical frameworks. The first framework that substitutes for such game design dimensions as learning content, interaction, feedback, and motivation is proposed by Hiver et al. (2024). This model closely aligns with the pedagogical purposes identified in studies involving digital games. The second model was modified in reference to the Ackermann learning areas model of digital game-based learning: cognitive, motivational, affective, and behavioral (Gorman et al., 2024). Based on these two factors, the analysis did not focus solely on the structural design of games but also on their educational outcomes. This quality of a two-frame view eventually connected the mechanics of what we were designing to the

visible learning effects on children's language and literacy acquisition. The thematic analysis was done using the more general categories in this paper (i.e., vocabulary and literacy interventions; grammar and phonological awareness; communication and interaction; executive function/social-cognitive skills; cultural/contextual adaptations of digital game-based learning) to divide the studies. Therefore, this procedure enabled the review to identify and synthesize both quantitative data on effective practices and qualitative accounts of how and why digital games can facilitate language development in children.

RESULTS AND DISCUSSION

The relevant empirical studies on the effects of digital game-based learning on the language, literacy, and communication development of children aged 3-8 years were identified and synthesized in this metadata review of published studies on the topic released in 2020–25. The initial one was the preparation of a thematic synthesis; it was needed to introduce the data and provide metadata for this corpus. This descriptive review places the evidence in perspective by considering trends in publications, geographical location, theoretical underpinnings, features of study samples, and the types of games administered. We can develop these features and, in that manner, learn to view the breadth of the literature, its strengths and weaknesses, and the gaps that were further analyzed.

These studies span the last several decades, suggesting that the last five years have seen a rising trend in research on digital game-based learning. The 24 studies were all published between 2021 and 2023, with a slight increase in 2021. Early-on modeling was originally combined with the consideration of designing based on interventions and culture in applications of games that were bound to a study (e.g., 2000), but in more recent years, empirical tests based on actual game-based instruments have been flooding in. This pattern aligns with international trends in the education technology sector, where adoption of digital platforms has soared in both formal education systems and non-formal learning environments during the COVID-19 pandemic and the period after it. Simultaneously, the additional output in 2021 and 2022 may also be related to the immediate need for new, distance-learning solutions due to prolonged school closures across significant portions of the globe. It is not until 2024 and 2025 that we will have publications describing a more mature level of development, where not only individual measures are being tested, but also whether frameworks themselves are tested against meta-analyses or even cross-cultural utilization.

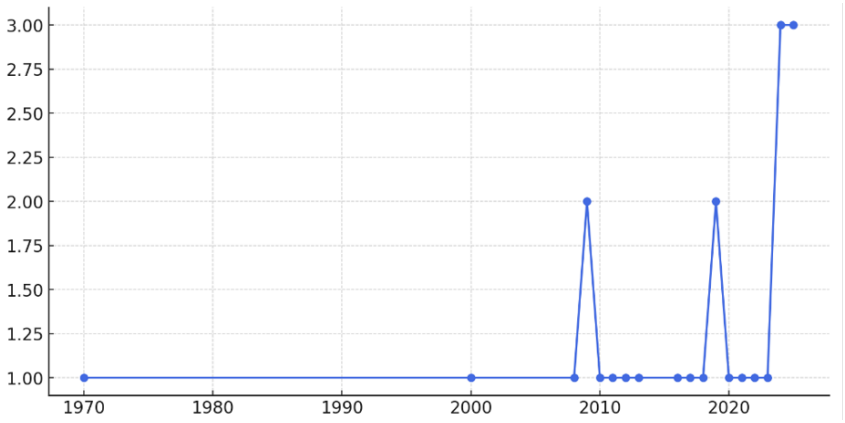

Figure 1. Year of Publication

Additionally, the experiments were conducted across various regions of the world, including both developed and developing countries. The third one was in European nations (Finland, Estonia, Portugal, Netherlands), which tend to take a long time to validate digital literacy tools like

GraphoLearn or ScratchJr. Approximately a third of them were of Asian origin in China and Indonesia. Most Indonesian studies, such as Rahman et al. (2024) and Khadijah et al. (2022), and unlike some of their peers, who conduct studies on the analysis of preschool language acquisition based on designed digital pedagogical tools (e.g., Chen & Fan, 2025), employed locally developed literacy games, which were in line with the early-grade curriculum. The remaining studies conducted in North America focused on maker literacies, coding, and technology-enhanced games in the United States; one New Zealand study focused on executive functions using playful interventions (Baikulova et al., 2024). African perspectives were covered and related to the traditional play through Zimbabwean research (Madondo & Tsikira, 2022) and its potential to become digital. The article on geographical dispersal shows that DGBL is a global phenomenon, although there are some disparities: African and Latin American countries do not represent East Asian or European countries (Davis et al., 2021; Raimundo & Terra, 2021).

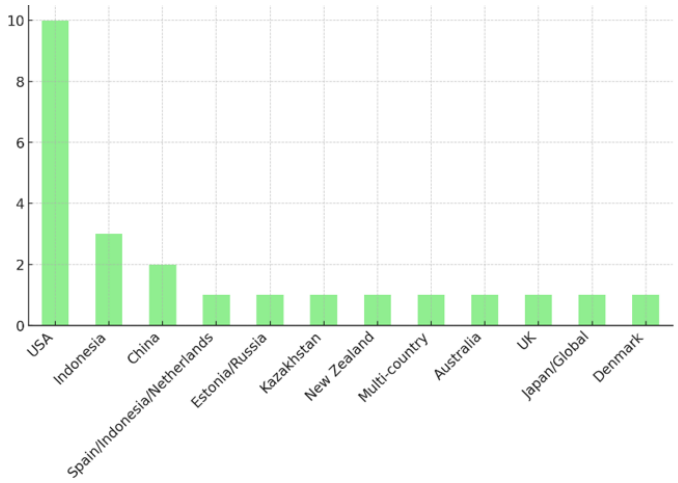

Figure 2. Country of Publication

The corpus is rather diverse in methodology. The experimental and quasi-experimental designs, including randomized controlled trials (e.g., Keown et al., 2020) and before–and–after intervention (Rulyansah et al., 2023; Khadijah et al., 2022), were used in most of these studies. When pooled, these studies provided significant evidence that at least 1 DGBL program had a positive influence on children's vocabulary, literacy preparation, or executive functioning. A second cluster was more inclined towards qualitative approaches, especially ethnographic observation, case studies, and grounded theory. These are the Bergen et al. on tech-games, the Davis et al. (2021) on maker literacies, and Madondo and Tsikira (2022) on traditional play in Zimbabwe. These analyses were biased towards the richness of context; overlaying things onto and perceiving interactional nuances and cultural complexity that may not be apparent in more quantitative counts. Besides that, some studies utilized a mixed-methods design comprising questionnaires, classroom observations, interviews, or learning analytics. Strawhacker and Bers (2019) tested English games at the university level, evaluating quantitative tests and collecting qualitative feedback, and Baikulova et al. (2024) linked coding assessment results to the investigation of children's projects. At the meta-level, McTigue et al. (2020) conducted a massive systematic review and meta-analysis of GraphoGame, combining 28 studies to estimate the overall efficacy worldwide. This variety of approaches suggests that DGBL is not a single sphere and is interdisciplinary, but it is also difficult to compare directly. Ecological validity is not always accompanied by qualitative rigor, and rigorous experimentation contradicts it. The heterogeneous and conflicting evidence makes it essential to engage in integrative reviews of this kind (Zhang & Zheng, 2023).

The studied samples comprised children aged 3-12, with a mean of 3.5, indicating they were in preschool or primary school. Some of these studies were premised on samples of preschool-aged children (e.g., Chen & Fan, 2025; Keown et al., 2020), suggesting that the foundational language and literacy skills should be considered. The vast majority of studies focused on vocabulary, reading, and grammar in primary schools (e.g., Rahman et al., 2022; Khadijah et al., 2023; Maassen et al., 2025). Some special needs groups were also present in our corpus. Hyppa-Martin et al. (2013), who tested the modality sampling of communication with a 2-year-old child with Angelman Syndrome, and Crowe et al. (2017). Furthermore, Pierce et al. (2009) developed The Bridge, a competency-based literacy portfolio assessment designed to evaluate students' literacy development through authentic and performance-oriented tasks rather than relying solely on standardized testing. The model was later examined through pilot studies involving students with and without disabilities, demonstrating its potential as an inclusive and alternative approach to literacy evaluation. Most interventions took place in the classroom, were often delivered by teachers, and were incorporated into regular lessons. Some studies were carried out at the laboratory or clinic level, particularly in speech and communication disorders. Some other studies were also conducted in informal learning settings, including parent-child interactions at home (Bergen et al., 2010) and maker workshops (Davis et al., 2021). Differentiation demonstrates that the DGBL exists both within and outside the school, but is largely motivated by and embedded in the context of schooling practices.

The analyzed studies incorporated different interventions, suggesting a wide range of methods by which digital games can facilitate language and literacy promotion. Most studies reported DL and VGs. These were introduced and evident in the majority of the reports, such as Chen and Fan (2025), Rahman et al. (2022), and Khadijah et al. (2023), who use the designs of apps and Android-based systems to integrate graphics and audio and playful interactivity to promote vocabulary learning as part of early reading readiness. Such interventions had been successful in increasing engagement and improving language outcomes, especially when core literacy activities and play were combined. Decoding and phonological awareness were also key participants in the corpus, especially in comparing languages. GraphoLearn is a well-tested platform that has placed mini-games between graphemes and phonemes in various languages in the hands of children (Maassen et al., 2025; McTigue et al., 2019). Crowe et al. (2017) developed a phoneme-focused app to improve speech perception in speech-deficient children as well. Both were considered a manifesto for the way forward regarding digital games designed to develop foundational or core literacy skills, particularly in instances where a phonological processing problem exists. Simple grammatical structures embedded in repeated play, as in a few puzzles such as ALPA Kids (Lilles, 2021), have not been thoroughly studied in first-language development. These procedures aimed to achieve implicit grammar acquisition, with children learning rules through exposure rather than by deriving them.

The other important direction of action broadened literacy as such to include coding and computational literacy. Strawhacker and Bers (2019) studied ScratchJr and provided evidence that coding games involved general logical thinking among children; nevertheless, they also required the use of their verbal, math, spatial, or social skills. This broadened notion of DGBL included the idea that the digital age required transversal literacies that games could nurture. In this spirit, communication-based social games are more focused on communication than on language structure. Bergen et al. (2010) found that the use of technology-enhanced games enabled humor during ILI and between parents and infants, and that a board game helped children at risk of language delay take communicative turns in a turn-taking game (Smith & Fluck, 2000). In their research, Keown et al. (2020) demonstrate that the implementation of an old circle game in its online form stimulates executive functions, with a lesser effect on communication and self-regulation. The difference was welcome in such interventions, since the school learning focused on versatile digital games as a

pedagogical tool, only to become a real challenge in terms of synthesis. Others focused on specific, narrow subskills such as phoneme recognition or vocabulary, while others were macro in nature and saw communication as multimodal and socially situated. These two jointly demonstrate that the digital play can and must be both specific and general, narrowing into specific language acquisition and at the same time tracing the pathways of general development.

Regarding the linguistic information analyzed, the language dimensions discussed by the 24 articles were broad. The most prevalent intervention was vocabulary, often in connection with early literacy competency. The other major group was phonological awareness and decoding, especially in cross-linguistic studies. We found that grammar learning was less commonly addressed, though it was present in some application-based interventions. The skills acquired through game, coding, and social games studies were joint attention, turn-taking, and expressive language. A few works also examined multimodal literacy, noting that digital play could scaffold not only language-related development but also other areas such as agency, collaboration, and critical media literacy.

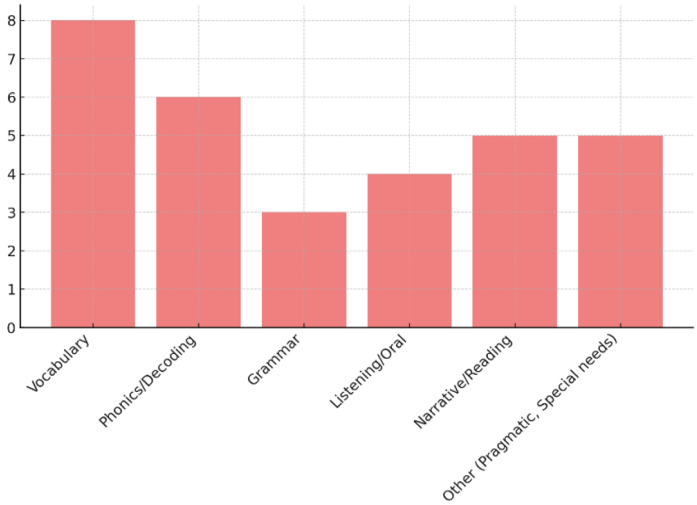

Figure 3. Language aspects being studied

Along with these descriptive features, each of the 24 articles was analyzed for a keyword (the dataset included more than 1,000 terms reflecting the field's intellectual orientation). Frequency and word cloud analysis revealed that the most prevalent keywords were literacy, learning, pedagogy, development, and language, each with a frequency of 60 instances. Such tendencies point to the fact that research on early childhood digital learning through games is based on a binary view of literacy gains and the development of innovative pedagogy. A core of words existed, and the other terms, such as digital, educational, communication, playful, and classroom, hovered around it, identifying the techno-interactive spaces where interventions are formed and executed. Additionally, the more specific keywords, such as phonological, grammar, storytelling vocabulary, and coding, were present at moderate frequency, suggesting that various interventions are targeting some linguistic areas. Other less commonly used words, such as Angelman Syndrome, Zimbabwe, and the Abecedarian Project, further confirm that digital games can be customized to address the needs of various types of learners and fit into different cultures. Collectively, this question has justified that the literature is skewed toward general orienting purposes in literacy and pedagogy, as well as toward different forms of design and appetite among learners. This word cloud, like most words in this exercise, has provided a conceptual image of the research situation: a domain where literacy is the most cross-sectioned dimension but is fed by (play, technology, and multiplicity) lenses on language development. This metadata stage contextualizes the next phase of thematizing synthesis and also offers a rendered dimensionalization of the complexity of digital game-based pedagogy in early language learning.



Figure 4. Bibliometric topic within the scope

Besides this descriptive metadata of the corpus, synthesizing the results of the 24 studies leads us to conclude that several theme strands define where we are in terms of digital learning based on the game, in support of children's language, literacy, and communication. However, not necessarily opposites, but a scale of topics, where a complementary design and a complementary consequence are sometimes synonymous. By combining them, they also offer an idea of how digital play facilitates language development and how it can continue to do so.

One of the most common themes that emerged from the data was the use of digital games to facilitate vocabulary and early literacy. Some of these studies found that fun digital programs were not only more entertaining but also more effective at helping people learn new words, letters, and reading readiness skills than traditional methods. Chen and Fan (2025) provided strong evidence that children who were exposed to game-based pedagogy in a digital game environment during the preschool years learned more vocabulary, formed sentences more effectively, and learned through oral means to a greater extent than those who did not have such an experience. The interactive, yet playful, nature of the digital sphere provided students with repetition, feedback, and engagement that motivated many of them. Similar results were also reported by Rahman et al. (2022) and Khadijah et al. (2023), who found that literacy game design is conducted in the Indonesian region. These lessons turned a drilling early reading activity into an interactive, multisensory activity that captivated children's interest and met age-appropriate developmental early literacy indicators. The findings indicate that game-based literacy activities are effective with pre-schoolers and early primary-grade students, and that learning resistance may be alleviated through intrinsic motivation. Nonetheless, much of this work assumed short-term effects, and it is unclear whether early interventions to improve vocabulary or reading preparation could have long-term benefits for general literacy (Dethan et al., 2024).

The other group of findings pertained to PA and grammar learning. These language areas are building blocks of literacy, and most studies have examined the role of the rated digital games in reinforcing these domains. For instance, Maassen et al. (2025) employed GraphoLearn - an adaptive phoneme-grapheme mapping mini game, according to which they investigated the learning potential of the game in languages with a different depth of orthographic representation. GraphoLearn induced the greatest support and transfer in the clean, transparent orthographies of Spanish (and Indonesian, on which our orthography was modeled), in which few sound-symbol correspondences are not aligned, but this effect reduced when tested in Dutch (a more opaque orthography) (Raimundo & Terra, 2021). This linguistic difference supports the significance of language organization in the formation of the DGBL interventions. In a similar investigation, Lilles (2021) modified the ALPA Kids and used it to examine the effectiveness of games in grammar learning in Estonian and Russian among

kids. Basic syntactic structures, including verb-goal (which were widespread in the input), were also internalized in the play, but varied across first languages. On the contrary, Crowe et al. (2017) discovered considerably more conservative estimates. The children with speech-sound disorders were engaged in their phoneme-based game, but the intervention did not detect any learning improvements, mainly because it was delivered infrequently. In general, these investigations indicate that dialectal context, dosage, and exposure period play significant roles in shaping the effects of digital games on underlying language mechanisms.

The third theme strand revealed that when social or communicative play involved games, especially embedded ones, it aided communication. Bergen et al. (2010) provide an early yet useful example of how the parent-child use of technology-enabling games influences interaction. With the addition of auditory and sensory experiences to the games, the researchers observed greater joint attention (the duration of time a child and an adult focused on the same object), more humor, and more parent-directed language to children. The research demonstrates how digital affordances may influence the quality of communication even in pre-linguistic levels. Smith and Fluck (2000) applied this reasoning to children with communication delays at a young age, and the results indicated that an intervention taught in a structured social play setting benefited turn-taking and language use. The most effective modalities were based on symbolism, suggesting that digital interventions may also offer expressive opportunities for children with speech impairments. The Bridge, a portfolio system by Pierce et al. (2009), covered authentic literate assessment reporting on slight states of continuing child literacy development, with and without disabilities. Together, such studies show that digital play cannot only expand children's formal literacy but also expand the communicative potential of those at a disadvantage through more conventional speech and language processes.

Opportunities of online play in the development of executive functions and transversal competences. The principal theme of the discussion is the possibility of using online games to develop executive functions and transversal competences. Keown et al. (2020) employed a digitized circle game called Red Light Purple Light to investigate and improve the executive functions of 4-year-old New Zealand children. These gains were attributed to better self-regulation and cognitive flexibility, which are non-linguistic yet essential to effective communication and learning. Strawhacker and Bers (2019) took it one step further by studying the coding application of ScratchJr during children's participation in verbal, mathematical, spatial, and social reasoning. The study demonstrated that coding as play promotes literacy in calculation and numerous additional thinking spaces (including language) (Crowe et al., 2017). These findings indicate that digital games cannot be categorized as a separate set of linguistic activities, but instead as a medium for the development of transversal capabilities that will help children build a comprehensive capacity to learn about the literacies of the twenty-first century (Lin, 2012).

The culture and context can be traced to digital games. Although acquisition skills were dominant among the interventions, a minority of the studies took a broad approach to digital play, placing it in cultural and sociohistorical contexts. Combining the outcomes of 28 studies of the GraphoGame, McTigue et al. (2019) found that the tool proved efficient under certain conditions, alongside teacher instruction; it produced a greater effect when the adults who participated in the implementation engaged. This is one form of scaffolding that attempts to demonstrate that context is better than exposure. On the contrary, the original, long-ago yet not entirely digital Abecedarian Project still served to characterize new realizations so that the light-hearted language-interest education of very young children might yield productivity in educational and health conditions over a lifetime. Madondo and Tsikira (2022) incorporated a cultural contribution as they examined indigenous games in Zimbabwe, demonstrating their potential for digitization to transfer indigenous knowledge beyond literacy and numeracy. Davis et al. (2021) focus on maker literacies and workshops

in the US and how multimodal literacy, agency, and critical media literacy can be developed through game hacking and filmmaking. These works are context-specific, and it is important to keep in mind that DGBL does not constitute an obstacle to children's social and cultural life. They argue that effectiveness is not only tied to cognitive outcomes but also to games' ability to capture children' hearts through identities, communities, and cultural repertoires.

Patterns that occur across these themes also emerge. Digital games have consistently kept children engaged and more motivated towards language-related learning (Wang et al., 2010). They particularly performed well in certain small portions, such as vocabulary acquisition and phonemic awareness, when the adaptive times-on-task step was implemented (e.g., adequate repetition). They also had great opportunities for communication, particularly regarding child developmental disorders, and were even found to stimulate transversal skills at times as executive functions. However, the synthesis also has serious drawbacks. The majority of interventions were short-term, so their long-term effects could not be measured; consequently, their influence varied across individuals, giving alphabetic languages a greater advantage than non-alphabetic languages. Adult and teacher roles continued to recur as influential mediators in interventions, and the most effective ones were orchestrated through scaffolding (Pierce et al., 2009). Third, few studies have examined cultural adaptation thoroughly; thus, it is unclear how digital play can be adjusted to various educational systems and local traditions. It is consequently an intricate thematic combination. Moreover, are games naturally the panacea for what afflicts education, or are they? It is a plan that involves applying relevant design, contextualization, and inclusion within a broader pedagogical action (Smith & Fluck, 2000). The problems in this regard inform the review, which establishes a platform for discussing the affordances of digital play in a more subtle manner that can be utilized to facilitate language and literacy development in young children across diverse environments.

The paper began with empirical evidence compiled between 2020 and 2025 on digital game-based learning (DGBL) as a means of language, literacy, and communication development in children, based on a systematic literature review. This review contributes to the growing body of academic literature, which underscores the role of different age cohorts and is informed by diverse methodological traditions, to both the potential efficacy of playful digital settings and learning. Unlike narrative reviews, which tend to highlight the use of anecdotal evidence, this research synthesized the scale, design, results, and cultural backgrounds of DGBL, which was organized into nature and provided us with a broad context of what we already know and what we still do not know about the field of DGBL. The usefulness of the review is undoubtedly to provide an account of what we already know; better still, to identify patterns and gaps in the literature that are most prominent in the cross-linguistic variation, long-term effects, and adult mediation. The procedure was a systematic review conducted in accordance with the PRISMA 2020 guidelines. A literature search was conducted in Scopus only because it has stringent inclusion criteria for the peer-reviewed educational research index. This preliminary search (2020-2025) yielded about 70 articles. After eliminating duplicates, 24 were finally included in the study. At this point, six articles were eliminated based on the type of game: they concerned mathematics games, music interventions, or non-digital (traditional) games that were not discussed in language and literacy. To obtain the data, two complementary matrices were developed: one focused on theoretical and methodological aspects (principles of knowledge production) of data production, and the other summarized the key results and included a descriptive quotation. The Mixed Methods Appraisal Tool (MMAT, 2018) was used to evaluate the quality of studies, ensuring that both experimental and qualitative studies were evaluated using the same criteria.

One of the most important findings was that DGBL interventions were effective in improving children's motivation and engagement. Furthermore, that drive can have spillage effects on every

aspect of language development. The vocabulary and emergent literacy interventions yielded proximal outcomes in word learning (Yuanwei, 2025), reading readiness, and letter recognition (Blanchard et al., 2025). Phonological awareness studies indicated that game-based learning, such as GraphoLearn, might result in quicker grapheme-phoneme mappings among young, typical readers, but only when taught in a game that offers some form of orthographic transparency. Games that emphasize communication broadened the possibilities for self-expression through play, particularly for language-limited children, and games that offered technological enhancements allowed a parent and child to communicate their play in a more advanced way. In addition to language, digital play may also affect executive functions and cross-functional skills, such as self-regulation, computational thinking, and collaborative problem-solving. In this case, the effects of the context-language system, cultural appropriateness, and adult scaffolding were mentioned throughout the corpus. The current findings can be explained by previous research on learning with educational games and technology-based learning. Past meta-analyses and reviews have identified that digital games can help improve learner motivation and learning in general education (e.g., Connolly et al., 2012). This literature review has been restricted to language and literacy in children; however, the same trends can be seen here: games make learning more motivating and can be of meaningful linguistic value (when designed wisely).

Nevertheless, the review also contains differences from past syntheses. For example, when Connolly et al. (2012) focus on overall cognitive and affective outcomes, the current review presents the nature of language-related consequences on a skills scale (from vocabulary to phonological decoding). Besides, the majority of the sources are Asian (primarily China and Indonesia) and thus introduce a major regional perspective that was grossly underrepresented in other reviews. Important similarities and differences can also be found between the current synthesis and single research in general, but not within the 2020-2025 decade. In comparison, this corpus shows the impact of orthographic transparency on efficacy (Maassen et al., 2025). This subtle route is not a silver bullet but must be integrated into our understanding of the mechanisms of individual language systems. It is reported that the Abecedarian Project has long-term positive outcomes for playful early intervention (Gkinko & Elbanna, 2022). Digital games, however, possess a special ability to engage adaptive feedback, multimodal input, and scalability that traditional interventions cannot (Munoto et al., 2020). The causes of those observations are complicated. DGBL is a good approach to vocabulary and early literacy development because its games are multisensory (Saifulloh et al., 2025). Children learn not only through reading and hearing but also through interactive feedback processes that support the development of a strong memory (Ismail & Sabrina, 2023). Adaptive games can make the greatest contribution to phonological awareness by providing slowed-down response time, which reinforces more specific sound-symbol correspondence practice that children seem to need when provided with meaningful context before the grammar structure is attained. Games, beyond speech, are an alternative form of communication for children with special needs, as speech is a particular feature of these children. The advantages of executive functions are also associated with the rule-following aspect of games and with structured fun, which require planning and the suppression of behavior, and once again demand flexible thinking.

Outcome variance, however, is attributed to the corpus's limitations. Shorter intervention trials (less than 6 months) were an indicator of instant effect that may be transient, whereas long-term effects were to be questioned (Safar & Anggraheni, 2024; Sparling & Meunier, 2019). Results were lower in opaque orthographies, indicating that linguistic complexity can also affect results. For example, Crowe et al. (2017) seemingly neutralized efficacy, which aligns with McTigue et al.'s (2019) meta-analysis focused on scaffolding. Cultural adaptation was also important: games that appealed to both children's lived experience and their educational background, such as literacy apps created

locally in Indonesia (Izzati et al., 2020), were more likely to be engaged with, whereas tools developed in other regions of the world were sometimes more difficult to identify with. Overall, the research hypothesis of this review is that although there is a possibility of language and literacy acquisition during digital play, an uninformed adoption may be problematic as well (Eisenring et al., 2024). Design and context, where pedagogy goes, DGBL works; and it is a possibility only. It fails to provide an alternative to traditional methods; instead, it magnifies delightful, adaptive, and entertaining aspects (Essien et al., 2024). The review provides new evidence by combining research across various contexts on how features of language systems, cultural contexts, and adult gatekeeping contribute to the efficiency of digital games. This integrative step highlights the strengths and weaknesses of DGBL as a pedagogical instrument and recommends that future research be more longitudinal, intercultural, and theoretically mindful.

CONCLUSION

An overview of 24 studies in varied contexts and language systems that offer an overview of both the potential possibilities and issues with using digital play as an early learning method. Not only was it concerning evidence gathering, but also how design, context, and pedagogy interplay to influence effectiveness. Findings indicate that digital games have a strong influence on motivation, a significant factor in facilitating vocabulary development, phonological awareness, and the practice of grammar and oral skills. Even non-language benefits include executive functions, self, and computational literacy. Such benefits, however, are subject to conditions. The presence of orthographic transparency was a major concern, as more interventions proved effective in languages with transparent, rather than opaque, sound-symbol relations. The time and effort invested in interventions were important too, with limited potential for short projects to provide long-term insight. Once again, adult scaffolding was necessary. When teachers or parents mediated gameplay, children benefited the most compared to when they played the tool on their own. Finally, the cultural relevance affected engagement levels, with locally developed games more applicable to children's identities and contexts than imported or generic games. The review fills a gap we identified in the previous literature for the research community: there was none on systematic synthesis across studies of language and literacy. However, new gaps emerge. Moreover, we possess very scant longitudinal evidence on what short-term gains actually translate into in the long-term development of literacy. Future research must therefore take into account a longer time period and a wider range of markers of language learning, as well as cultural adaptation and fair access to digital technologies.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

CONFLICTING INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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