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Ludic programs and their application in reading: A systematic review

[1]Nila Magdalena Marcelo Rojas, [2]María Rosario Palomino Tarazona, [3]Juan De La Cruz Mamani Apaza, [4]Silvia Del Pilar Alza Salvatierra, [5]Robert Julio Contreras Rivera

[1]Universidad Privada César Vallejo, Lima, Perú, nmarcelor@ucvvirtual.edu.pe, ORCID: 0000-0003-1506-3808
[2]Universidad Privada César Vallejo, Lima, Perú, mpalominota@ucvvirtual.edu.pe, ORCID: 0000-0002-3833-7077
[3]Universidad Nacional de Educación "Enrique Guzmán y Valle", Lima, Perú, jmamani@une.edu.pe, ORCID: 0000-0002-5177-8264
[4]Universidad Privada César Vallejo, Lima, Perú, salzas@ucv.edu.pe, ORCID: 0000-0002-7075-6167
[5]Universidad Privada César Vallejo, Lima, Perú, rjcontrerasr@ucvvirtual.edu.pe, ORCID: 0000-0003-3188-3662

Abstract

In this research article, a systematic review of different bibliographic sources that have interactive reading, playful programs, and reading comprehension as research variables was carried out. The main objective of the article is to compile, expose and analyze these sources or evidences, so that future researchers can find theoretical diversity for the research variables, also they can easily find the diversity of playful reading programs that are under study and pre-application to promote reading comprehension in both children and adults and expose the different technologies or pedagogies used by these programs. A rigorous source search was carried out in Scopus, inclusion, and exclusion criteria were applied, and finally, 23 sources were considered for the present review. A general and also detailed analysis was made, in which each source was analyzed and relevant concepts could be extracted, which were included in the first subsection of results, then sources describing case examples of interactive programs in children and adults were found, which were included in the second subsection, and finally, theories and conclusions were presented as a discussion.

Keywords: Investigative reading, reading comprehension, playful programs, interactive games, reading skills.

Introduction

In the current context and thanks to the recent health disaster, the accessibility of the "multiscreen" society to audiovisual, multimedia, and digital materials has been increasing; the constant use of smartphones, computers, and tablets has proliferated and they are even considered -due, and in large part, to the pandemic- as a key tool for the improvement of contemporary education (Honorato-Errázuriz and Ramírez-Montoya, 2020). In Latin America there is a large educational gap (Honorato-Errázuriz and Ramírez-Montoya, 2020); however, games and video games have become predominant forms of entertainment in this region, likewise, and have had a strong impact on different cultures and communities (de Carvalho and Coelho, 2022 and Guillén-Yparrea and Ramírez-Montoya, 2021).

In attempting to use these tools to intervene in academic learning, the so-called "play programs" were developed. In the last decade,

many studies have shown positive effects on the use of appropriate playful reading strategies to improve reading comprehension (Junhee and Yusun, 2022). Playful programs are forms of game-based entertainment that aim to stimulate the learning process. The word “ludic” comes from the Latin word “Ludus”, which stands for and means “game” and the properties of games that currently, and mostly, encompass advanced and immersive technologies, as well as virtual reality (de Carvalho and Coelho, 2022). In other words, it is game-based learning associated with the improvement of any competency.

Since reading is a multifaceted process, it can be inferred that its main objective is comprehension. Currently, students are facing a lack of interest in reading, which may be one of the reasons why an early reading habit is not created. The findings found in reviews of information related to reading habits lie in the importance of promoting unique techniques and strategies to promote the lost interest in acquiring new knowledge through reading. It is considered necessary to have reading materials in a suitable environment, to devote quality time to reading, as well as to prepare the reader to be an individual with regulated reading comprehension (Mehrpour et al., 2022).

Reading and writing are very important skills for the development of society, as it is the path to formal education, democratic participation, and a higher level of well-being (Urzúa et al., 2021; Oh and So, 2022).

Comprehensive reading is a skill that represents a complex cognitive process and can be difficult for some individuals to master. Therefore, different reading comprehension schemes are applied to favor students' processes in reading courses to identify the most appropriate model for each one of them. Due to these circumstances, there is a need to adopt a learning model that integrates advanced technologies focused on improving reading comprehension (Mufliharsi et al., 2022).

Likewise, it is known that reading has multiple positive effects on the brain, such as reducing stress in addition to favoring memory (Bresó-Grancha et al., 2022). Narrative skills should be stimulated from an early age, since their future school, professional and social integration depends on this (Thomas et al., 2019; Honorato-Errázuriz and Ramírez-Montoya, 2020; and Veloso and Paiva, 2021). However, this does not mean that higher education institutions have not designed creative programs to increase students' academic performance (Urzúa et al., 2021). Digital resources are becoming increasingly important in reading, through interactive digital materials, which generate a high level of immersion and motivation for children, youth, and adults (Bautista-Vallejo et al., 2020). From programs that seek face-to-face collaboration, telematic tools (Berrios-Aguayo et al., 2020), to activities that include virtual reality video games that lead us to the search for techniques to show transferable comprehension strategies instead of teaching for the test or exam that, frequently, is the method of choice for certain educators (Arner et al., 2021).

Also, it should be taken into account, in this changing environment, that reading habits and information consumption, in general, are shifting towards “digital reading”. There are multiple studies where the conditions or factors that lead to low reading comprehension and reading habits are developed, and there are also studies where strategies are developed to mitigate this problem using various recreational programs supported by technology, most of these studies are conducted in countries outside South America and in languages other than Spanish, for this reason, this review seeks to collect and analyze sources and evidence so that future researchers can find some theoretical diversity, both for the variable “playful programs” and for “reading comprehension”, and also easily find the diversity of programs that are under study and pre-application to promote reading comprehension in both children and adults, and finally, some conclusions of later works are presented, which coincide in the validity of these cases, which are discussed in the discussion section.

CONDITIONS AFFECTING READING COMPREHENSION

Several conditions can affect language-based learning, such as the case of reading. One of the most common conditions is dyslexia, which occurs in about 10% of the population (Broadhead et al., 2018). Dyslexia is attributed to the difficulty in the use or understanding of words during language use or reading, although it cannot be attributed to some type of intellectual deficit, its origin is still being studied; current consensus indicates that it originates during neurodevelopment (Broadhead et al., 2018). Rodríguez-Cano et al., define it as the difficulty of accuracy and fluency in recognizing words (written) and a deficit in decoding and spelling skills (2021).

Another condition that most people go through upon reaching older adulthood, is the progressive loss of cognitive function as a result of the decrease in intellectually stimulating activities such as reading, which causes memory to be impaired and reading comprehension levels to decline progressively (Reidy et al., 2020). Beyond reading for recreation in older adults, this can cause activities such as getting to a certain destination or shopping to become difficult as they are unable to follow written instructions efficiently (Reidy et al., 2020).

The socioeconomic level and a low command of the language are factors that affect literacy levels, as well as reading and reading comprehension levels; for this reason, some countries establish differentiated teaching methods for children of low socioeconomic levels or multilingual families, whose children or young people have school difficulties due to a lack of reading comprehension (Thomas et al., 2019).

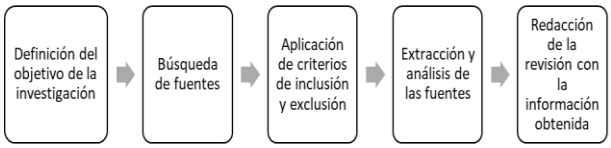
The low level of educational preparation during the early years is a factor that affects the level of reading comprehension and that comes to light at later ages, such as the university stage, because at this stage students are exposed to more complex texts (Urzúa et al., 2021).

The digital environment is interfering with the reading habits and information consumption of many young people and adults, who reduce their reading horizon to only short texts, even some "gurus" predict the end of books. This change in the type of reading, which depends on the medium, through which this activity is being carried out (computer, cell phone, tablet, and other devices) can lead to a decrease in the retention of what is read (Sala et al., 2020).

MATERIALS AND METHODS

Design: This research article follows a qualitative approach, and for its development, a systematic review was carried out, which began with a mapping of the literature related to the application of play activities to encourage reading and improve reading comprehension. Sources extracted from reliable repositories such as SCOPUS were included. The research conducted is descriptive and its objective was to show the respective contributions of the sources used for the review, such as concepts, examples, and reflections of other authors. The definitions and examples were developed in different sections within the results, while the main reflections, comments, and conclusions of the sources are shown in the discussion section. For better detail, it is explained in Figure 1.

Figure 1 Systematic Design



Source: Own elaboration.

Search strategy: From the beginning, SCOPUS was chosen as the main source to obtain the articles that will be part of this review. An initial search was carried out with the variables "reading AND reading comprehension", "reading AND playful", "reading AND interactive", and "program AND reading", and the searches were repeated using the same words, but translated into English. Multiple sources were found in SCOPUS, where English sources and studies related to cases where reading programs are applied, supported by

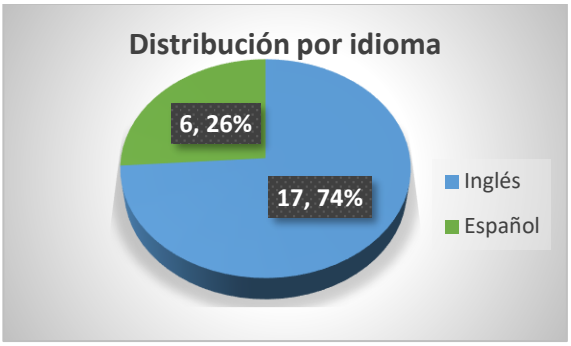
technology, and aimed at children predominated. The search continued for entry words such as "program AND reading AND adults", and "reading AND adults" to have a broader view of the playful reading comprehension programs, without discriminating by age, and sources related to the conditions that favor poor reading comprehension were also found.

Inclusion and exclusion criteria: Sources no older than 5 years (2018-2022) belonging to the SCOPUS repository were included. Sources were not excluded, due to their language, since they were mostly in the English language. Sources that dealt with a repeated case of an already selected source or gave the same example of a ludic program were removed, to have more variety. Articles that were not open access and did not include some of the research variables as keywords were excluded. However, if the abstract was promising or in line with the objective of the review, then the source was considered. After the initial search and filters, there were about 170 articles; however, after applying the last filters and trying to find texts that could fit into the sections shown in the results and discussion, the number of articles selected was reduced to 23.

Data extraction: A total of 23 sources were considered relevant and following the objective of this review. For data extraction, each of these texts was read in its entirety. The contributions of each of these articles were reviewed and analyzed, which included fundamental concepts about the keywords and main variables, case examples of playful programs to encourage reading and improve reading comprehension were shown, as well as opinions, conclusions, and reflections of different authors who explained the influence of playful programs on reading.

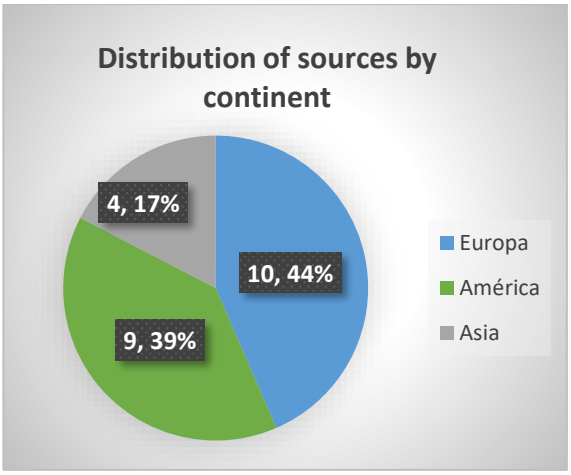
Data analysis: The information analyzed was divided into sections for a better understanding; the first section consists of showing the sources and their respective conceptual contribution; the second sub-section shows case examples of playful reading programs focused on young people and adults; and finally, the discussion talks about some comments, reflections, and trends in research related to interactive reading.

Figure 2 Percentage Distribution by Language



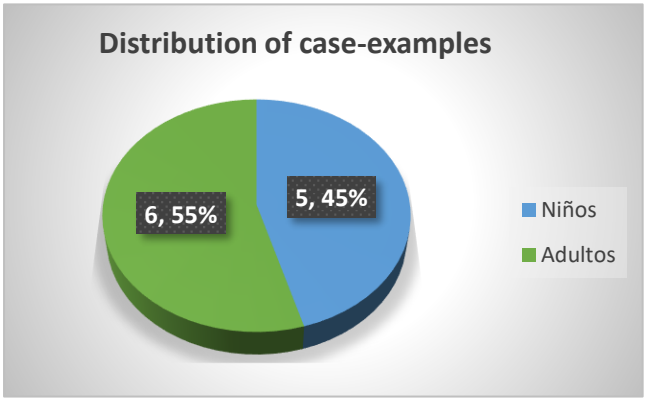
Note: The data analysis showed that 73% of the sources included in the review were in English and 27% in Spanish.

Figure 3 Percentage of Distribution by Continent of Origin



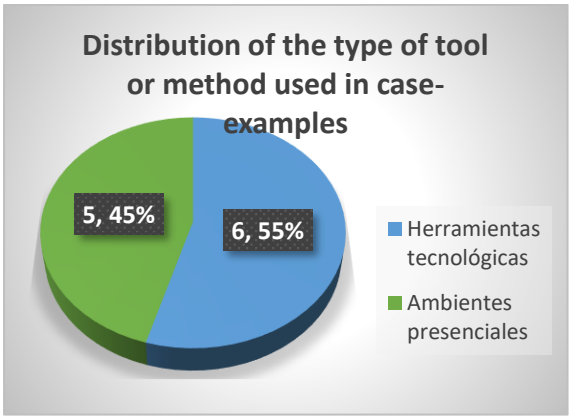
Note: Of the 23 sources considered for the review, the majority came from Europe (44%), 39% came from the Americas, 17% from Asia, and 17% from Asia.

Figure 4 Percentage Distribution by Ages.



Note: Of the 11 sources that were considered as case examples, 45% were obtained for children and 55% for adults.

Figure 5 Distribution of Type of Tool or Method Used in Example Cases.



Note: Of the 11 case examples used in this review, 55% used technological tools, and the other 45% used face-to-face and pedagogical collaborative environments.

RESULTS

READING AND PLAY ACTIVITIES: CONCEPTUAL REVIEW

Table 1 shows different sources that provide relevant concepts on reading, reading comprehension, playful reading, and interactive programs.

Table 1 Different contributions and important concepts extracted from the review

Year-country	Author	Contributions - Concepts
2021 - Chile	Urzúa, S., Riquelme, R., and Micin, S.	Reading is a fundamental tool for human beings, in other words, it is a "competence for life" and gives us the ability to make decisions, interpret messages, communicate effectively and express a critical thought or idea (Urzúa *et al*., 2021). Academic literacy is a process that responds to a set of strategies that favors the production and analysis of texts by university students (Urzúa *et al*., 2021).
2021 - Chile	Pascual, G., Goikoetxea, E. and Bustos, H.	Reading comprehension is defined as the mental process of extracting and constructing meaning from the reading of a text, and teachers assess reading comprehension ability to understand school performance, know the differences in the level of comprehension and evaluate intervention strategies (Pascual *et al*., 2021). Reading comprehension can be measured through international tests such as PISA (Programme for International Student Assessment) or standardized tests (Pascual *et al*., 2021).
2021 - Argentina	Ferroni, M.	Reading comprehension has been defined as a complex skill developed by a reader, where meaning is constructed from a written text (Ferroni, 2021). It is fundamental in early developmental stages, since it is one of the main methods for acquiring knowledge, and it also enables the mental representation of a written text (Ferroni, 2021).

2022 - Italy	Florit, E., Roch, M., Dicataldo, R. and Levorato, M.	Reading comprehension is the product of decoding and listening comprehension (Florit *et al*., 2022). The former is defined as the ability to read accurately and silently single and isolated words, while the latter is defined as the ability to take in lexical information and interpret sentences (Florit *et al*., 2022).
2021 - Argentina	Vernucci, S., Aydmune, Y., Andrés, M., Burin, D. and Canet-Juric, L.	Reading comprehension is a complex cognitive skill that is defined as the ability to make a graphical or mental representation of what is read. During childhood, verbal working memory is one of the most consistent predictors of reading comprehension, because it allows for storing and processing information simultaneously during a task or activity such as reading (Vernucci *et al*., 2021).
2019 - Costa Rica	Barberousse-Alfonso, P. and Vargas-Dengo, M.	Reading can be defined as the decoding of texts; however, its importance goes beyond that, as it includes the internalization of the message, its interpretation, and contextualization (Barberousse-Alfonso & Vargas-Dengo, 2019). Reading favors the emergence of complex thoughts for learning, language, and communication; in other words, it is a tool to discover and learn more about the world (Barberousse-Alfonso and Vargas-Dengo, 2019).
2019 - Belgium	Thomas, N., Colin, C. and Leybaert, J.	Interactive reading is a learning activity in a collaborative environment that is based on both books and narratives and is intended to provide a positive experience related to reading (Thomas *et al*., 2019).
2020 - Belgium	Thomas, N., Colin, C. and Leybaert, J.	Interactive reading is defined as a device, which encourages exposure to "print" material and language development based on a text or book, and includes strategies to improve reading comprehension (Thomas *et al*., 2020).
2022 - Switzerland	de Carvalho, C. and Coelho, A.	Playful programs are activities to achieve learning through play and creativity, possessing characteristics such as immersion, which makes the individual enter into a state of deep concentration or mental involvement and improves the learning process, through multisensory stimulation provided thanks to various materials or technologies (de Carvalho and Coelho 2022).
2022 - Korea	Junhee P. and Yusun K.	Play programs are activities that follow particular reading or pre-reading strategies, which encourage readers to use their existing knowledge to facilitate comprehension and the addition of new ideas (Junhee and Yusun, 2022).

Note: Own elaboration

EXAMPLES OF PLAY PROGRAMS - CHILDREN

Table 2 shows the cases that served as examples to describe the play programs for children that were applied to improve reading comprehension.

Table 2 Different case examples in children important to review

Year-country	**Author**	**Contribution - cases**
2018 - United Kingdom	Broadhead, M., Daylamani-Zad D., MacKinnon L., and Bacon L.	There are several approaches to improving the difficulty of comprehension during reading; however, phonics is one of the tools, which promises more engagement on the part of students (Broadhead *et al*., 2018). Broadhead *et al*. propose a computer-assisted intervention, where there will be a game with a 3D environment consisting of 44 zones, which represent the 44 standard English phonemes, likewise, each zone will be categorized and identified by a color and sound, and the letters that represent each phoneme. This system will help the reader's categorization and will help her to fix the relationship between the sound (phonetic) and the grapheme (written), likewise, zones can be added, which correspond to more complex phonemes, so that the player's skills can be increased (Broadhead *et al*., 2018).
2021 - Spain	Rodríguez-Cano, S. Delgado-Benito, V. Ausín-Villaverde, V. and Martín, L.	Rodríguez-Cano *et al*. (2021) propose the creation of a video game with virtual reality software where participants, who will be children, can choose an avatar and go through extraplanetary worlds advancing through different challenges. These challenges consist of activities focused on increasing the habit of reading and reaching a fairly acceptable comprehension along the way, these activities focus on the grapheme-phoneme relationship, syllable recognition, word reading, selection and identification of letters, identification of repetitive consonant sounds, and recognizing words within a text (Rodríguez-Cano *et al*., 2021).
2019 - Belgium	Thomas, N., Colin, C. and Leybaert, J.	Thomas *et al*. (2019) propose interactive reading sessions in French, a language different from the native language of the children to whom this session is directed starting from basic reading activities such as onomatopoeias, vowels, actions, to activities where children can read and explain in their terms the meaning of the words studied. Among the objectives, it was also outlined that students can recognize misspelled words during the final sessions (Thomas *et al*., 2019).
2020 - Spain	Bautista-Vallejo J., Hernández-Carrera R., Moreno-Rodriguez R., Lopez-Bastias J.	Bautista-Vallejo *et al*. (2020) propose the use of a software called Action Manager, which supported by the technology of an interactive whiteboard, allows children to participate in a type of "card game", where they must form pairs, when discovering the "pair" cards the word will be displayed and in a sentence or videos will explain the definition of the word, which will increase vocabulary and encourage reading, also, it has a very creative character that helps you to go through the different screens and levels of complexity (elementary, intermediate, and advanced).

2019 - Chile	Arancibia-Gutiérrez, B. and Bustamante-Molina, M.	The use of the interactive whiteboard is proposed for children in the first years of elementary school, who practiced activities with their teachers on the interactive whiteboard for 14 weeks, to improve reading comprehension. The activities consisted of linking a written word with the illustration that represents it, as well as reading sentences and linking them with their respective drawing, the more sentences, the higher the level, finally, a scene and different alternatives are presented, where the one that best describes the scene must be selected (Arancibia-Gutiérrez, 2019).

Note: Own elaboration

YOUTH AND ADULTS

Table 3 shows the case examples of playful programs for adults, supported by different technologies, which were applied to improve reading comprehension.

Table 3 Different case examples in adults important for review

Year-country	**Author**	**Contribution - cases**
2020 – United Kingdom	Reidy, L., Chan, D., Nduka, C. and Gunes, H.	Reidy *et al*. (2020), propose the creation of a cognitive training game using virtual reality and facial electromyography, aimed at older adults or adult stroke victims. The game consists of two environments; a supermarket, where the participant must follow a supermarket list and find the products, according to the quantities requested; and a museum, where they must follow written instructions to find the monuments, entrances, and exits, also, a questionnaire will be applied every 45 seconds to verify the presence of the game, as well as a screen where the score can be displayed, the remaining time among other important information (Reydi *et al*., 2020). The difficulty of the game will be regulated through the participant's emotions, shown through facial expressions, thanks to facial electromyography and his character will have the same expressions at the time of achieving the objectives (Reydi *et al*., 2020)
2021 - Chile	Urzúa, S., Riquelme, R., and Micin, S.	As a result of the low academic level of some university students in the interpretation of discursive and more complex academic texts, Urzúa *et al*. (2021) propose a program called “Reading and Writing Laboratories” based on different sessions where tutors are presented, which are students with a more advanced level of reading and writing, who support and advise other students, through the use of techniques such as underlining, marginal annotation, creative concept maps, effective summaries, among others; all this to develop in an interactive and collaborative environment the bibliographic contents of the course and that students have a greater understanding of their texts (Urzúa *et al*., 2021).

2021 – United States	Arner, T., McCarthy, K. and McNamara, D.	Stair Stepper combines the preparation needed to complete a test, and reading comprehension strategies in a fun gaming environment (Arner *et al*., 2021). It is an intelligent tutoring system based on reading training with self-explanation to verify understanding of what is being read (Arner *et al*., 2021). The game is aimed at young people in advanced school or incipient university stage, and consists of going through a staircase, where on each step comprehension questions on increasingly difficult texts will be answered, these can be multiple choice questions or questions to complete in the participant's own words what he/she has understood. Each time he/she goes up a step or reattempts the same step, he/she will receive a message from an intelligent tutor, "Mr. Evans", who will provide motivational feedback, regardless of the result (Arner *et al*., 2021)
2022 - United States	Peterson, J	Hybrid extensive reading has an approach, which focuses on learning a foreign language were students - aimed at young people and adults - are exposed to a large amount of easy reading material and chosen by themselves (Peterson, 2022). They should read as much as they can at a fast speed since reading is its reward, also, this activity should be done individually and silently, under the monitoring and accompaniment of teachers, who are considered role models of a reader, guiding and guiding their students (Peterson, 2022)
2022 - China	Chen, J., Hu, B., Peng, W., Chen, Q. and Tang, B	Chen *et al*. (2022), propose a new enhanced reading comprehension framework for biomedical information and relation extraction, which incorporates an enhanced attention mechanism, where effective and noisy knowledge is improved. This model is based on the fact that open-domain reading comprehension data and knowledge representation can be improved, effectively in biomedical relation extraction (Chen *et al*., 2022). Chen *et al*. (2022) aimed to design a sophisticated reading comprehension model for the application of biomedical relations in biomedical tasks.
2019 - Costa Rica	Barberousse-Alfonso, P. and Vargas-Dengo, M.	Barberousse-Alfonso and Vargas-Dengo (2019) outline two proposals, one towards the animation of reading and the other towards the development of ludic strategies such as the elaboration of puppets for literacy workshops, through pedagogical mediation with tools or techniques such as jocular songs, storytelling, the game of charades, workbook, painting, and puppet construction. This program was aimed at children, young and adult university students (Barberousse-Alfonso and Vargas-Dengo, 2019).

Note: Own elaboration

DISCUSSION

In the case of research related to ludic programs aimed at encouraging reading, it is observed that the trend is to use programs associated with new technologies such as virtual reality, facial electromyography, video games, interactive whiteboards, information, and communication technologies, among others. This trend can be explained by the preference of children for games, especially digital games, about 80% of

children and adolescents prefer to play on their smartphones, laptops, or digital consoles (Mastroberti, 2020 Honma et al., 2022). On the other hand, multiple studies defend these digital tools and associate them with a beneficial factor for the reading habit and an improvement in reading comprehension. Digital tools, along with learning materials should be chosen according to the nature of what you want to teach, multiple tools can serve for reading classes such as Google Meet, a videoconferencing platform, and Jamboard, which serves to give answers in real time, underwriting or drawings through a tablet (Ahshan, 2021). Also, for high-impact presentations, you can use Canva, and in case the presentation is made collaboratively among students or you want to save notes or interactive murals, you can use Padlet.

Broadhead et al. (2018) argue that reading comprehension and literacy problems, in children, are studied through different perspectives; traditionalists, argue that it is achieved more effectively when working through text encoding using phonics; progressives, consider that effectiveness is achieved by working with whole words or language-based methods. While for Cabezuelo-Lorenzo et al. (2020), digital tools function as an important tool for education, within all fields.

Interactive reading or game-based reading is a key tool that increases language skills and, therefore, strengthens their future integration at school, work, and in their community (Thomas et al., 2019). After the implementation of interactive reading sessions in a school in Belgium, a benefit was found in the lexical and reading comprehension level of students (Thomas et al., 2019). Thomas et al. (2020) argue that the students who participated in their study of the application of interactive reading sessions evolved, significantly, in literacy skills.

Rodríguez-Cano et al. (2021) show that technology associated with virtual reality is an interesting treatment guide to improve reading comprehension in children, including children with dyslexia, because it offers a playful, controlled, and motivating environment. She also indicates that this type of technology can provide opportunities because it promotes immersion and presence, which increases motivation and interest.

For their part, Arancibia-Gutiérrez and Bustamante-Molina (2019) in their study, found that there was a greater development of reading skills after the use of the interactive whiteboard for the development of CLP tests (reading comprehension test of progressive linguistic complexity).

The programs aimed at adults, according to the sources reviewed, mostly followed activities that combined physical sessions in a face-to-face collaborative environment with digital tools. An example is an application of the literacy laboratory program in a university in Chile, where a positive relationship was found between the level of participation and the academic performance of students (Urzúa et al., 2021) and the approach of a new model of reading comprehension to understand texts related to medical research (Chen et al., 2022).

Despite this, sources were also found where programs to improve reading comprehension using digital tools are discussed. Pascual et al. (2021) show that cognitive training, through virtual reality games and surreal and everyday scenarios, has shown quite encouraging results related to improving cognition in humans, through their influence on problem-solving, reading comprehension, and information retrieval.

Arner et al. (2022) show iStart, where students learn and improve their reading comprehension through complex text games, especially because the teaching of strategies serves to successfully develop any type of test related to text analysis in critical, interpretive, and argumentative reading.

Likewise, sources were also found that indicate that the most efficient way to improve reading comprehension is to find a balance between pedagogy and technology. Arancibia-Gutiérrez and Bustamante-Molina (2019) argue that a balance must be found between pedagogy and education full of technological artifacts and materials so that playful material “empty of pedagogy” is avoided. Moncada and Sánchez

(2018) agree and indicate that education and technology should not be juxtaposed, but rather articulated.

CONCLUSIONS

Virtual reality, facial electromyography, video games, interactive whiteboards, and information and communication technologies are tools that, when used in the teaching process, together with pedagogy and teaching knowledge, add value and can be beneficial to student performance through improved reading comprehension. While it is true that most young people are trained to use technological tools, these are also applied, in combination with face-to-face sessions, to interactive reading programs aimed at adults, since in the search for case examples, the same distribution of cases using digital tools and cases using only pedagogical methods were found in both children and adults. It is concluded that this review article will be of great use for future researchers, teachers, and young people who wish to search for relevant sources of information related to this topic. Digital tools, in combination with pedagogical tools, may prove to be the best way to achieve favorable results in reading comprehension tests, as well as an improvement in the quality of life and achievement of goals in children, youth, adults, and humanity.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest in the process of drafting, revising, and publishing this article.

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