

A 10-Year Systematic Review on the Incorporation of Digital Games for Multimodal Literacy Education

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Abstract: - Digital games increasingly penetrate young people's lives and have become a prominent tool for 21st-century teaching and learning. While digital games are promising resources for fostering multimodal literacy, empirical evidence of their application in educational settings remains limited. This study conducted a 10-year systematic review of 20 relevant empirical journal articles to provide a comprehensive understanding of utilizing digital games in multimodal literacy learning across primary, secondary, and higher education levels. The findings revealed the main contextual features, game features, theoretical and methodological perspectives, and the possibilities of digital games for multimodal literacy learning. In conclusion, the extant empirical studies prove that digital games are legitimate learning resources to foster students' multimodal literacy, whereas limitations are also evident. Correspondingly, this study provided recommendations to address these limitations and leverage digital games for 21st-century literacy education, thus contributing to computer research in educational contexts.

Key-Words: - Digital Games, Digital Game-based Learning, Multimodal literacy, Literacy Education, Literature Review, PRISMA.

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1 Introduction

The rapid advancement of digital media and the ubiquity of multimodality have fundamentally changed how people process information, communicate, and connect with the world, [1]. Correspondingly, the recent two decades have witnessed the reconceptualization of print-based, language-centered literacy into multimodal literacy, which highlights critical, appropriate, and creative consumption and production of context-specific discourses made of multiple semiotic modes (e.g., language, images, sounds, and gestures), [2]. For young people, multimodal literacy is crucial in effectively navigating the technology-driven and media-rich world, consuming value-laden information with a discerning eye, and contributing new knowledge as an active social participant, [3].

Multimodal literacy is mindfully nurtured rather than naturally gained due to its sophistication. According to [3], multimodal literacy accentuates contextual and textual knowledge of distinct affordances (i.e., advantages and limitations) of different semiotic modes and their orchestration as coherent multimodal texts appropriate for a specific social context. Engaging in multimodal practice, multimodally literate people can conceptualize a

metalanguage to describe how semiotic modes enact meaning from representational (presenting ideas and events), interpersonal (enacting social relations), and compositional perspectives (combining meaning into a coherent ensemble), [4]. Beyond that, they can interrogate semiotic choices from functional (e.g., causes and effects of using semiotic modes) and critical dimensions (e.g., the preferred viewpoint embedded). Furthermore, they should have the initiative and skills to transfer their semiotic knowledge and experience into new multimodal products for self-expression. Unfortunately, young people's varied and casual engagement in digital media practice indicates that the young do not inherently possess proficient multimodal literacy, [5].

Researchers and educators have incorporated authentic multimodal texts (e.g., digital books, films, advertisements, and webpages) to address school learners' multimodal literacy at different levels of education, [6]. As [7] and [8] conceptualized, digital games have gained recognition as "a multimodal literacy par excellence" among diverse resources, given their prominent multimodality, interactivity, and popularity among the youth. Ideally, digital

gameplay offers an embodied and authentic learning environment for agentive, situated, progressive, and social literacy learning in a multimodal semiotic domain, developing criticality in multimodal meaning-making. Furthermore, digital games offer an affinity space (social groups with a shared goal) for students' social interactions, collaboration, and construction of multifaceted identities, addressing the socio-cultural nature of multimodal communication. Meanwhile, digital gameplay allows students to be co-designers of meaning by applying multimodal resources and digital tools to create new products within the games, [7], [9]. Playing games also engages students in making game-related multimodal compositions, [10], also called game paratexts (e.g., game walkthroughs and reviews), [11].

Despite theoretically sound, empirical evidence is lacking to substantiate digital games as valuable resources for multimodal literacy learning, [12]. The insufficient empirical knowledge fails to address the practitioners' concerns about game selection, theoretical basis, pedagogical approaches, and learning outcome evaluation, [13], making digital games undervalued in educational practice. Given the thriving gaming industry and advancing gaming devices, digital games continue to penetrate the youth's lives as an influential cultural force [8], simultaneously providing new resources and opportunities for multimodal literacy practices. Hence, it is worthwhile to fully grasp the possibilities of digital games in multimodal literacy education to echo students' daily media experiences and cater to their new demands.

This study aims to synthesize the extant empirical evidence from the recent 10-year literature exploring how digital games inform multimodal literacy education at different levels. Of central interest to this review are school learners across elementary, secondary, and higher education and learning activities in and out of classroom context, thus offering a holistic view and practical implications for researchers and educators across sectors and contexts. The scope of incorporating digital games encompasses playing any game on electronic devices and transferring the digital game experience to any form of game-related media products. Accordingly, the paper is guided by the following research questions (RQs):

RQ1: What are the contextual features of the extant literature exploring students' multimodal literacy through digital games?

RQ2: What are the main features of the digital games utilized in students' multimodal literacy practice?

RQ3: What theoretical perspectives underpinned the exploration of digital games for multimodal literacy practice?

RQ4: What research methods were applied to explore digital games for multimodal literacy practice?

RQ5: What opportunities can digital games offer for students' multimodal literacy learning?

2 Related Works and Gaps

Previous systematic reviews discussed the pedagogical affordances of digital games for literacy practices from multiple perspectives. [14] and [15] systematically reviewed journal articles about digital game-based language learning and substantiated that digital games of various genres facilitate language comprehension, interactions, motivation, and engagement. However, these reviews mainly focused on using digital games as auxiliary tools to enhance linguistic-centered literacy instead of multimodal literacy. [16], thoroughly analyzed 30 research articles about K-16 students' game design as literacy practices. Their synthesized findings proved that game design fostered diverse multimodal literacy skills. However, this review did not include digital gameplay and game-based multimodal compositions, which are more prevalent, accessible, and relevant forms of multimodal literacy learning through digital game-based learning (DGBL). [17], reviewed 77 articles on DGBL in K-12 literacy and language learning contexts. This review discussed game features, theoretical foundations, methodologies, and empirical evidence of cultivating multimodal literacy through digital game-based activities such as multimodal composition and game design. Notably, this review did not include higher education contexts. Besides, the specifications of the research design and learning outcomes were limited.

Overall, the previous systematic reviews manifest the great research enthusiasm surrounding digital game-based literacy learning and yield illuminating empirical evidence of its incorporation in various educational settings. However, there is a lack of a thorough overview of how digital games were employed in multiple ways across educational levels for multimodal literacy learning with different focuses. Therefore, this study endeavors to extend the scope of inquiry by classifying and analyzing past studies regarding contextual features, game features, theoretical perspectives, methodologies, and possibilities of digital games in multimodal literacy learning.

3 Methods

This study was guided by the PRISMA 2020 guideline [18] to search, identify, select, analyze, and synthesize relevant literature in Web of Science (WOS) and Scopus (Figure 1). The keywords were: (“multimodal literacy” OR “multimodal” OR “multiliteracies” OR “new literacy” OR “media literacy” OR “digital literacy” OR “game literacy”) AND (“digital game” OR “video game” OR “computer game” OR “game-based learning” OR “gameplay” OR “game paratext”). A total of 20 articles (Table 1) from 1484 results were selected for this systematic review. The inclusion criteria are full-length empirical studies incorporating existing digital games in learning activities relevant to multimodal literacy among primary, secondary, or university students. These articles should be written in English and published in peer-reviewed journals between 2013 and 2023.

This study applied content analysis [19] to classify and analyze the selected articles based on

the five research questions. For contextual features (RQ1), the researchers categorized the participants into primary, secondary, and higher education levels and recorded the sample size, specifying the reported focal cases. Also, they classified the research contexts by country and their specific educational setting (i.e., incorporated in school language courses, workshops at school, or out-of-school). Second, game features (RQ2) were coded from various dimensions. The researchers classified the digital game into commercial games and serious games according to [20]. The learning principles of video games [7] guided the framing of game characteristics. To address RQ3 and RQ4, the researchers synthesized each reviewed article’s theoretical perspectives and methodology (including data-collection methods, interventions, and data analysis methods), highlighting the similarities, advantages, and limitations. Concerning RQ5, the researchers coded the learning outcomes relevant to multimodal literacy [1], [3].

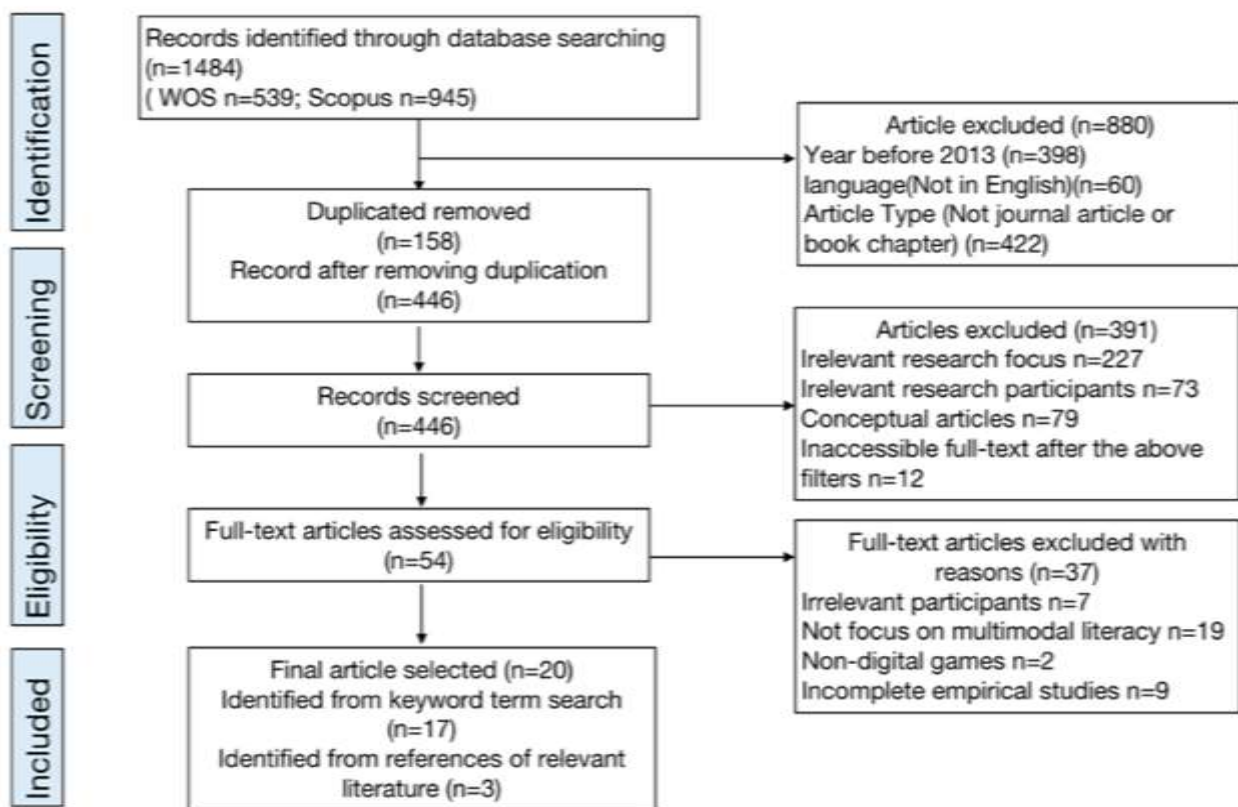


Fig. 1: PRISMA diagram for paper selection

Table 1. An overview of the selected articles

No.	Article	Level	Sample Size	Country	Setting
S1	[21]	Higher education	Not specified (one class)	the UK	Incorporated in school language course
S2	[22]	Primary	Two group cases from 13 students	Spain	Workshops at school
S3	[23]	Secondary	20	the US	Incorporated in school language course
S4	[24]	Primary	Four	Australia	Out of school
S5	[25]	Secondary	One focal case	Iran	Out of school
S6	[26]	Secondary	Two focal cases from 27 students	the US	Incorporated in school language course
S7	[27]	Primary	Two focal cases from 33 students	the US	Workshops at school
S8	[28]	Secondary	One focal case	the US	Workshops at school
S9	[29]	Higher education	Two focal cases from 11 students	Taiwan, China	Incorporated in school language course
S10	[30]	Secondary	14	Australia	Incorporated in school language course
S11	[31]	Secondary	One focal case	the US	Incorporated in school language course
S12	[32]	Secondary	One focal case	the US	Incorporated in school language course
S13	[33]	Secondary	27	Spain	Workshops at school
S14	[34]	Secondary	13	Spain	Incorporated in school language course
S15	[35]	Primary	Two group cases from 50 students	Norway	Incorporated in school language course
S16	[12]	Secondary	Four group cases from 31 students	the US	Incorporated in school language course
S17	[36]	Secondary	Not specified	the US	Incorporated in school language course
S18	[37]	Higher education	Two focal cases	Singapore	Out of school
S19	[38]	Higher education	Not specified (one class)	the US	Incorporated in school language course
S20	[39]	Secondary	Four group cases from 31 students	the US	Incorporated in school language course

4 Findings and Discussion

4.1 Contextual Features

As illustrated in Table 1, the extant literature has probed multimodal literacy practice through DGBL among school learners across primary (n=4), secondary (n=12), and higher education levels (n=4). Secondary education received the most attention, echoing the findings of [16]. This may relate to the pedagogical emphasis on nurturing higher-order cognitive skills, collaborative abilities, and cultural identities among secondary-level students who are at a pivotal stage of cognitive and social development, [40]. By contrast, primary education prioritizes basic literacy skills, while higher education addresses more specialized content areas relevant to one’s career path. Moreover, the reported sample sizes were small, primarily focusing on just one or two individual or group cases, indicating the limited generalizability of these studies.

Concerning research locations, the selected articles were mainly situated in Western countries, especially the US (n=10), followed by Spain (n=3) and Australia (n=2). A plausible explanation of the

Western-centric research contexts is the advanced technological infrastructure (e.g., computer labs and game consoles) equipped in these developed countries, where students have more access to digital devices for interactive DGBL. Besides, most studies (n=17) explored students’ game engagement in school contexts, among which four organized game-based workshops and 13 studies integrated game activities into existing language courses. For instance, [38] applied *World of Warcraft* in the first-year composition course at a university, while [31] incorporated Minecraft in the fundamental literacy course of a high school. This proves the legitimacy of digital games as literacy practice in different levels of formal education. Besides, it indicates the flexible curriculum system and supportive school policies within the research contexts. These factors encouraged the application of digital games in classrooms, thus stimulating research in this field. Moreover, studies explored students’ digital gameplay in informal learning contexts (e.g., at home), substantiating multimodal literacy learning embedded in everyday gaming beyond the classroom.

4.2 Game Features

The reviewed articles unanimously applied commercial video games in their research project (Figure 2), with sandbox construction games and role-playing games dominating the chosen genres. One explanation is that commercial games excel in facilitating engaging, open-ended, and in-depth multimodal learning experiences due to their superior accessibility, richer game narratives, enhanced interactivity, sophisticated game mechanics, and higher popularity among students when compared to educational games designed for learning purposes, [20]. Another similarity is the familiarity and age-appropriateness of the games for the student participants in the research context. For instance, many participants in past studies were experienced in playing *Minecraft* before entering the research project, [12], [28] and [30]. Some games like *Harry Potter and the Global Fire* were adapted from other media types (e.g., novels and films) familiar to students [21], [22]. Researchers in [25], [26] and [37] allowed students to choose their favorite games. Ensuring students' familiarity with the game choice bridged their preferred daily media practice with literacy learning, enabled them to adapt to the game environment quickly, and facilitated the connections between their previous and new knowledge in multimodal meaning-making [2]. Besides, the games were suitable for students' age levels. For example, *Super Smash Brothers* and *Pokémon Go* feature simple game mechanics manageable for primary students. Similarly, making artifacts with blocks in *Minecraft* is within the regime of competency of primary and secondary students. By contrast, games like *World of Warcraft* and *Second Life* were more appropriate for university students, given their sophistication for fostering more nuanced multimodal interactions and in-depth reflection.

Among diverse commercial games applied, *Minecraft*, a globally known sandbox construction game, dominated the game choices (n=8), reinforcing the finding of [17]. Highlighting digital games as interactive systems, researchers accentuated that *Minecraft* offered a non-prescribed open space and abundant semiotic resources (building blocks of different textures) for agentive exploration and creative multimodal designs [30]. Such features resonate with other selected games such as *LEGO World*, *The Sims*, and *Second Life*. It echoes "empowered learner" (i.e., good video games should empower players to be co-designers), a crucial learning principle of good video games, further corresponding with the core concept of "learning by design" highlighted in multimodal

literacy [7]. Another key feature is social interactions enabled by the selected games. Specifically, some selected games (e.g., *Minecraft*, *World of Warcraft*, *Second Life*, and *Harry Potter and the Global Fire*) offer an online platform for multiplayer communication and collaboration in the virtual world. Besides, there are large affinity groups around the games for players to be knowledge contributors, such as sharing expertise in game forums and YouTube channels of *Minecraft*).

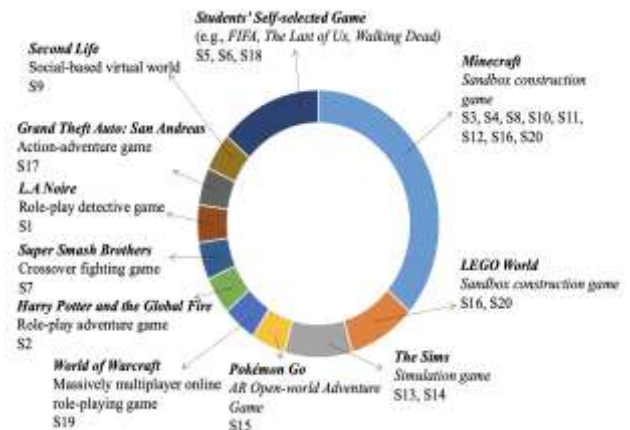


Fig. 2: Digital games in the reviewed studies

Emphasizing game narratives, [21], [27] and [36] selected games with potentially biased representation that address the critical aspect of multimodal literacy. For instance, *Grand Theft Auto: San Andreas*, *L. A Noire*, and *Super Smash Brothers* are characterized by dominant male characters and the underrepresentation of female characters, offering resources for critical reflections on gender stereotypes embedded in multimodal texts.

4.3 Theoretical Perspectives

The reviewed articles were grounded in new literacy and sociocultural theories, echoing [17]. Specifically, many studies (e.g., [12], [25], [31] and [32]) introduced theories broadening the scope of literacy in the digital era, such as multiliteracies [41], digital media literacy [42], and video game literacy [43]. Besides, [22], [30], [33] and [34] referred to the theoretical perspectives highlighting the sociocultural nature of literacy practice, such as "participatory culture" [44] and "affinity group" [7]. Both theories emphasize meaning-making as a constructive process in close social interactions where students enact agency and negotiate self-identities. The above theories justify the researchers' epistemological stance that recognizes literacy learning as a multimodal, diversified, constructive, and sociocultural practice, further

legitimizing incorporating digital games to cultivate students' multimodal literacy.

On the other hand, the selected articles revealed limited specifications on the theoretical underpinnings. Most studies offered concise descriptions of relevant theories without a structured conceptual framework as provided by [12] or [30]. Besides, although they described reconceptualized literacy, it remains ambiguous regarding the criteria for being multimodally literate in a certain age group (e.g., what can be counted as effectively utilizing digital multimedia for high school students). Moreover, few studies elaborated on pedagogical theories that guided the researcher's interventions. The lack of comprehensive conceptual and pedagogical frameworks poses challenges for non-expert practitioners to construct instructional knowledge and effectively incorporate game activities in practical educational settings, thus limiting the scope and scale of this research field.

4.4 Methodological Perspectives

The selected articles unanimously adopted the qualitative research paradigm, corroborating [17]. One explanation is that the constructive philosophical stance of the qualitative paradigm resonates with the contextualized nature of multimodal literacy through DGBL, [45]. As shown in Figure 3, case study (n=10) and ethnography (n=6) were two main approaches (Figure 3-a). Four studies did not specify the research approach. Despite slight differences in the researcher's position and focus, one common goal of these approaches was to gain a fine-grained understanding of students' constructive learning progress through DGBL in a natural context, [45]. Besides, all the research designs involved multiple data-collection methods, such as observation, video recordings, interviews, students' artifacts, and field notes. Various data sources offered multiple perspectives, a dynamic and holistic picture of students' learning process, and enabled data triangulation to enhance trustworthiness, [45].

Researchers designed different digital game-based activities (Figure 3-b). Five studies focused on students' digital gameplay, including their in-game actions, creations, and oral expressions. For instance, [37] observed how the students critically analyzed and applied multimodal information in the gameplay and empathized with the game characters. Additionally, 15 studies incorporated game paratext-making activities to explore students' multimodal literacy through game paratext-making. For instance, students engaged with game video-making in [23], [28] and [34], social media posts in [22],

[30] and [33], digital game reviews or walkthroughs in [27] and [35], and reflective writing regarding gaming experiences and knowledge in [12], [21], [31], [32], [38] and [39].

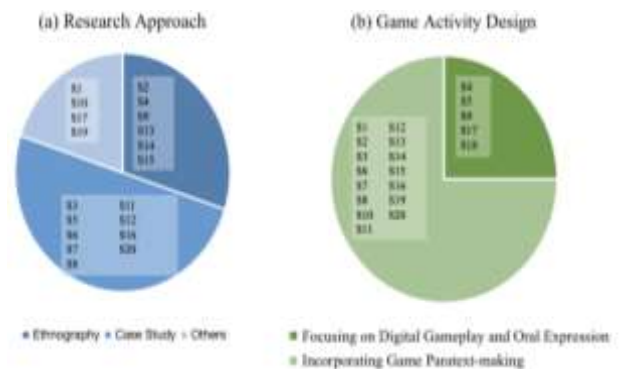


Fig. 3: Research design of the reviewed studies

One primary similarity of the research design was the researchers' emic view and active participation in the research programs. For instance, researchers in [24] and [36] directly interacted with the students, asking probing questions during the game activities or tasking students to "think it aloud" in terms of the "why" and "how" of their game actions [37]. In [21], [26] and [37], researchers worked closely with teachers and facilitated the whole process. Pedagogical tools were also adopted, such as handouts containing instructional knowledge [12] and guiding questions [39]. The interventions set clear learning goals for students' navigation, enhanced students' semiotic awareness and reflective thinking, and allowed them to articulate their ideas for rich findings. Nevertheless, these studies revealed insufficient details regarding instructional knowledge and the pedagogical approach to building the intervention model. It affects the transferability of the research design in other contexts.

Concerning data analysis, the reviewed articles reported varied approaches. It encompasses multimodal discourse analysis [27], [35], inductive analysis [28], [33], content analysis [25], template analysis [12], [39], and comparison analysis [26]. Although termed differently, these methods shared the same core of analyzing multiple data sources inductively to interpret students' learning. This is a contextualized and constructive meaning-making process, with theoretical frameworks being a broad reference, [45]. Consequently, researchers relied on their keen visions, profound theoretical knowledge, and outstanding analytical ability to interpret and synthesize a sheer volume of multimodal data. The demanding workload and high competency required in the analytical process constrain the sample size of

these studies. Besides, although such flexible analysis methods yielded thorough findings, they are prone to subjectivity due to vague criteria. For instance, it may raise debate whether the student's surface description: "in the video game it's you who moves the characters, and in the film, you see them" [22] can be claimed as demonstrating critical thinking. The lack of criteria may lead to inconsistent evaluations of students' learning outcomes and hinder the overall robustness of the research findings, potentially undermining the recognition of digital games as an effective way of literacy learning.

4.5 Possibilities of Digital Games for Multimodal Literacy

The reviewed articles substantiated that digital games incorporated through different pedagogical approaches offer possibilities for students' multimodal literacy learning regarding critical analysis of multimodal texts, creative design of multimodal compositions, and active engagement in social-cultural meaning-making (Table 2).

Most studies exemplified digital games can develop students' multimodal literacy in reading, analyzing, and applying abundant multimodal semiotic modes critically from multiple perspectives. Representationally, [21], [27] and [36] proved digital games as legitimate literature that sparked students' critical insights into stereotypical depictions of gender and race in multimodal texts. It further inspired interrogations of these issues in their lifeworld, such as a girl reflecting that the under-represented female characters mirrored the minimization of herself in a boy-dominated group [27]. Interpersonally, [12], [37], and [39] demonstrated digital games as valuable interactive texts, allowing students to form a critical awareness to examine the affordances of multimodal semiotic modes in enacting relationships with players (e.g., affecting players' decision-making and problem-solving). Compositionally, [26] and [33] evidenced digital games as versatile resources for students to approach from different angles (as narrative texts and interactive experiences), thus forming a comprehensive understanding of multi-layered meaning-making systems in multimodal texts.

Creative design of multimodal composition took place within and around the games. Studies applying construction games (e.g., *Minecraft* and *the Sims*) highlighted students' agentive creations in the game world. For instance, [23] and [24] emphasized that *Minecraft* provided students with rich multimodal resources and open space to assemble their artifacts and realize their design ideas with minimum cost,

thus cultivating creativity. Such flexible game space also enabled educators to combine traditional literature with digital gameplay, connecting students' preferred media practice and school literacy. For instance, students in [31] and [32] recreated scenes from a classic novel in *Minecraft*, strengthening their bond with the literature and enhancing their ability for critical multimodal analysis and creative composition.

Besides, digital games provide abundant design resources for students to engage in interest-driven and close-to-life transmedia multimodal compositions [23], such as digital videos [28], game reviews or walkthroughs [35], and social media posts containing written comments and game videos [30]. These activities extended students' multimodal literacy learning to a broader context, merging the boundaries between literacy activities in and out of the classroom and reshaping students' perspectives of what literacy means and how it relates to their lives [31]. Also, they empowered students to leverage multimodal semiotic resources, digital tools (e.g., video-editing software), and social spaces (e.g., social media platforms) to share experiences as producers and knowledge contributors [10].

Meanwhile, researchers underscored the social-cultural nature of students' critical and creative engagement with digital games. The game-based activities involved students in affinity space, in which students applied multiple semiotic modes to share game experiences with the real audience, such as viewers of social media posts [30]. Students also learned from more capable learners, including peers, teachers, researchers, or other players. For instance, expert gamers in [29] and [30] facilitated novice ones during gameplay and co-constructed their meaning-making system through constant communication and collaboration. Immersed in this sociocultural practice, students were empowered to take multiple identities [28], such as avatars, gamers, producers, knowledge distributors, students, and teachers, through which they negotiated and reconstructed their self-identity as active social participants [7].

Overall, the reviewed studies contributed positive learning outcomes proving that digital games are "a multimodal literacy par excellence" [7]. Nevertheless, one major limitation is the insufficient specification and depth of the findings. For instance, some studies briefly presented the student's self-reported enhancement in the ability to process multimodal information in gaming but did not offer concrete examples to support the claim [25].

Table 2. Possibilities of digital games for multimodal literacy learning

Game	Pedagogical Approaches	Learning Outcomes	Evaluation Method
<i>Minecraft /LEGO World</i>	<ul style="list-style-type: none"> • Gameplay (creation mode on computers/consoles), creating artifacts with assigned themes using blocks (S3, S4, S8, S10, S11, S12) • Design digital videos for storytelling using game scenes (S3) • Share game knowledge by videos (S8)/social media posts (S10) • Individual reflective writing of decision-making based on multimodal information (S16, S20) 	<ul style="list-style-type: none"> • Creative and agentive design of multimodal compositions in and around the game for self-expression (hereafter LO1) • Critical analysis of multiple semiotic modes for decision-making and problem-solving (hereafter LO2) • Active social interaction in an affinity group and identity building (hereafter LO3) 	<ul style="list-style-type: none"> • Qualitative evaluation of students’ digital gameplay process through field observation or video recordings without specified criteria (S2, S4, S5, S9, S17, S18). • Qualitative evaluation of students’ in-game artifacts (S3, S4, S8, S9, S10, S11, S12) or paratexts (S3, S7, S8, S10, S13, S14, S15) without specified criteria. • Qualitative analysis of students’ reflective accounts regarding their learning experiences and gains without specified criteria (all the reviewed articles).
<i>The Sims</i>	<ul style="list-style-type: none"> • Create and manage a community in the game on computers (S13, S14). • Design digital videos for storytelling about avatars (S14) • Online discussions for game knowledge sharing (S13) 	<ul style="list-style-type: none"> • LO1 • LO2 (in video design) • LO3 	
<i>Pokémon Go</i>	<ul style="list-style-type: none"> • Gameplay on tablets • Create digital game reviews or walkthroughs in groups (S15) 	<ul style="list-style-type: none"> • LO1 • LO2 (in paratext design) • LO3 	
<i>World of Warcraft</i>	<ul style="list-style-type: none"> • Individual gameplay on computers • In-depth game analysis and essay writing (S19). 	<ul style="list-style-type: none"> • Critical analysis of broader implications of game representation in academic writing 	
<i>Harry Potter and the Global Fire</i>	<ul style="list-style-type: none"> • Group gameplay • Classroom discussion (compare the game narratives with the novel (S2)). 	<ul style="list-style-type: none"> • LO3 • Critical analysis of games as multimodal composition. 	
<i>Super Smash Brothers</i>	<ul style="list-style-type: none"> • Group gameplay • Design digital posters or drawings about game character design (S7). 	<ul style="list-style-type: none"> • Critical analysis of game representation (stereotypes) in multimodal texts (hereafter LO4) 	
<i>L.A Noire</i>	<ul style="list-style-type: none"> • Analyze game narratives (e.g., gender) and write an essay (S1). • Share game expertise with teachers 	<ul style="list-style-type: none"> • LO3 • LO4 (e.g., gender) 	
<i>Grand Theft Auto: San Andreas</i>	<ul style="list-style-type: none"> • Observe the teacher’s gameplay. • Classroom discussions regarding gender and racial stereotypes with guiding questions (S17). 	<ul style="list-style-type: none"> • LO3 • LO4 (e.g., gender and race) 	
<i>Second Life</i>	<ul style="list-style-type: none"> • Group gameplay • Recreate scenes of the traditional literature in the virtual world (S9) 	<ul style="list-style-type: none"> • LO1 • LO2 • LO3 	
Student-selected Games	<ul style="list-style-type: none"> • Think-it-aloud gameplay of <i>The Walking Dead</i> (S18). • Reflect on learning gains from previous gaming experiences (S5) • Game analysis and design (S6). 	<ul style="list-style-type: none"> • LO2 • LO3 • Critical analysis of games as multimodal composition and multimodal practice 	

Additionally, the findings focused mainly on students’ multimodal literacy embedded in game-based activities, whereas scarce evidence showcased measurable improvements in their multimodal literacy levels and specific criteria of the outcome evaluation. This deficiency raises concerns about the significance of incorporating digital games in fostering students’ multimodal literacies in school settings and calls into question the justification for the substantial investments in digital devices and allocating curriculum time for these activities.

5 Conclusion, Implications, and Recommendations

In conclusion, this study systematically reviewed 20 articles exploring digital games for multimodal literacy learning across education levels, focusing on the contextual features, game features, theoretical perspectives, methodologies, and learning outcomes. The findings offered empirical evidence that digital games have been applied across primary, secondary, and higher education, but limited to small-scale studies and narrow-scope locations. The

researchers employed diverse commercial digital games that offered students agency for free exploration and creation, rich narratives for critical interrogation, and affinity groups for social interactions and identity reconstruction. The selected articles referred to various theoretical perspectives grounded in the core principles of multiliteracies and socio-cultural theories. However, they generally lack systematic organization and specificity concerning conceptual and pedagogical frameworks. Methodologically, the qualitative research paradigm dominated the research design, in which researchers took an emic view, employed multiple data-collection methods, enacted active interventions, and conducted inductive analysis to yield rich research findings. The synthesis of the research findings unveiled the possibilities of digital games for multimodal literacy in terms of critical analysis of multimodal information, creative design of multimodal composition in and around the game, and active engagement in social-cultural meaning-making empowering knowledge construction, collaboration, and identity reconstruction.

This review has implications for future research to venture deeper into digital game-based multimodal literacy studies. Given the contextual features discussed in section 4.1, researchers can pioneer similar research programs involving larger groups of student participants from less researched social contexts where digital games also play a significant part in youth's lives (e.g., Asian contexts). The broadened scope can address concerns about the Western-centric focus of prior studies, contributing to a more globally inclusive understanding of digital games' impact on multimodal literacy education and highlighting its socio-cultural diversity [2].

Second, this review offers a variety of digital games suitable for educators across different educational levels to enhance students' multimodal literacy. This addresses educators' uncertainty about game selection [13]. Besides, this study identified main game features pertinent to multimodal literacy, which can facilitate researchers and teachers to relate digital games to their teaching objectives and explore more digital games within their specific contexts, thus extending the educational value of digital gameplay beyond limited options.

Third, this review provides an overview of theoretical and methodological perspectives of the extant literature. The findings can guide researchers and educators to make informed decisions, effectively selecting appropriate theoretical frameworks and research methods to explore digital game-based multimodal literacy. Furthermore, this

study illuminates a promising avenue for researchers to improve the clarity and systematization of existing theoretical frameworks, aligning with more specific pedagogical theories. This alignment can substantially facilitate educators and researchers to structure instructional knowledge, adopt systematic pedagogical approaches, and evaluate students' learning outcomes. Consequently, it can bolster the practical applicability and effectiveness of cultivating students' multimodal literacy through digital games, as well as enhance the trustworthiness of studies in this study field.

Last, students' learning outcomes synthesized in this study offer different perspectives for future research to explore the possibilities of digital games in multimodal literacy learning (e.g., critical analysis and creative production of multimodal texts). However, since the findings were based on textual data from small-scale qualitative inquiries, the effectiveness of digital games on multimodal literacy has not been statistically examined, unveiling a new terrain for further investigations. Researchers can develop quantitative instruments and adopt pre and post-tests to assess the effects of different digital games on each dimension of multimodal literacy learning to substantiate these possibilities. Such approaches also empower larger-scale studies to enhance the rigor and generalizability of the findings.

While offering synthesized existing knowledge and valuable insights, this study acknowledged the potential omission of relevant studies despite our rigorous search methodology. Some relevant articles were not included in this review due to the inaccessibility of full-length articles, affecting the comprehensiveness of this review article. Besides, as a qualitative systematic review, this study contains a certain level of subjectivity in interpreting the findings. Despite these limitations, we believe this systematic review serves as a new benchmark for future research and educational practices in game studies and literacy studies to keep updates and refinements, thus better fulfilling students' needs and social demands in the ever-changing media landscape.

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- Yanan Shen conducted the literature review, analyzed the selected articles, and drafted the manuscript.
- Habibah Ab Jalil formulated the research questions, checked each procedure, and revised the manuscript.
- Rahimah Jamaluddin contributed to the cross-check and finalized the manuscript.

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