

Application of Interactive Digital Resources for the Development of the Reorganizational Level of Comprehension

Flores Revoredo, Rina Del Rosario¹, Dr. Bejarano Álvarez, Patricia Mónica²

¹ Universidad César Vallejo, Lima, Perú, dfloresre12@ucvvirtual.edu.pe (<https://orcid.org/0009-0005-8383-6632>) ² Universidad César Vallejo, Lima, Perú, pbejaranoa@ucv.edu.pe (<https://orcid.org/0000-0003-3059-6258>)

HOW TO CITE: ABSTRACT:

Flores Revoredo, R. D. R., & Bejarano Álvarez, P. M. (2026). Application of interactive digital resources for the development of the reorganizational level of comprehension.

International Journal of Special Education, 41(23s), 1335 - 1346.

COPYRIGHT STATEMENT:

Copyright: © 2026 Authors.
Open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

This study was conducted under Sustainable Development Goal (SDG) 4: Quality Education to evaluate the role of interactive digital resources in developing students' reading comprehension. The location of the study was in a public educational institution in San José de los Molinos, Ica, Peru, in 2025. An applied study with a quantitative approach and quasi-experimental design was conducted. The research involved two groups: a control and an experimental group, with a total number of participants of 50 students and a population of 90 students. The non-probability convenience sampling method was used, dividing the selected sample into two equal groups of 25 students each. The ACL Reading Comprehension Test was implemented, and five experts validated the instrument and confirmed its reliability ($KR-20 = 0.774$). As a result, 56% of the participants in the experimental group reached a satisfactory level of reading comprehension, while only 4% of the students in the control group achieved similar results. In addition, it was found that the reading comprehension level improved significantly after the intervention ($U = 146$, $p = 0.001$). Significant differences were found in the reorganizational level of reading comprehension ($p = 0.007$), inferential ($p < 0.001$), and critical ($p = 0.003$), while the literal level did not show a significant difference ($p = 0.068$). Therefore, the use of interactive digital resources significantly increases the level of reading comprehension, especially in terms of critical, inferential, and reorganizational comprehension, which is why they are recommended for implementation in basic education.

Keywords: interactive digital resources, reading comprehension, SDG 4, basic education, quasi-experimental design.

1. Introduction

Reading comprehension is a fundamental competence in primary education since it contributes to the development of critical thinking, the construction of new knowledge, and

the academic advancement of students in Latin America. In Peru, there is a worrying scenario regarding this skill, as evidenced by the low performance in national and international

evaluations (UNESCO, 2020; MINEDU, 2023). According to the results of the PISA 2023 report, Peru ranks 57th among the 81 countries participating in the assessment, underscoring the need to adopt new methodological approaches to improve literacy skills. It is noteworthy that Peru is not an isolated case, as neighboring countries such as Colombia and Ecuador also exhibit inadequate levels of reading comprehension (Marín et al., 2024; Arteaga et al., 2020).

At the national level, reports from the Regional Census Assessment of Students (ECRE) and the National Assessment of Learning Achievement (ENLA) evidence that despite the improvements recently recorded, gaps still persist between students from urban and rural areas, as well as between public and private institutions (MINEDU, 2024). For instance, in the Ica region, the percentage of students achieving a satisfactory level in reading has decreased, while the percentage of learners at the beginning level has increased. This shows a deficit in terms of interpretation, inference, and critical analysis of textual information. Such shortcomings have repercussions on other learning areas, such as mathematics and science, since poor understanding of reading materials hinders problem solving and analysis of information. In the institutional context, these problems are manifested in everyday learning sessions, as a considerable percentage of students are unable to develop reading competence adequately, thus affecting their overall performance. Although there has been an increase in the usage of digital resources, their incorporation into instruction is still limited and in some cases, irrelevant to learners' needs (Benavides & Zambrano-Ramírez, 2023). Therefore, it is pertinent to consider innovative strategies and interactive technologies to not only improve students' levels of reading comprehension but also promote their participation in the learning process.

At an international level, some studies have demonstrated that the use of digital strategies can contribute to improving reading comprehension at different levels. First, Berral-Ortiz et al. (2024) carried out a systematic review and meta-analysis of digital intervention programs in primary

education students. The main finding was that educational technologies can contribute to text comprehension and promote students' motivation. On the other hand, Montaña (2025) found in Colombia that reading comprehension is related to cognitive and non-cognitive factors (anxiety), and digital technologies can alleviate anxiety through a more interactive and less rigid methodology. Meanwhile, Zerpa Sandoval de Villarreal (2023) reports that digital strategies allow for greater motivation, collaboration, and active construction of knowledge; however, he warns that it will depend on the resources and pedagogical strategies used. Finally, the other analyzed articles show that there is a growing trend to consider classroom contextual variables and technologies to promote reading comprehension. Mena-Bernal and Hoster (2025), in Spain, emphasise the influence of contextual factors and the need for motivating materials and ICT to support attention, self-regulation, and reading performance, proposing formative strategies that combine motivational practices with cognitive and metacognitive development. Complementarily, González and Alvarado (2024), in Mexico, demonstrate that the ICT-mediated RIRE strategy strengthens reading comprehension by providing opportunities for practice and reflection, suggesting replication in other contexts and inclusion in institutional programs. The systematic review by Pikhart et al. (2023) highlights the effects of digital media on L2 reading comprehension, identifies methodological limitations, and points to the need for broader, longitudinal studies with stronger theoretical and pedagogical integration. Finally, Castro and Sevillano (2022) show that digital serious games, such as Leobien, improve reading comprehension and academic performance, reinforcing the effectiveness of gamification and learning analytics as educational tools while emphasising the need to continue evaluating their overall impact.

Taken together, these studies show that combining motivational strategies, ICT, and gamification positively affects reading comprehension; however, rigorous pedagogical design and systematic evaluation are needed to optimise outcomes. At the national level, Ascencio Gonzáles et al. (2024) proposed a model for

applying digital texts in a rural educational institution. They found significant improvements in inferential comprehension compared with printed materials. Salazar-Pisfil et al. (2024), meanwhile, point out that Peruvian schools insufficiently address critical reading, which limits the development of autonomous and reflective thinking. These results highlight the importance of rethinking the ways in which we teach reading comprehension to students in order to bring the materials being provided to be more engaging and provide a better learning experience for the students involved.

Several learning theories can be associated with the implementation of the abovementioned resources. First, Mayer's (2009; 2021) cognitive theory of multimedia learning states that learners can construct a deeper understanding of the information provided when it is presented by combining verbal and pictorial representations. In complementarity, Sweller et al.'s (2019) cognitive load theory assumes that working memory plays a critical role in learning since it encodes the taught information into the long-term memory. The encoding is achieved through an instructional design that reduces cognitive load during the learning task (Sweller et al., 2019). Finally, Vygotsky's (1978) sociocultural theory considers learning as a social and cultural activity where higher mental functions are fostered through mediation and collaborative learning activities. Digital resources contribute to such learning environments where learners interact with the material and the teacher with the help of technology. Thus, digital resources should be regarded as a tool for educators to promote a new approach to reading, comprehension, and constructing the meaning of the text. It empowers students to be actively engaged in the reading process and encourages reciprocal reading (Castillo, 2020). It fosters their reading processes at literal, inferential, reorganizational, and critical levels as well as their motivation towards the reading process. Moreover, motivation should be prioritized in the reading instruction process since it can prevent the perception of reading as a boring and meaningless activity (Castillo, 2020).

Consequently, it is necessary to explore how

interactive digital resources can enhance the reading comprehension of primary education students. This study aims not only to answer the local educational need in the Ica region but also to participate in the international debate on the possibilities and limitations of technological resources in the classroom. It is also related to the goals of the 2030 Agenda, specifically Sustainable Development Goal (SDG) 4, which promotes quality education that prepares students to confront the challenges of the twenty-first century. In the theoretical and empirical frameworks of this research, it is proposed as a general hypothesis that the application of interactive digital resources significantly improves students' reading comprehension in an educational institution in Ica in 2025. Specific hypotheses are formulated to verify the effect of these resources on the different levels of reading comprehension, such as literal, inferential, reorganizational, and critical. The analysis of the effect will help understand how digital environments can become methodological allies to promote active and meaningful reading in the current school scenario.

2. Method

The study falls under the category of applied research since, according to Bisquerra (2023), this type "includes those projects which seek to obtain knowledge with an immediate application in order to improve a certain educational fact or teaching process, through the introduction of modifications or innovations of a technological nature." Therefore, it can be concluded that the study is not only concerned with obtaining knowledge about the phenomenon but also with evaluating the effectiveness and expediency of using interactive digital resources as a tool for improving the reading comprehension process. The choice of a quantitative method is explained by the fact that the study seeks to identify the correlation between the use of interactive digital resources and improvement in the reading comprehension level. According to Hernández-Sampieri and Mendoza (2022), the quantitative approach involves obtaining numerical data and conducting statistical analysis to test hypotheses, identify patterns, and objectively test theories. This approach is appropriate for measuring the effect

of the independent variable (interactive digital resources) on the dependent variable (reading comprehension), enabling statistical analysis of the change produced after the intervention. Consistent with Creswell and Creswell (2023), this approach allows examination of relationships between variables and prediction of behaviours within the educational context. The study uses a one-group pretest-posttest design, in which students are assessed before and after the intervention without random assignment. According to Hernández-Sampieri and Mendoza (2022), this design is appropriate when the natural organisation of school groups cannot be modified. Still, the effect of the manipulation is of interest. In this case, as the experiment involved giving access to electronic resources, a standard reading-comprehension test could be given both before and after the intervention, thus providing a measure of reading gains.

Interactive digital resources can be defined as those educational materials that stand out for being characterised by the incorporation of multimedia elements and the fact that they allow interaction. The authors Cabero and Llorente (2020) argue that this type of resources contribute to motivation, participation, and instant feedback. In this research study, interactive digital resources such as Genially, Educaplay or LearningApps have been implemented to improve reading comprehension skills. This process is based on constructing a representation of the information that goes beyond the literal message, implying therefore reflection and critical thinking. With respect to the variables, and according to Català et al. (2001), a distinction must be made between the level of literal, reorganizational, inferential, and critical comprehension. On the other hand, the population refers to students who are enrolled in primary education in the year 2025. The inclusion criteria were to belong to the grade under study, to participate actively in class, and to have parental authorisation. On the other hand, those who suffered from frequent absences and those who did not belong to the grade receiving the intervention were excluded. In this regard, the population refers to a collective of 90 students who share certain characteristics (Hernández-Sampieri & Mendoza, 2021). The sample consists

of 50 students selected according to non-probability sampling since convenience was prioritised when choosing the participants. The survey technique was implemented both in the pretest and the post-test. According to Flick (2022), a technique is a set of procedures to collect information in a systematic and accurate manner to later perform a quantitative analysis. The instrument used was the ACL Reading Comprehension Test designed by Català, Molina, Monclús, and Riba (2001) updated subsequently by Català et al. (2022) as ACL-2. According to Arias (2020), the instrument can be defined as a technical procedure that allows for measuring the different aspects of the variables of interest. The ACL test is intended to measure the levels of literal, reorganizational, inferential, and critical comprehension in order to determine the participants' reading ability by means of multiple choice questions that appear together with narrative or informative texts.

To ensure content validity, the researchers provided the instrument for evaluation by five education experts, who assessed the items' relevance, coherence, and clarity. The researchers considered their recommendations when compiling the final version of the tool. To establish test reliability, the researchers requested a pilot study among a sample that met the target population's characteristics. They report that the items' reliability was confirmed at a satisfactory level ($KR-20 = 0.774$). The researchers included validity and reliability reports from experts in the appendices. The researchers organised the data in an Excel database. They initiated the analysis by describing ACL test results using such descriptive statistics as frequencies and percentages to compare the scores from the pretest and posttest. Finally, the researchers conducted an inferential analysis to examine the relationship between the two variables. They applied the Shapiro-Wilk test to assess the data's normality, given that the sample size was fewer than 50. If the distribution was normal, the researchers would use the Student's t-test for related samples; otherwise, they would apply the Mann-Whitney U test. The analysis would help the researchers conclude whether the interactive use of digital resources could affect the outcomes.

The study adhered to the research ethics outlined in the Research Ethics Code of César Vallejo University (UCV, 2020). Specifically, the research was conducted under the principles of integrity, intellectual honesty, autonomy, and equity, as well as the ethical treatment of participants. The study maintained integrity at all stages and conducted the research responsibly and ethically to avoid undermining the scientific rigor of the study. Intellectual honesty was achieved by recording and reporting the research data accurately without any alterations and providing proper citations of all the references used in the study following the APA 7 standards. Autonomy was respected when seeking

the consent of the parents or guardians to participate in the study on behalf of their children and ensuring they had the right to withdraw at any time. Equity and human integrity were upheld by treating each participant equally and respectfully without discrimination and giving them equal access to the digital resources used in the study. Finally, the confidentiality of the participants was maintained as their data were collected and stored securely and used exclusively for the purposes of this study. Additionally, the institutional documents, consent forms, and validation records will be stored securely and not included in the public version of the research paper.

3. Results

Table 1. Frequency and percentage of the reading comprehension variable

		CONTROL GROUP	CONTROL GROUP	EXPERIMENTAL GROUP	EXPERIMENTAL GROUP
		Pretest	Pretest	Pretest	Pretest
		f	%	f	%
Valid	Beginning	9	36.0	15	60.0
Valid	Process	16	64.0	9	36.0
Valid	Satisfactory	0	0	1	4.0
	TOTAL	25	100%	25	100%
		Posttest		Posttest	
		f	%	f	%
Valid	Beginning	8	32.0	4	16.0
Valid	Process	16	64.0	7	28.0
Valid	Satisfactory	1	4.0	14	56.0
	TOTAL	25	100%	25	100%

The results suggest that the application of the method with interactive digital resources has a positive impact on the readers' comprehension. The comparison between the groups identified that both classes showed similar proportions before the intervention, with no satisfactory levels of comprehension and having either the beginning or process levels as the highest. However, the scores of the control group remained almost the same after the intervention, while the experimental group increased its level of satisfactory comprehension from 4% to 56% and decreased the starting and process levels from 75% to 16% and 28%, respectively.

Table 2. Frequency and percentages for the dimensions of literal, reorganizational, inferential, and critical comprehension

		CON TRO L GRO UP							EXPERI MENTA L GROUP								
		Prete st							Pretest								
		D1		D 2		D 3		D 4		D 1		D 2		D 3		D 4	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
V al i d	Begi nin g	5	2 0 %	1 1	4 4 %	1 7	6 8 %	1 2	48%	1 6	6 4 %	1 7	6 8 %	1 9	7 6 %	1 5	6 0 %
V al i d	Proc ess	9	3 6 %	5	2 0 %	8	3 2 %	1 1	44%	5	2 0 %	5	2 0 %	6	2 4 %	6	2 4 %
V al i d	Satis fact ory	11	4 4 %	9	3 6 %	0	0 %	2	8%	4	1 6 %	3	1 2 %	0	0 %	4	1 6 %
	Tota l	25	1 0 0	2 5	1 0 0	2 5	1 0 0	2 5	100	2 5	1 0 0	2 5	1 0 0	2 5	1 0 0	2 5	1 0 0
		Postt est							Posttest								
		D1		D 2		D 3		D 4		D 1		D 2		D 3		D 4	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
V al i d	Begi nin g	5	2 0 %	1 0	4 0 %	1 6	6 4 %	1 2	48%	4	1 6 %	3	1 2 %	4	1 6 %	6	2 4 %
V al i d	Proc ess	7	2 8 %	6	2 4 %	8	3 2 %	1 1	44%	6	2 4 %	8	3 2 %	1 2	4 8 %	5	2 0 %
V al i d	Satis fact ory	13	5 2 %	9	3 6 %	1	4 %	2	8%	1 5	6 0 %	1 4	5 6 %	9	3 6 %	1 4	5 6 %
	Tota l	25	1 0 0	2 5	1 0 0	2 5	1 0 0	2 5	100	2 5	1 0 0	2 5	1 0 0	2 5	1 0 0	2 5	1 0 0

The analysis by reading comprehension dimensions dimension, the students were on a similar level with revealed that most of the dimensions improved the control group after the intervention was steadily in the experimental group. In the literal introduced. On the other hand, the reorganizational

dimension was increased significantly as far as and critical comprehension were also increased satisfactory level was concerned which revealed the which proved that the students successfully students' abilities to synthesise, sequence, and improved their abilities to deduce, interpret and structure the information properly. The inferential critically evaluate the texts.

Table 3. Rank test for the general hypothesis

	GROUP	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
PRETEST	CONTROL	25	30.12	753.00	197.000	.024
PRETEST	EXPERIMENTAL	25	20.88	522.00	197.000	.024
	Total	50			197.000	.024
POSTTEST	CONTROL	25	18.84	471.00	146.000	.001
POSTTEST	EXPERIMENTAL	25	32.16	804.00	146.000	.001
	Total	50			146.000	.001

Table 4. Rank test for the specific hypotheses

		GROUP	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
PRETEST	D1	CONTROL	25	31.66	791.50	158.500	.002
PRETEST	D1	EXPERIMENTAL	25	19.34	483.50	158.500	.002
PRETEST	D1	Total	50			158.500	.002
PRETEST	D2	CONTROL	25	28.72	718.00	232.000	.113
PRETEST	D2	EXPERIMENTAL	25	22.28	557.00	232.000	.113
PRETEST	D2	Total	50			232.000	.113
PRETEST	D3	CONTROL	25	25.22	630.50	305.500	.888
PRETEST	D3	EXPERIMENTAL	25	25.78	644.50	305.500	.888
PRETEST	D3	Total	50			305.500	.888
PRETEST	D4	CONTROL	25	26.66	666.50	283.500	.553
PRETEST	D4	EXPERIMENTAL	25	24.34	608.50	283.500	.553
PRETEST	D4	Total	50			283.500	.553
POSTTEST	D1	CONTROL	25	21.80	545.00	220.000	.068
POSTTEST	D1	EXPERIMENTAL	25	29.20	730.00	220.000	.068
POSTTEST	D1	Total	50			220.000	.068
POSTTEST	D2	CONTROL	25	20.00	500.00	175.000	.007
POSTTEST	D2	EXPERIMENTAL	25	31.00	775.00	175.000	.007

POSTTEST	D2	Total	50			175.000	.007
POSTTEST	D3	CONTROL	25	18.04	451.00	126.000	<.001
POSTTEST	D3	EXPERIMENTAL	25	32.96	824.00	126.000	<.001
POSTTEST	D3	Total	50			126.000	<.001
POSTTEST	D4	CONTROL	25	19.50	487.50	162.500	.003
POSTTEST	D4	EXPERIMENTAL	25	31.50	787.50	162.500	.003
POSTTEST	D4	Total	50			162.500	.003

The Mann-Whitney statistical tests evidenced the presence of these differences since the overall general hypothesis was supported ($p = 0.001$). The reorganizational ($p = 0.007$), inferential ($p < 0.001$), and critical ($p = 0.003$), dimensions presented significant differences in favor of the experimental group whereas, the literal dimension did not evidence any post-intervention statistically significant difference ($p = 0.068$), which implies that the students attained a performance equivalent to the control group. In summary, the results demonstrated that the intervention favored the integral development of the reading comprehension since higher order processes like information reorganization, inference, and critical judgement were attained, thus, it can be concluded that the strategy implemented within the evaluated educational context, promotes the efficacy in reading comprehension.

4. Discussion and conclusions

The general objective of this research was to describe the influence of applying digital interactive resources on students' reading comprehension in a public educational institution of the district of San José de los Molinos, Ica, in 2025. The post-test results demonstrated a significant increase in the percentage, reaching 56% of students in the "Satisfactory" category compared to only 4% in the control group. This fact confirms that the use of such method influenced the improvement of students' reading comprehension. Firstly, from a theoretical perspective, the data can be explained by referring to the Cognitive Load Theory (Sweller, 2011) and Cognitive Theory of Multimedia Learning (Mayer, 2021). The design of the digital material, which included a balanced combination of visual, audio

components and action, allowed to avoid the overload of working memory and transfer the information to long-term memory. Secondly, the application is an excellent tool that acts as a mediator in the development of such cognitive abilities as thinking, attention, learning, and consciousness according to the Sociocultural Theory (Vygotsky, 1978). This assumption is supported by the research of Benavides and Zambrano-Ramírez (2023) and Zerpa Sandoval De Villarreal (2023), who show that self-regulated and interactive virtual environments not only facilitate students' hidden abilities related to reading but also motivate them to cooperate. On the one hand, Martínez Vivar (2024) demonstrates through the study conducted in Peru that the use of technologies when intentional and sustainable in terms of the teacher's planning contributes to a better understanding of the topic. On the other hand, Campos and Rivera-Alegre (2024) show that the recreational use of ICT without proper adult monitoring can inhibit the assimilation process in students. Hence, the experimental group's improvement can be seen as a result of a useful and productive ICT-based learning environment that took into consideration the threats mentioned above.

Concerning the first research objective, which concerned the literal level, the non-parametric test of Mann-Whitney U ranks indicated a paradoxical statistical outcome. The initial assessment (pretest) demonstrated a stark deficit for the experimental group over the control one: 19.34 vs. 31.66 ($p = 0.002$). However, the situation was precisely the opposite one week after the intervention (posttest): 29.20 vs. 21.80. Although the p-value ($p = 0.068$) exceeded the conventional .05 threshold

and thus failed to reject the null hypothesis, the descriptive statistics suggest a considerable recovery in the intervention group. In other words, the slight mean shift to the right indicates that multimodal texts foster processing of explicit information, which accords with the findings of Sweller (2019) and González (2022) on reducing working memory load via restricted stimuli.

Nevertheless, the mentioned outcomes differ from the categorical findings reported by Sánchez et al. (2025), González and Alvarado (2024), and Novoa-Castillo et al. (2021). The latter's studies indicated statistically significant gains of literal comprehension through technological tools. In my opinion, such a contrast was conditioned by the fact that literal comprehension, which relies highly on automatized processing and retention mechanism, takes much longer to achieve technical fluency in at such a low level of basic proficiency. Therefore, data can explain that the mentioned tools make it more engaging but not substitute the fundamental process of forming a reading-familiarity mechanism.

The second specific objective examined the inferential level. Preliminary results (pretest) indicated initial homogeneity between the groups ($p = 0.113$), ruling out any advantages for the control group. After the intervention, there is evidence to suggest the exposure to interactive platforms, the inclusion of hyperlinks and reflective exercises promotes the formulation of deductions and the activation of prior knowledge. The empirical behaviour observed supports the convergence of sociocultural mediation and cognitive-load management. By allowing the mind to free space through the presence of interactive visual supports, students have more analytical resources to go beyond what is explicitly stated. These findings align closely with Sánchez et al. (2025) and González and Alvarado (2024), who argue that hypertextual architecture requires the reader to perform complex metacognitive operations to connect the fragments of information. The findings also support the thesis of Ascencio Gonzales et al. (2024) who confirmed that digital support can outperform traditional printed material in stimulating deductive thinking, provided that pedagogical guidance can help

students connect explicit clues with their conceptual hypotheses. The third specific objective of reorganizational level, produced one of the study's most pronounced effects. Starting from identical conditions in the pretest ($p = 0.888$), the posttest reflects a substantial difference in favour of the experimental group (mean rank 32.96) against 18.04 for the control group, with statistical significance ($p < 0.001$). This qualitative improvement suggests that interactive digital resources are very effective tools for synthesising, classifying and restructuring information. By allowing students to manipulate diagrams and complete interactive maps and classify concepts in real time, digital tools act as an "external scaffold", helping to avoid cognitive overload, a central tenet of Sweller's theory.

Contrary to traditional approaches, these data strongly confirm the findings of Sánchez et al. (2025), González and Alvarado (2024) and Novoa-Castillo et al. (2021) that the tasks integrated before and after multimedia reading offer students better operational skills to organize and distill textual macrostructures, overcoming methodological limitations of traditional linear teaching. Finally, the analysis of the critical level which corresponds to the fourth specific objective, produced similar results to methodological success. Although the groups were initially equivalent at pretest ($p = 0.553$), posttest measurements were found to be significantly separated between two groups ($p = 0.003$), with the experimental group achieving a mean rank of 31.50 compared with 19.50 for the control group. This finding is important because the critical level represents the top level of the taxonomy of reading comprehension (Català et al., 2001). The fact that the digital intervention produced significant changes in this dimension show that the tools were not just technical entertainment, but promoted critical judgment and content evaluation. This empirically confirms Vygotsky's and Mayer's theories because interactivity created an environment of immediate feedback that required students to confront, compare and evaluate the validity of texts. The results agree with Sánchez et al. (2025) and González and Alvarado (2024) on the role of hyperlinks in diversifying readers' perspectives,

and with Novoa-Castillo et al. (2021) on reinforcing metacognitive skills. Similarly, the intervention's success agrees with Castro and Sevillano (2022) on digital game-based learning. When an explicit and rigorous pedagogical purpose guides gamification and interactivity, they can become important catalysts in developing autonomous and deeply reflective thinking in basic education.

The pedagogically planned use of interactive resources (digital text, multimedia, and interactive activities) is associated with statistically significant improvement in students' overall reading comprehension. After the experiment, 56% of the experimental group achieved satisfactory result, compared to only 4% of the control group, which proves that digital resources planned by a teacher can effectively facilitate reception, comprehension, and evaluation of the presented textual information.

The most evident and robust effect of intervention was identified at the level of reorganization. Starting with the homogeneous initial conditions (pretest, $p = 0.888$), the posttest demonstrated the significant difference with a mean rank of 32.96 compared to 18.04 for the control groups ($p < 0.001$). It means that interactive tools optimally strengthen students' ability to synthesise, classify, prioritise, and restructure information. The reading comprehension at the critical level improved significantly as well. Although the groups started at the same point ($p = 0.553$), the posttest demonstrated a mean rank of 31.50 compared to 19.50 for the control groups ($p = 0.003$). The findings suggest that the systematic intervention develops the ability to analyse,

compare, evaluate, and issue well-founded judgments with the sufficient support of appropriate pedagogical design, feedback, and teacher mediation. Although the experimental group began with a significant disadvantage in the pretest ($p = 0.002$) and achieved a higher mean rank in the posttest, the final difference did not reach conventional statistical significance ($p = 0.068$); therefore, the specific hypothesis for the literal dimension is not supported. With similar initial conditions in the pretest ($p = 0.113$), the theoretical potential of digital resources to stimulate deductions and predictions is recognised; however, because the posttest statistical data for this inferential dimension are not available in the source document, the magnitude and actual significance of the intervention effect cannot be determined.

This study makes a significant contribution to the ongoing debate about the effectiveness of educational technology in cognitive-linguistic domains. Firstly, it provides empirical evidence to support the claim that technology, in and of itself, is not a literacy-generating tool but rather its pedagogical use designs and teacher mediation determine student gains. Secondly, it specifies the type of technology that proves to be the most effective for fostering high-level cognitive processes such as reorganisation and critical reading: interactive reading software. This study effectively addresses the methodological shortcomings of prior research by providing a large-scale mixed-methodology analysis and offers valuable data for subsequent studies attempting to disentangle the effects of virtual environments on Latin America students' reading comprehension.

References

- Acuña-Torres, L., Trujillo, A. A., & Hermosilla, D. A. M. (2024). Impacto de la pizarra digital interactiva en la comprensión lectora de estudiantes de primaria. 5.
- Alvarado, L. N. C. (2021). Programa alternativo para mejorar la comprensión lectora en escolares peruanos. *PsiqueMag*, 10(1), Article 1. <https://doi.org/10.18050/psiquemag.v10i1.2742>
- Arteaga, D. V. M., Gómez-Parra, M. E., & Mohedano, R. E. (2020). Estrategias de enseñanza de la comprensión lectora aplicadas y percibidas: un estudio con docentes y estudiantes de cuarto grado de educación básica en Manabí, Ecuador. *Investigaciones Sobre Lectura*, 14, Article 14. <https://doi.org/10.24310/isl.vi14.12238>
- Ascencio Gonzáles, J. P., Ascencio Gonzáles, J. A., Quintana Pizarro, Y. M., & Gonzáles Soto, V. A. (2024). Textos digitales para la comprensión lectora en estudiantes de zona rural peruana. *Revista de Climatología*, 24, 833-842. <https://doi.org/10.59427/rcli/2024/v24cs.833-842>

- Arias, F. G. (2020). El proyecto de investigación científica. Editorial Episteme.
- Benavides, N., & Zambrano-Ramírez, J. (2023). Comprensión lectora autorregulada apoyada en tecnología en estudiantes de Educación Básica. *Revista Electrónica Educare*, 27(3), Article 3. <https://doi.org/10.15359/ree.27-3.17221>
- Berral-Ortiz, B., Cáceres-Reche, M. P., Romero-Rodríguez, J. M., & Alonso-García, S. (2024). Programas de entrenamiento y recursos tecnológicos en la mejora de la comprensión lectora en educación primaria. *Información tecnológica*, 35(2), 49-60. <https://doi.org/10.4067/s0718-07642024000200049>
- Bethzabe, C. M. (2024). Herramientas digitales educativas. Instituto Universitario de Innovación Ciencia y Tecnología Inudi Perú.
- Bisquerra, R. (2020). Metodología de la investigación educativa. Editorial La Muralla.
- Buendia Barberà, M., & García, J. H. (2022). Aplicación de recursos tecnológicos digitales para mejorar el nivel de comprensión lectora de lengua catalana. Un estudio de caso. *EduTec, Revista Electrónica de Tecnología Educativa*, 79, 253-271. <https://doi.org/10.21556/edutec.2022.79.2065>
- Cabero, J., & Llorente, M. C. (2020). Tecnología educativa: diseño y uso de materiales didácticos digitales. Editorial Síntesis.
- Cabero, J., & Marín, V. (2022). Tecnologías digitales y educación: nuevos escenarios de aprendizaje. Ediciones Pirámide.
- Català, G., Molina, J., Monclús, R., & Riba, C. (2022). *Avaluació de la Comprensió Lectora (ACL): Manual técnico y guía de aplicación*. Barcelona: Graó.
- Cassany, D. (2021). Enseñar lengua. Graó.
- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.
- Creswell, J. W., & Guetterman, T. C. (2021). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Pearson.
- Del Carpio Carrizales, D. (2016). Relación entre comprensión lectora y pensamiento analógico en estudiantes de primero a cuarto grado de primaria de una institución educativa privada de La Molina [Universidad de Lima]. <https://doi.org/10.26439/ulima.tesis/2322>
- Estrada-Molina, J. L., Huertas-Arias, L. C., & Sosa Díaz, H. (2023). Digital resources as an aspect of teacher professional digital competence: One term, different definitions – a systematic review. *Education and Information Technologies*, 28(4), 3711-3738. <https://doi.org/10.1007/s10639-022-11321-z>
- Etikan, I., & Bala, K. (2023). Sampling and sampling methods: Updated perspectives. *International Journal of Research Studies*, 12(3), 45–58.
- Evaluación Muestral de estudiantes EM 2022 resultados lca.pdf. (s. f.). Recuperado 4 de noviembre de 2023, de <https://repositorio.minedu.gob.pe/bitstream/handle/20.500.12799/9152/Evaluaci%C3%B3n%20Muestral%20de%20estudiantes%20EM%202022%20resultados%20lca.pdf?sequence=1&isAllowed=y>
- Flick, U. (2022). *An introduction to qualitative research*. SAGE.
- Galina-Russell, I. (2012). Retos para la elaboración de recursos digitales en humanidades. *Profesional de la información*, 21(2), 185-189. <https://doi.org/10.3145/epi.2012.mar.09>
- García Atoche, C., Junchaya Palomino Néida, R., Julia, M. R. C., & Marvin, N. Y. Y. (2024). Improving Reading Comprehension in Secondary School Students through ICT Tools: An Innovative Approach. *International Journal of Membrane Science and Technology*, 11(1), 438-443. <https://doi.org/10.15379/ijmst.v11i1.3664>
- González, A. P. (2022). Teoría sociocultural: Potencialidades para motivar la clase de Historia de Cuba en las universidades.
- Hernández, R., Fernández, C., & Baptista, M. (2022). Metodología de la investigación (7ª ed.). McGraw-Hill.
- Hernández-Sampieri, R., & Mendoza, C. (2021). Metodología de la investigación: Las rutas cuantitativa, cualitativa y mixta. McGraw-Hill.
- Makuc, M. (2011). Teorías implícitas sobre la comprensión textual y la competencia lectora de estudiantes de primer año de la Universidad de Magallanes. *Estudios Pedagógicos (Valdivia)*, 37(1), 237-254. <https://doi.org/10.4067/S0718-07052011000100013>
- Makuc, M. (2020). Teorías implícitas de los estudiantes sobre la comprensión de textos: Avances y principales desafíos de investigación en la formación inicial de profesores y en otras disciplinas 1. *Sophia Austral*, 25, 71-92. <https://doi.org/10.4067/S0719-56052020000100071>
- Marín, M. P. R., Muñoz, M. E. G., Ruiz, L. K. J., Vides, M. M. T., Ojeda, M. Á., & Pinto, I. (2024). Memoria operativa y su relación con la capacidad de comprensión lectora en estudiantes de primaria. *Gaceta Médica de Caracas*, 132(3), Article 3.
- Martínez Vivar, S. J. (2024). Impacto de la tecnología digital en la comprensión lectora. *UCV - SCIENTIA*, 16(1), 55-66.
- Martínez-Salgado, C. (2020). Choosing and constructing samples for social research. *Qualitative Research Journal*, 20(2), 123–135.

- Ministerio de Educación del Perú. (2016). Currículo Nacional de la Educación Básica. MINEDU.
- MINEDU. (2016). Programa curricular de Educación Primaria. MINEDU. <https://repositorio.minedu.gob.pe/handle/20.500.12799/4549>
- MINEDU. (2023). Evaluación Muestral de estudiantes (EM) 2022: Resultados - Ica. <https://repositorio.minedu.gob.pe/handle/20.500.12799/9152>
- MINEDU. (2023). Currículo Nacional de la Educación Básica. Lima: Ministerio de Educación del Perú.
- Montaña, G. J. (2025). Estado actual de la investigación sobre la comprensión lectora y la ansiedad. *European Public & Social Innovation Review*, 10, 1-22. <https://doi.org/10.31637/epsir-2025-1039>
- OCDE. (2018). Marco de evaluación de PISA 2018. Lectura, matemáticas y ciencias. Ministerio de Educación y Formación Profesional. <https://www.oecd.org/pisa>
- Pisfil, D. E. S., Valencia, M. C., & Álvarez, A. M. H. (2024). Comprensión lectora como fundamento del desarrollo socioeducativo en el Perú: un análisis crítico desde el contexto actual. *Clío. Revista de Historia, Ciencias Humanas y Pensamiento Crítico*, 8, Article 8. <https://doi.org/10.5281/zenodo.12599007>
- Prensky, M. (2021). Enseñar a nativos digitales. Ediciones SM.
- Quispe Aquise, J., Jara Rodríguez, F., Sillo Sosa, J., & Arce Coaquira, E. L. (2023). Vista de la gestión educativa y de la competencia digital de los docentes de las instituciones educativas públicas de Puerto Maldonado. <https://rus.ucf.edu.cu/index.php/rus/article/%20view/3622/3563>
- RESULTADOS ENLA-2024.pdf. (s. f.). Recuperado 1 de junio de 2025, de <http://umc.minedu.gob.pe/wp-content/uploads/2025/04/Presentaci%C3%B3n-de-logros-de-aprendizaje-ENLA-2024.pdf>
- Rumelhart, D. (2020). Toward an interactive model of reading. Cognitive Science Press.
- Regmi, P. R., Waithaka, E., Paudyal, A., Simkhada, P., & Van Teijlingen, E. (2020). Guide to the design and application of survey instruments. *Journal of Health Promotion*, 38(5), 281–290.
- Salica, M. A. (2019). Carga cognitiva y aprendizaje con TIC: Estudio empírico en estudiantes de secundaria de química y física. *Revista Iberoamericana de Tecnología en Educación y Educación en Tecnología*, 24, e08. <https://doi.org/10.24215/18509959.24.e08>
- Salinas, J. (2017). Innovación educativa y uso de las TIC. *Comunicar*, 25(50), 71–79. <https://doi.org/10.3916/C50-2017-06>
- Solé, I. (2021). Estrategias de lectura. Editorial Graó.
- Solé, I. (1992). Estrategias de lectura. Barcelona: Editorial Graó.
- Solé. (2020). INFLUENCIA DE LAS ESTRATEGIAS DE LECTURA DE ISABEL SOLÉ EN LA COMPRENSIÓN LECTORA DE LOS EDUCANDOS DE QUINTO GRADO DE PRIMARIA. CHAKIÑAN, REVISTA DE CIENCIAS SOCIALES Y HUMANIDADES, 12, 95-105. <https://doi.org/10.37135/chk.002.12.06>
- UNESCO. (2020). Estudio Regional Comparativo y Explicativo (ERCE 2019) | UNESCO. <https://www.unesco.org/es/articles/estudio-regional-comparativo-y-explicativo-erce-2019>
- UNESCO. (2023). Código de ética para la investigación en educación. París: UNESCO.
- UNESCO. (2020). Análisis curricular del ERCE 2019 del conjunto de países que conforman la CECC/SICA - UNESCO Biblioteca Digital. <https://unesdoc.unesco.org/ark:/48223/pf0000375368>
- UNESCO, UNESCO, & UNICEF. (2021). Los aprendizajes fundamentales en América Latina y el Caribe. Evaluación de los logros de los estudiantes. Estudio Regional Comparativo y Explicativo (ERCE 2019). <http://bibliotecadigital.mineduc.cl/handle/20.500.12365/18615>.
- UNESCO. (2023). Marco de competencias de los docentes en materia de TIC. UNESCO Publishing.
- Universidad César Vallejo. (2020). Código de Ética en Investigación. Fondo Editorial UCV.
- Zerpa Sandoval De Villarreal, S. H. (2023). Estrategias digitales para la comprensión lectora en estudiantes de primaria: una revisión sistemática. *Revista de Climatología*, 23, 2823-2829. <https://doi.org/10.59427/rcli/2023/v23cs.2823-2829>
- Translation note: The main Spanish text has been translated into academic English while preserving the study's original terminology, statistical values, structure, and reported findings. Bibliographic entries are retained in their original publication language to preserve citation accuracy.