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Development of reading skills through video games: state of the art

Desarrollo de habilidades de lectura a través de los videojuegos: Estado del arte

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Abstract

This research analyzes the systematic linking of videogames in the processes towards the development of reading in the media and digital environment through the theoretical review. For this objective it was reviewed academic publications from international databases submitted between 2005 and 2016 related to the involvement of video games related on reading organized by school level, theoretical approach and research design. The results demonstrated its prevalence in secondary education basing its impact as an educational agent on changes in reading habits by opening a connection between readers and motivating of collaborative interaction. Likewise, the transformation of the process towards an oriented information search and acquisition of reading comprehension skills. Following this argument, it concludes in favor of the inclusion of videogames in the educational curriculum focused on the development of reading in the digital and media context.

Resumen

Esta investigación analiza la vinculación sistemática de los videojuegos hacia el desarrollo de la lectura dentro del entorno mediático y digital a través de la revisión teórica. Para ello, fueron examinadas diversas publicaciones académicas provenientes de bases de datos internacionales presentadas entre 2005 y 2016, relacionadas con la implicación de los videojuegos en la enseñanza de la lectura organizada según ámbito escolar, planteamiento teórico y diseño de la investigación. Los resultados demostraron la predominancia en la enseñanza secundaria, fundamentando su repercusión como agente educativo en los cambios de hábitos de la lectura, abriendo una ventana de conexión entre los lectores y motivando la interacción colaborativa. De igual modo, se vislumbró su impacto en la transformación de la lectura orientada a la búsqueda de información y a la adquisición de habilidades de comprensión. Tras esta argumentación, el artículo concluye a favor de la inclusión de los videojuegos en el programa curricular educativo, al fortalecer el interés por la lectura adaptada al contexto digital y mediático.

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Introduction

In today's globalised society, where the promotion of technologies, the outbreak of recent working sectors and the enormous quantity of information contents prevail (Cabero-Almenara, 2006), educational institutions constantly try to adapt to new pedagogical challenges, particularly digital inclusion and knowledge transformation through the acquisition of skills of use of Information and Communication Technologies (Dussel & Quevedo, 2010).

More specifically, the massive growth experienced by the video game industry, combined with the development of new technologies, has been driven in the last few years, becoming a leading means of mass consumption. China, ranging number one in this market, increased its investment thereon from 27.15 billion dollars in 2011 to 368.10 billion the following year (Ström & Ernkvist, 2014), followed by the United States, Japan, South Korea and Germany, which still are in the industry's upward production curve. Actually, according to Seiffert & Nothhaft (2015), the video game market has greater audience, higher growth and income than other media and entertainment industries such as cinema or music.

In addition to the economic indicators, the growth and fast popularisation of mobile devices -smartphones, tablets, laptops, phablets- have modified the interaction habits of users. The portability of online video games, combined with high multimedia capacity, cloud services, 3D graphics and touchscreens, provide access to any kind of entertainment content at any time, without limits in terms of storage space or device interface (Soliman, Rezgui, Soliman & Manea, 2013).

Likewise, equal attention should be paid to the impact that the content of games has on users. In first place, there are the benefits of playing video games because it has been shown that they increase well-being and prevent mental problems (Granic, Lobel, Rutger & Engels, 2014), promote attitudes such as per-

severance, commitment and effort (Ferguson & Olson, 2013) and encourage cooperative behaviours (Vélez, Greitemeyer, Whitaker, Ewoldsen & Bushman, 2014). On the contrary, it has also been shown that video games have a negative impact on people's behaviour when encouraging aggression, addiction, depression, procrastination, dodging the problems of the real world and a lack of interest in contributing to public life (Fikkers, Piotrowski & Valkenburg, 2016; Hussain, Williams & Griffiths, 2015).

Through combination of multiple factors such as the global market of an industry that is expanding rapidly, its pervasiveness through adaptation to mobile devices and the impact that the content displayed has on players, video games are a cultural phenomenon that is part of society's media reality where there is a need to educate users. In fact, education on video games is not a new idea. Huizinga (1955, p.75) already stated that the social aspects promoted when playing become productive for culture, acting as a civilising agent through different layers of ideas, knowledge systems, theories, rules and regulations. The combination of these layers is called society, which is nothing but the formalisation of a game where an established order is shared by a set of rules that present the rights and obligations of those who want to participate. Likewise, Caillois (1961, p. 167) also states that the game is a practice that consolidated society's moral and intellectual nature. In short, the classic vision links the game to a value that is associated to the teaching process when creating cultural forms.

In its part, the progressive transformation of culture has discovered several alternatives in other symbolic systems to produce, disseminate and appropriate meanings (Martín-Barbero, 2002), increasing in the media and digital landscape (Van Vliet, 2012). Reading and writing are specially concerned in this sense, by incorporating new interaction purposes, strategies and formats in the experience of students as already stated by Spencer

(1986) and recently confirmed by Martens (2010), Koltay (2011) and Knobel & Lankshear (2014), who concluded that identifying this alteration generated by the digital and media framework would enable us to find an efficient way to use them.

The level of correspondence between the text and the reader's knowledge affects the understanding of the text (Armbruster & Anderson, 1981). This premise, outlined over thirty years ago, matches Coiro's statement (2003) referring to the difference between reading books and reading on the Internet. Indeed, Leu, Kinzer, Coiro & Cammack (2004) accept the incorporation of concepts such as composition, decoding, comprehension and response to represent the factors designated in reading within hypermedia.

Gee (2012, p. 419) believes video games have special properties that develop comprehension skills, generating new meanings applied to reading. In the same vein, according to the studies carried out by the European Commission (2006) and UNESCO (Grizzle, 2011), the knowledge and skills aimed at accessing, processing and converting information in the media environment derived from audiovisual tradition, transcend the instrumentalisation, search, processing and dissemination of digital literacy technologies. This promotes skills in line with reading processes in the field of semiotics towards social interaction and critical thinking. In short, video games, when integrating in the literacy process, are structured in a process based on action, on the purpose, associating the combination of basic reading concepts when playing. More specifically, Hsu & Wang (2010) interpret reading as an identification and comprehension of the -semiotic- meaning of symbols through games.

This research tries to perform a descriptive analysis based on the specialised theoretical revisions of the link between video games and the development of reading in the digital and media environment. To that end, an esta-

blished order is set depending on the school environment, the theoretical approach and the research design. That way, an interpretative scheme about the purposes, strategies and skills developed in reading through video games is created.

Literacy and ICTs: Changes in reading habits

Nowadays' digital and media context has been formalised as a preference to attain the pedagogical objectives of the 21st century (Mills, 2010, p. 262). The media environment is complementary to the digital environment, because the technologies boom marks the start of the new visual and narrative representations, integrating texts, graphics, images, animations, audio and video (Ortlieb, Sargent & Moreland, 2014). This entails formalising a solid literary competence to facilitate the stimulation of readers and treating literature didactically when dealing with these new intertextual resources (Sánchez-García, 2011). Both contexts are aimed at the base lines previously set in the framework of the fourth cycle of the Progress in International Reading Literacy Study (PIRLS) (Mullis, Martin & Sainsbury, 2015). This basically outlines the changes in reading habits as a social experience, creating a sense of community because a window of connection among readers is opened, encouraging a collaborative interaction between readers and writers (Baron, 2015). Likewise, a transformation is observed in the process towards a type of reading aimed at searching for information and decision making (Wu, 2014), with a predominance of selective, non-linear and discontinuous reading in multimedia formats, which enable readers to increase comprehension, vocabulary, attention span and memory performance (Warschauer, Zheng & Park, 2013), with a positive impact on the cognitive encryption of information (Lin & Chen, 2007).

Likewise, according to the same premises outlined in the PIRLS (Mullis, Martin &

Sainsbury, 2015), the reading strategies and skills in this field were aimed at understanding and interpreting organised contents to summarise, ask, forecast, imagine, feel and clarify the multiple representations of online texts (Thorne *et al.*, 2013). This entails the integration of syntactic decoding skills, highlighting the correlation between the sentences in the text and operational skills aimed at using Information and Communication Technologies that make surfing in digital environments easier. This entails integrating self-regulation processes to maintain the task in question, which allows identifying and selecting those websites that fulfil specific needs and finding information in these interfaces, enhancing online reading activities. Although the PIRLS (Mullis, Martin & Sainsbury, 2015) focuses on the text's comprehension and does not show other variables explicitly, reading development in the digital and media environment is subject to changes in the strategies and skills aimed at the lexicon (Grue, Dobson & Brown, 2013) and the teaching of phonetics (Hinrichsen & Coombs, 2014).

Material and methods

The general objective of this study is to explain the information shown in different international bibliographical databases on reading and video games. In order to attain the goal of this study, we have analysed the literature of the last twelve years (2005-2016) of scientific production in the international reference databases. In this regard, Gu & Blackmore (2014) explain that the so-called "active period" of video game started in 2005, with a crucial increase in the number of publications related to this industry in different disciplines. For this reason, this year is taken as the initial search milestone. Likewise, it should be noted that the study is not dependent on the analysis of the displays, platforms or formats. In other words, the technical compendium linked to video games is not a

condition for the exploration outlined in this research.

Table 1 shows the systematic approach to identify the publications that are relevant for this research, carried out using the information search criteria and narrowing it to abstracts, conference proceedings and articles published in scientific journals published in online international databases: Web Of Science (WOS), Scopus and Education Resources Information Center (ERIC). The literature was analysed in June 2016, without focusing on additional studies.

Table 1 *Characteristics of the search in the databases*

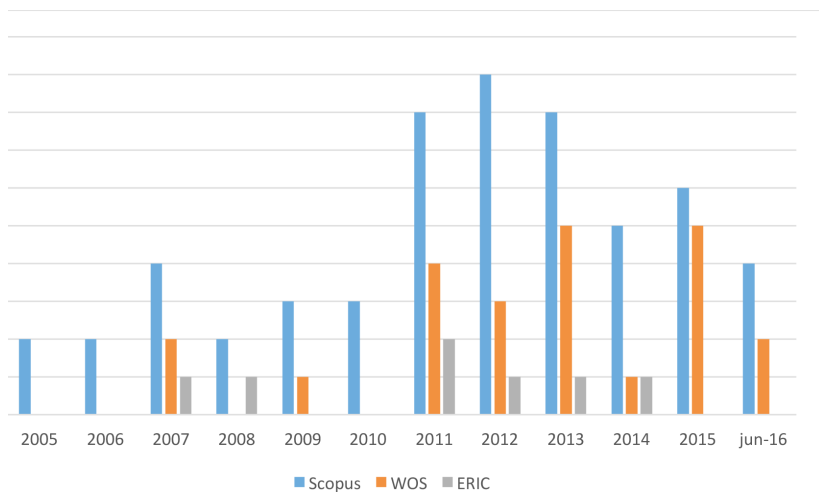
Bibliographic databases	Scopus, Web of Science and Education Resources Information Center
Types of publication	Articles, conference proceedings, book chapters.
Search words	«video games» AND «reading»; «videojuegos» AND «lectura»
Search mode	Delimited. Patents and quotes from third parties are not include.
Date range	2004-2016 (last updated in June 2016) *
Language	English and Spanish

Source: Prepared by the authors.

The search strategy combined words in English by using the Boolean operator AND to connect the concepts of the same search. According to this strategy: «videogames» AND «reading» were filters in the three databases selected. The «all fields» option is enabled, which means that the terms can be found in the article, title, abstract and keywords. Therefore, the range of publications associated to the study becomes even broader. A second search phase focuses on selecting the documents extracted from the databases using the following criteria:

- School environment (age segmentation): childhood education, primary education and secondary education.
- Theoretical approach: correspondence with the purposes, strategies and skills of the digital and media environment.
- Type of methodological strategy: exploratory, descriptive, correlational or explanatory.

Graph 1. Publications in the Scopus, Wos and ERIC databases on «video games» AND «reading»



Source: Prepared by the authors.

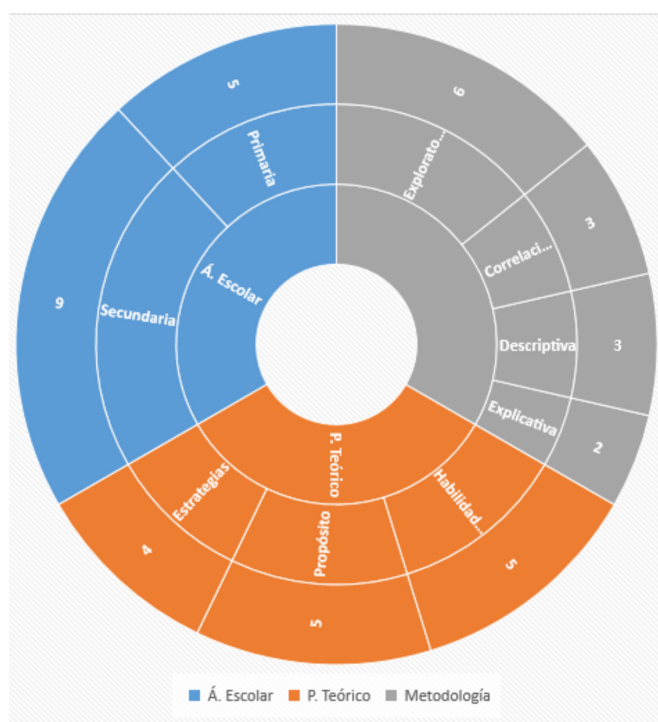
In first place, the school environment assumes the different age groups: preschool education between 0 and 6 years old, primary education between 7 and 12 years old and secondary school between 13 and 17 years old. Therefore, the theoretical approach is determined by the theoretical revision of the purposes: changes in the readers' habits or changes in the reading process, and the revision of strategies and skills previously set towards the text's comprehension, including the lexicon and the teaching of phonetics.

The research design is the last criterion, whereby both the type and approach are analysed. According to Dankhe (1989), the type of study can be classified as explanatory: overall perspective on a phenomenon that has not been sufficiently identified; descriptive: specification and measurement of properties, environments and components of a phenomenon; correlational: identification of the non-causal link between two or more variables; explanatory: principles and statements presented systematically about the interpretation of reality. On its part, according to Hernández-Sampieri, Fernández-Collado & Baptista-Lucio (2010), the focus is arranged in a qualitative way: subjective inference of phenomena; qualitative: deductive and experimental formulation of phenomena; or

hybrid: combination of instruments, variables and categories from both methodologies.

On its part, graph 1 shows the 85 documents collected during the first phase, 14 of which met the criteria of the second phase by classifying the research by age range, by its theoretical and its methodological approach. Nevertheless, the remaining 71 publications focus on a higher age group as in the following cases involving university students and adults (Gabay & Holt, 2015; Müller, 2012). In addition, those publications that refer to video games without mentioning the hypothesis exclusively were not included from the theoretical approach, including television or other media in the results (Romer, Bagdasarov & More, 2013), or those that refer to reading as another literacy component without exploring the development of its variables (Beavis, 2014;

Graph 2. Organisation of the 14 publications consulted



Source: Prepared by the authors.

Padilla-Zea, López-Arcos, Sánchez, Vela & Abad-Arranz, 2013).

According to the criteria set, graph 2 shows that the results of the largest amount of studies are: 10 in secondary education environment, 6 towards reading skills and 6 use exploratory methodology. On the contrary, in preschool education environment, there are no manuscripts supporting the use of games when reading in a clear, specific way for this age group.

On their part, reading strategies have 4 manuscripts (Gerber, Abrams, Onwuegbuzie & Benge, 2014; Jiménez & Rojas, 2008; Steinkuehler, Compton-Lilly & King, 2010; Zagal, Tomuro & Shepitsen, 2011), which are aimed at phonetics, the lexicon and reading comprehension. On the basis of the methodological trend presented, it is noted that explanatory type only has two studies that set forth principles and statements that are systematically presented about the interpretation of reading in video games (Drummond & Sauer, 2014; Jackson *et al.*, 2011).

Results

Purposes of reading through video games

According to the 5 documents related to the purposes of video games in reading (Berger & McDougall, 2013; Drummond & Sauer, 2014; Jackson, Von Eye, Witt, Zhao & Fitzgerald, 2011; López, Encabo & Jerez, 2011; Serrano-Laguna, Torrente, Moreno-Ger & Fernández-Manjón, 2012), the transformation of reading is assumed, taking into account that the use of video games is a justified practice that proves the complexity and non-linear nature of the text in digital and media representations. Given that this type of reading displayed in video game does not focus on one only type of text, it generates a dynamic dialogue that has an impact on the interaction among students (Berger & McDougall, 2013).

The high level of interactivity produced by video games, omitted in the analysis by

Jackson *et al.* (2011) because they are seen as a lonely activity, is indeed highlighted by Serrano-Laguna *et al.* (2012). In their research, they reveal the commitment and willingness of students through the high level of interactivity of video games towards a significant experience in a typically traditional activity as reading. Regardless of whether this interaction has a social nature or is systematised by computerised interfaces, they encourage that, in case video games are used in the reading process, innovating methods to evaluate learning should also be included, such as heat maps that identify the interaction level with the characters and the objects, making this task easier to educators.

While video games still have greater correspondence with spatial processing, which is close to mathematics and analytical-computational thinking, the reading process starts to be positively influenced by video games thanks to the portability and omnipresence of the latest-generation Internet, which offers a wide range of possibilities to teaching (Jackson *et al.*, 2011). The nuances of the study *a priori* mentioned are clarified by Drummond & Sauer (2014), who state that video games ultimately transform the reading performance of young people, slightly improving the performance of students and affecting their results in a positive way, as it occurs with science and mathematics.

After all, video games are promotion alternatives that approach more easily to reading as an entertainment activity through an appealing, different narrative, encouraging young people to read and enabling instructors to combine digital contents with in-person methodologies within the same space (López, Encabo & Jerez, 2011).

After verifying the multiple purposes of video games through two explanatory studies that can be cross-checked, one stating that video games still benefit the development of skills aimed at pure sciences (Jackson *et al.*, 2011), and the other outlining the positive

impact of video games in the development of reading (Drummond & Sauer, 2014), there is a trend to include them as an alternative resource in secondary education, according to the exploratory analyses consulted. This argument is based on their role as interaction drivers that have a positive impact on the interest of students in reading (Serrano-Laguna *et al.*, 2012; López, Encabo & Jerez, 2011).

Reading strategies through video games

The reading strategies linked to video games correspond to four manuscripts, of which one is aimed at primary education of an exploratory type and three to secondary education, two of a descriptive type and one of a correlational type, respectively (Gerber, Abrams, Onwuegbuzie & Benge, 2014; Jiménez & Rojas, 2008; Steinkuehler, Compton-Lilly & King, 2010; Zagal, Tomuro & Shepitsen, 2011). In first place, Zagal *et al.* (2011) make an exhaustive revision of the readability of video games, and state that the lexicon should be simple, using words with few syllables and organising information in short sentences. In order to know whether or not the video game's narrative fits the educational level of the students, strategies from the digital pre-age are applied: Gobbledygook measurement (McLaughlin, 1969), which revises the number of polysyllabic words written in the text; Coleman-Liau index (Coleman & Liau, 1975), which examines the number of characters used in each word; and Gunning fog index (Gunning, 1952), which measures the length of sentences and the portion of words with three or more syllables.

This way, by using these three tools, educators can verify the level of the video game's narrative, seeing its legibility and its suitability for the course. The correlational study by Steinkuehler *et al.* (2010) also analyses legibility but compared to gameplay by applying Gobbledygook measurement (SMOG), revised above, Fry analysis (Fry, 1968), which calculates the standard number of sentences and

syllables every hundred years, Flesch-Kincaid test (Kincaid, Fishburne, Rogers & Chissom, 1975), whereby texts are classified according to the different school levels in the US. After performing these tests, the authors conclude that only 20% of the narratives of video games use a language that is specialised in playing, while the remaining 80% are aimed at secondary education students.

On their part, in the study by Jiménez & Rojas (2008), video games are linked to the phonetic development of reading, although the sample focuses on dyslexic primary education children. In this case, the results show that video games foster the phonetic development when reading words. In order to support this finding, they analyse the cognitive processes involved in the phonological representations generated through reading; in other words, the interaction of phonemes through synthesis and segmentation strategies based on multimedia tools allows assessing the performance of students with regard to word recognition.

Ultimately, Gerber *et al.* (2014) prioritise the mixed experience, the design and comprehension of the hypertext being of primary importance. The knowledge of the game, including its content and stage, as well as the interpretation of the characters in RPGs (Role-Playing Games), means that students assimilate some specific vocabulary and apply symbols that are previously set to a specific end. Under these circumstances, this study believes that the construction of meanings in video games is connected to the comprehension of the information that is read. In this sense, those strategies that promote this kind of experiences should be set up through constructive, critical analysis based on permanent feedback, both from instructors and from other students, thus reinterpreting the meaning of the discourse conveyed by video games.

In short, the documents revised present three different approaches on the reading

strategies of video games. Nevertheless, this triad has a clear trend to integrate the instructor actively, playing the role of a guide during these educational experiences, regardless of whether these strategies are aimed at the lexicon, phonetics or the text's comprehension. In addition, the three documents have a high level of specificity, which makes it more difficult to extract strategies that can be generalised in the digital and media context with regard to video games.

Reading skills through video games

The five documents classified towards reading skills can also be subdivided into phonetics (Ludovico, Di Tore, Mangione, Di Tore & Corona, 2015) and text's comprehension (Bengoechea, 2009; Gerber & Onwuegbuzie, 2013; Michaelsen & Pihl, 2012; Pfannenstiel, 2016). The first of them, Ludovico *et al.* (2015), is an analysis aimed at the same field of Jiménez & Rojas's study (2008), using the same descriptive methodology in dyslexic primary education children. In this case, they focus on the impact of video games in reading accuracy and speed, showing that accuracy is increased but speed will depend on the student's level of experience within a similar format.

The comprehension skills of the text are classified based on two correlational analyses of secondary education (Bengoechea, 2009; Michaelsen & Pihl, 2012), of a descriptive analysis of primary education (Gerber & Onwuegbuzie, 2013) and an explanatory analysis of secondary education (Pfannenstiel, 2016). The two correlational analyses are performed in two different geographical contexts, Norway (Michaelsen & Pihl, 2012) and Spain (Bengoechea, 2009), and they present reading comprehension in video games from three different variables: (1) information acquisition, (2) interest reinforcement (Michaelsen & Pihl, 2012) and (3) promotion of critical thinking (Bengoechea, 2009). The results of both studies are aimed at the same purpose: while video games may

increase the interest of students and the acquisition of information (Michaelsen & Pihl, 2012), and promote reflection on critical view (Bengoechea, 2009), they lose all of their value as a pedagogical resource because they are not part of the curriculum. For this reason, Gerber & Onwuegbuzie (2013), by showing that students are more interested in making progress in reading when video games are incorporated to the reading process, try to present video games as a vehicle between extracurricular practices and the skills that are integrated in the curriculum, drawing a parallel and synchronising those reading skills that are part of the curriculum and video games. In last place, the explanatory analysis by Pfannenstiel (2016) includes a number of reading comprehension skills that may be enhanced through video games:

- Analysing and evaluating the course's material.
- Making interesting questions about the course's material.
- Practising the presentation skills.
- Encouraging discussion on in-person reading material.

Discussion

Video games teach about accessing, viewing information and operating social interaction systems (Marsh, 2014). The interpretative nature of their narrative, generated through interaction, highlights their adaptation in the educational environment by deconstructing visual texts and identifying the different meanings of the information displayed (Björk & Holopainen, 2005). This enables students to learn in an active, participative way, notably with regard to the reading process.

Regarding the revision of the literature of the last twelve years (2005-2016) of scientific production related to video games and reading, the correlational subject of games and reading and writing was first accepted in high-impact scientific journals in 2011, and the amount of publications aimed at this subject has increased dramatically. The

enhancement of virtual reality devices and the progressive adaptation of video games to the school environment, offer new opportunities with high expectations for their academic development.

On the other hand, it is confirmed that there is a greater number of conferences indexed in international databases than publications in scientific journals. This is due to the idealisation of video games in disciplines such as computer science, which is developed in this type of forums. The general trend shows that there will be a similar number thereof in the years to come.

Regarding the selection of documents extracted based on the school environment criteria, the theoretical approach and the type of methodological strategy, it is confirmed that video games are being gradually incorporated as a reading resource in secondary education. In fact, according to Gutiérrez and Tyner (2012), video games are educational agents that are not alien to teaching because they have an important impact in the media education of young people. In this sense, it is necessary that instructors are aware of their implementation to protect users from unintended consequences of media use (Aguaded & Romero-Rodríguez, 2015).

The transformative effect of video games in the educational context can be noted in the concept of digital literacy, as it is used as a pedagogical tool. Therefore, the theoretical approach of the manuscripts linked to reading tends to perform an exploratory revision without engaging in trivialising their implementation. Nevertheless, given the short theoretical development on the link to reading, the simplification of the methodological types, the absence of studies related to preschool education and the non-inclusion of entertainment activities in the curriculum lead to further analysis in future research.

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