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Digital educational resources: Impact on communication skills of high school students in Quito, Ecuador.

Recursos educativos digitales: Impacto en las competencias comunicativas de los estudiantes secundarios de Quito, Ecuador.

Recursos educativos digitais: impacto nas competências de comunicação dos alunos do ensino secundário em Quito, Equador.

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Abstract

This study analyzes the impact of digital educational resources (DER) on the development of oral and written comprehension and expression skills in high school students in the Metropolitan District of Quito, Ecuador. A quasi-experimental research with a mixed approach was carried out in two educational institutions, in which an experimental group used these digital tools, while a control group continued with traditional methods. The results of the statistical analysis revealed a significant positive effect on the communication skills of the group that used the digital resources, compared to the control group. These findings, contextualized with previous studies, suggest that the appropriate integration of technology in the classroom can considerably improve educational quality. However, effectiveness may vary depending on individual and contextual factors, highlighting the importance of personalized approaches. In conclusion, the study provides empirical evidence on the value of educational technology in secondary education and suggests the need for further research on its implementation to optimize its impact on learning.

Keywords: Digital educational resources, skills, education

Resumen

Este estudio analiza el impacto de los recursos educativos digitales (DER) en el desarrollo de las destrezas de comprensión y expresión oral y escrita en estudiantes de preparatoria en el Distrito Metropolitano de Quito, Ecuador. Se llevó a cabo una investigación cuasi-experimental con un enfoque mixto en dos instituciones educativas, en la cual un grupo experimental utilizó estas herramientas digitales, mientras que un grupo control continuó con métodos tradicionales. Los resultados del análisis estadístico revelaron un efecto positivo significativo en las habilidades comunicativas del grupo que empleó los recursos digitales, en comparación con el grupo control. Estos hallazgos, contextualizados con estudios previos, sugieren que la integración adecuada de la tecnología en el aula puede mejorar considerablemente la calidad educativa. No obstante, la efectividad puede variar dependiendo de factores individuales y contextuales, lo que destaca la importancia de enfoques personalizados. En conclusión, el estudio proporciona evidencia empírica sobre el valor de la tecnología educativa en el ámbito de la educación secundaria y sugiere la necesidad de continuar investigando su implementación para optimizar su impacto en el aprendizaje.

Palabras clave: Recursos educativos digitales, destrezas, educación

Resumo

Este estudo analisa o impacto dos recursos educativos digitais (DER) no desenvolvimento de competências de compreensão e expressão oral e escrita em alunos do ensino secundário do Distrito Metropolitano de Quito, Equador. Foi realizada uma investigação quase-experimental com uma abordagem mista em duas instituições de ensino, em que um grupo experimental utilizou estas ferramentas digitais, enquanto um grupo de controlo continuou com os métodos tradicionais. Os resultados da análise estatística revelaram um efeito positivo significativo nas competências de comunicação do grupo que utilizou os recursos digitais, em comparação com o grupo de controlo. Estes resultados, contextualizados com estudos anteriores, sugerem que a integração adequada da tecnologia na sala de aula pode melhorar consideravelmente a qualidade da educação. No entanto, a eficácia pode variar em função de factores individuais e

contextuais, salientando a importância de abordagens personalizadas. Em conclusão, o estudo fornece provas empíricas sobre o valor da tecnologia educativa em contextos de ensino secundário e sugere a necessidade de mais investigação sobre a sua implementação para otimizar o seu impacto na aprendizagem.

Palavras-chave: Recursos educativos digitais, competências, educação.

Introduction

In the contemporary educational context, digital educational resources (DER) emerge as fundamental tools to transform teaching and learning procedures, especially in the field of oral and written comprehension and expression. Digitalization has caused a revolution in the educational field, allowing the creation of more interactive and accessible learning environments (UNESCO, 2014). This change is particularly relevant in preschool education, where the first interactions with language are crucial for the cognitive and social development of children (Vygotsky, 2020). In Ecuador, the Organic Law on Intercultural Education (2015) underlines the importance of integrating information and communication technologies (ICT) in educational processes, establishing a regulatory framework that promotes the use of DER to improve educational quality.

The current state of research on the use of DER in preschool education shows promising results in the development of language skills. Previous studies highlight that the integration of digital technologies in the classroom can strengthen oral and written comprehension and expression in students, by offering teaching materials that capture attention and motivate learning (Real, 2019; Sánchez et al., 2022). These findings are consistent with Vygotsky's constructivist theory, which emphasizes that learning is a social process that is enriched through interaction with appropriate tools and resources (Vygotsky, 2020). In addition, recent research conducted in Colombia (Ministry of National Education, 2021) reinforces the idea that open digital educational resources (EDA) are essential to personalize and adjust learning to the specific needs of students.

This research is conducted in two educational institutions in Quito, Ecuador: Unidad Educativa Liceo Naval Quito and Unidad Educativa León Cooper. Unidad Educativa Liceo Naval Quito, an institution with a long tradition in the comprehensive education of young people, is characterized by its focus on experimental educational projects that integrate technology as part of the teaching-learning process. In addition, Unidad Educativa León Cooper, recognized for its commitment to quality and warm education, is in the process of more significantly incorporating digital educational resources into its pedagogical practices.

These two institutions provide an ideal setting to explore how the implementation of DER influences the development of communication skills in high school students.

Despite progress, there is a significant gap in the effective implementation of DERs in some educational institutions, which limits their potential to strengthen students' communicative skills. Direct observation of activities in these institutions revealed that, although ICTs are recognized as teaching-learning strategies, their use in classrooms does not always translate into a significant impact on the development of high school students' language skills. This study focuses on analyzing the influence of DERs on oral and written comprehension and expression, a critical area that, according to González (2019) and Vernon and Alvarado (2014), is imperative for the academic and social success of preschool-aged children.

The main objective of this study is to analyze how digital educational resources (DER) influence the development of oral and written comprehension and expression skills in high school students in Quito. It is hypothesized that DER has a positive and significant impact on the development of these communication skills, improving both comprehension and expression in students who use them, compared to those who follow traditional teaching methods. The research seeks to demonstrate how the integration of these technologies in the classroom can optimize learning and contribute to the comprehensive development of students in preschool education.

Methodology

This study adopted a mixed approach, combining both quantitative and qualitative methods to obtain a comprehensive understanding of the problem under investigation. Numerical and qualitative data were collected and analyzed using statistical processes and qualitative analysis techniques, to respond to the problem statement. This mixed approach made it possible to reduce interpretative biases and provide a more complete perspective on the impact of digital educational resources (DERs) on the development of oral and written comprehension and expression skills in high school students (Hernández Sampieri, 2014).

The purpose of the research was applied, aimed at solve specific problems related to improving communication skills in preschool students. The research focused on observing, measuring, and experimenting with how DERs could improve these skills, providing relevant empirical evidence that could be used by teachers in educational practice. The results obtained have direct applications in curricular adaptation and the integration of educational

technologies, to assist in the modernization and continuous improvement of the educational system in Ecuador (Castro et al., 2023).

The scope of the study was correlational, allowing to determine the relationship or degree of association between the DER as an independent variable and the strengthening of oral and written comprehension and expression skills as a dependent variable. This type of study was suitable to explore how the DER influenced the communication skills of students and to provide evidence on the effectiveness of these digital tools in an educational environment (Hernández Sampieri, 2014).

The research design was quasi-experimental since the independent variable (the DERs) was manipulated to observe its effect on the dependent variable (communication skills). Two private educational institutions were selected: the Liceo Naval Quito Educational Unit and the León Cooper Educational Unit. In this design, an experimental group used the DERs to improve their communication skills, while the control group continued with traditional teaching methods. Pretests and posttests were administered to both groups to assess changes in students' communication skills throughout the 2023-2024 school year (Sampieri, 2014). The data collected were analyzed using the Student T test to determine the effectiveness of the DERs compared to traditional methods (Sánchez, 2015).

The research was conducted with a total population of 50 preschool students from the two educational institutions mentioned above. The sample was intentional since the entire population was included in the study, dividing it into an experimental group (Unidad Educativa Liceo Naval Quito) and a control group (Unidad Educativa León Cooper). This methodological decision eliminated the need for a sampling procedure, ensuring that all participants contributed to the statistical analysis of the data.

To collect the information, observation techniques, and standardized tests were implemented. The observation was carried out using the CODA model, which allowed the evaluation of the quality of the DERs applied in the experimental group. This technique provided an objective evaluation of the resources used, based on technological and pedagogical criteria (Pampillón et al., 2012).

In the research, a thorough analysis was carried out of the results obtained by applying a pretest and a posttest using the Comprehensive and Expressive Language Exploration Test (ELCE). This analysis was carried out on a population of 50 students, divided equally between two educational institutions: the Liceo Naval Quito Educational Unit and the León Cooper Educational Unit, with 25 students in each.

The pretest was initially administered to assess the student's level of development in the areas of oral and written comprehension and expression before any intervention. This first step was crucial to establish a baseline that would allow identifying the initial state of students' communication skills in both institutions.

Subsequently, a specific intervention was implemented in the experimental group, which consisted of the use of digital educational resources designed to improve oral and written comprehension and expression skills according to the high school curriculum. These activities were carefully selected and applied to promote the development of students' linguistic skills.

Finally, a post-test was administered to both groups (experimental and control) to assess the progress achieved after the intervention. The post-test allowed a comparison of the results obtained with those of the pre-test, providing a clear view of the effectiveness of digital educational resources in the development of communication skills.

Results

This section presents the results obtained after applying the pre-test and post-test using the Comprehensive and Expressive Language Exploration Test (ELCE) in a sample of 50 students from the educational institutions Liceo Naval Quito and León Cooper. The results are analyzed to determine the impact of digital educational resources on the development of oral and written comprehension and expression skills.

1.1 Pretest

A pretest was administered to students from the León Cooper Educational Unit and the Liceo Naval Quito Educational Unit. The purpose of this pretest was to assess the initial level of oral and written comprehension and expression skills in both groups, thus establishing a baseline that would allow for comparing subsequent results and determining the impact of the intervention.

- **Statistical analysis: Pretest**

Table 3 specifies the statistical analysis carried out in this research, through the comparison of different descriptive measures, seeking to identify patterns of performance, dispersion, and symmetry in the scores obtained by the students of the institutions involved, thus allowing a detailed interpretation of the results obtained before and after the intervention.

Table 1

Pretest statistical analysis

Statistics	Leon Cooper Educational Unit	Naval High School Educational Unit Quito
Average	141,4268	140,876
Typical error	3,057958182	2,692621276
Median	146	143
Moda	#N/A	137
Standard deviation	15,28979091	13,46310638
Sample variance	233,777706	181,255233
Kurtosis	1,047803881	1,169520124
Coefficient of asymmetry	-1.154079338	-1.088544856
Range	56.5	55.2
Minimum	103.5	103.3
Maximum	160	158.5
Addition	3535.67	3521.9
Account	25	25

Note: The average results (means) are similar between the two institutions, the Liceo Naval Quito Educational Unit presents a greater dispersion in the scores, which is reflected in its greater standard deviation and variance.

The negative skewness (asymmetry) and positive kurtosis in both institutions suggest that the results tend to be concentrated in higher scores, with a greater presence of extreme values. These analyses allow us to conclude that, although the average performance is similar, the internal dynamics of variability and distribution of scores differ between the two institutions, which could influence how the impact of educational interventions on each group is interpreted.

This equality in the initial scores is fundamental for the validity of the experiment since it ensures that any changes observed in the post-test results can be attributed to the intervention with digital educational resources and not to initial differences between the groups.

The preliminary analysis reinforces the idea that the two selected groups were comparable at the beginning of the research, allowing for a fair and balanced assessment of the impact of digital educational resources on the development of student's communication skills.

- **Two-Sample F Test for Variances: Pretest**

The F test of the variances of two samples, to check if the variances can be considered equal or different. This test determines the variance of the pretest and posttest where it is assumed that the variances are equal when the p value < critical value and Ho is not rejected.

Table 2 details the analysis of the two-sample F test for variances, which indicates that there is no significant difference in the variances of the pretest scores between the students of

the León Cooper Educational Unit and the Liceo Naval Quito Educational Unit. Although the variance is slightly higher in the León Cooper group, this difference is not statistically significant, suggesting that the two groups are comparable in terms of score dispersion before the intervention.

Table 2

Pretest - F-test statistics for two-sample variances

F for two-sample variances		
	Leon Cooper Educational Unit	**Naval High School Educational Unit Quito**
Average	141,4268	140,876
Variance	233,777706	181,255233
Observations	25	25
Degrees of freedom	24	24
F	1,28770793	
P(F<=f) one tail	0.26893713	
critical value for F(One-tailed)	1.98375957	

Note: The analysis of the two-sample F test for variances indicates that there is no significant difference in the variances of the pretest scores between the students of the León Cooper Educational Unit and the Liceo Naval Quito Educational Unit.

Although the variance is slightly higher in the Leon Cooper group, this difference is not statistically significant, suggesting that the two groups are comparable in terms of score dispersion before the intervention.

The value of 1.98 that F must exceed for there to be considered a significant difference between the variances of the two groups. In this case, the calculated F value is 1.28, which is less than the critical value of 1.98. Therefore, the null hypothesis (Ho) is not rejected.

1.2 Post test

Two private educational institutions were selected for this research: the Liceo Naval Quito Educational Unit and the León Cooper Educational Unit. The first was designated as the experimental group, where digital educational resources specifically designed to improve oral and written comprehension and expression skills were implemented. The second, the León Cooper Educational Unit, was assigned as the control group, continuing with traditional teaching methods.

- **Analysis of pre-test results**

The analysis focuses on evaluating the effectiveness of an educational intervention implemented to improve the language skills of students in two educational institutions.

- **Mean and standard deviation**

Table 4 shows the results of the post-test in two educational institutions: León Cooper Educational Unit and Liceo Naval Educational Unit, Quito.

Table 3

Post-test statistical analysis

	Post Test	
Test	**Leon Cooper Educational Unit**	**Naval High School Educational Unit Quito**
1	146,00	161,00
2	162,00	162,00
3	145.50	161,00
4	142.50	150.70
5	153,00	164,00
6	149,00	164,00
7	163,00	146.70
8	157,00	161,00
9	116.70	129,00
10	144,00	135,00
11	159.50	146.70
12	150,00	156,00
13	156,00	159,00
14	126,00	158,00
15	144,00	154.00
16	152.90	153,00
17	138.70	161.50
18	121,00	158,00
19	129.20	160,00
20	150.50	157,00
21	162,00	159,00
22	153.50	139,00
23	139,00	164,00
24	145.70	143,00
25	141.50	152,00
Average	**145.93**	**154.18**
Standard Dev.	**12.43**	**9.47**

Note: The results of the application of the post-test after the intervention are presented.Naval High School Educational Unit, Quito.

The higher mean obtained by students from the Liceo Naval Quito Educational Unit (154.18) compared to the León Cooper Educational Unit (145.93) suggests that the specific intervention with digital educational resources had a significant positive effect. This difference in the means indicates that students who participated in the intervention not only improved

their language skills, but they did so to a greater extent than those who did not have access to the same resources.

The lower standard deviation at Unidad Educativa Liceo Naval Quito (9.47) suggests that student scores were more concentrated around the mean, indicating a more uniform response to the intervention program. This can be interpreted as a success of the program since it not only improved average scores but also led to a greater number of students reaching similar levels of competence. In contrast, the higher standard deviation at Unidad Educativa León Cooper (12.43) indicates greater variability in results, suggesting that the lack of a similar intervention led to less homogeneous development of skills among students.

- **Post-test - F-test statistics for two-sample variances**

Table 4 presents the analysis of the results of the post-test using the F test statistics to compare the variances of two samples, specifically between the León Cooper Educational Unit and the Liceo Naval Quito Educational Unit, providing crucial information on the homogeneity of the variances and the difference in the group means.

Table 4

F-Test Statistics

Statistics	Leon Cooper Educational Unit	Naval High School Educational Unit Quito
Average	145,928	154,184
Variance	154,6287667	89,6614
Observations	25	25
Pooled variance	122,1450833	
Hypothetical difference of the means	0	
Degrees of freedom	48	
t-statistic	-2.641111254	
P(T<=t) one tail	0.005559461	
Critical value of t (one-tailed)	1,677224196	
P(T<=t) two tails	0.011118922	
Critical value of t (two-tailed)	2,010634758	

Note: The results of the application of the post-test after the intervention at the Naval High School Educational Unit in Quito are presented.

The posttest mean is higher at the Liceo Naval Quito Educational Unit, suggesting that students in this group obtained better scores, possibly due to the specific educational intervention with digital resources.

The variance is significantly higher in the León Cooper Educational Unit, indicating a greater dispersion in student scores. This may suggest a less uniform response to educational

activities compared to the Liceo Naval Quito group, where the specific intervention seems to have reduced the dispersion of results, reflecting a more consistent impact among students.

The pooled variance (122,14) represents a weighted average of the variances of both groups. This value is used to calculate the t statistic and is an indicator of the overall variability within the two samples.

The negative t statistic indicates that the mean of the Liceo Naval Quito Educational Unit is significantly higher than that of León Cooper.

The p-value for the two-tailed test is 0.011, which is lower than the common threshold of 0.05. This indicates that there is a statistically significant difference between the means of the two groups, supporting the hypothesis that the intervention at Liceo Naval Quito had a positive effect.

The critical t values confirm that the difference observed in the means is significant in both the one-tailed and two-tailed tests, reaffirming the effectiveness of the intervention. Therefore, Ho is not rejected, and the two-sample t-test was used assuming equal variances.

1.3 Comparative analysis pretest and post-test

The comparative analysis between the pretest and posttest results aims to evaluate the impact of the educational intervention with digital resources on students' oral and written comprehension and expression skills. By comparing the data obtained before and after the intervention, we seek to identify significant improvements in student performance, as well as changes in the variability of scores. This comparative analysis is crucial to determine the effectiveness of the digital educational resources implemented and to validate the hypotheses proposed in the research.

- **Student's T-test**

To analyze the data from the pretest and posttest t-test, the Gaussian bell curve or normal distribution was used since it is essential in the interpretation of statistical results and provides a visual representation of how the data is distributed concerning the mean (Sánchez, 2015).

For decision-making in the Student t-test, it is assumed that:

If t value < critical value 0.05: the null hypothesis is not rejected, the alternative is rejected

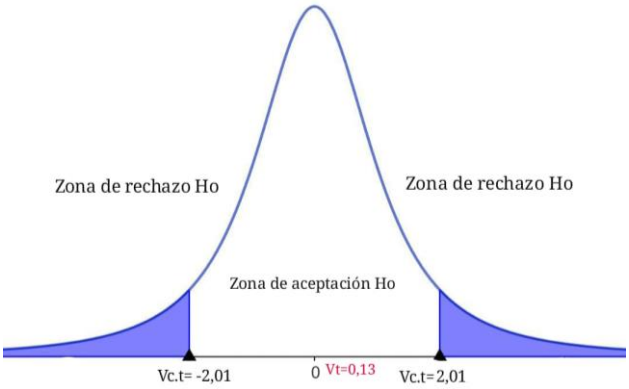
If the t value > critical value 0.05: the null hypothesis is rejected, the alternative is accepted

Rule of rejection and acceptance

Graph 1 shows the Gaussian bell curve of the pretest, which shows that from the critical points (-2.010; 2.010) the rejection zone is located when the value of t is less than -2.010 or greater than 2.010, and the acceptance zone when the calculated value of t is between -2.010 and 2.010.

Figure 1

t-test in the pretest Gaussian Bell

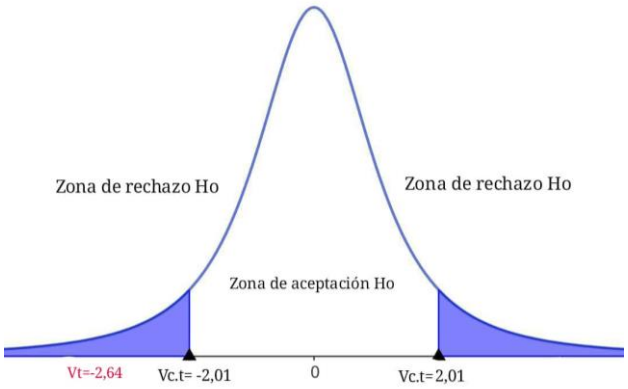


Note: Acceptance and rejection zones are specified
Tc= t obtained value (0.135) < critical value (2.010).

The graph of the result of the t-statistical test (0.135) is located within the acceptance zone of the Gaussian bell curve. This implies that, when obtaining a t value less than the critical value, it falls within the acceptance zone and the null hypothesis is not rejected, which leads to the conclusion that the means are not significantly different.

Figure 2

t-test in the Gaussian Bell post-test



Note: Acceptance and rejection zones are specified

tc= t obtained value (-2.64) < critical value (-2.010).

Figure 2 shows that the result of the t-statistical test obtained is (-2.64), which falls within the rejection zone in the Gaussian bell curve. This implies that the t value is less than the critical value. When it falls within the rejection zone, the null hypothesis must be rejected and the alternative hypothesis is accepted, therefore, there is sufficient statistical evidence to conclude that the observed effect is significant.

When comparing the results of the post-test of the control group (León Cooper Educational Unit) and the experimental group (Liceo Naval Quito Educational Unit), a statistically significant difference is evident in the experimental group. For this reason, the alternative hypothesis is accepted, which states that digital educational resources influence the development of skills in the area of oral and written comprehension and expression of high school students.

- **Calculating Effect Size (Cohen's d)**

Effect Size (Cohen's d) is a statistical measure that quantifies the magnitude of the difference between two groups or conditions in a study (Cohen, 1988).

1. Effect Size for Pretest:
Cohen's d: 0.038
2. Effect Size for Post-Test:
Cohen's d: -0.747
Interpretation:
Pretest: Cohen's d value is 0.038, indicating a very small effect size. This reinforces the earlier conclusion that there was no significant difference between the pretest scores of the two institutions, and any observed differences are minimal.

Posttest: Cohen's d is -0.747, suggesting a moderate to large effect size in the difference between the posttest scores. A negative Cohen's d simply indicates that the mean of the group at the Liceo Naval Quito Educational Unit is higher than that of the León Cooper Educational Unit group. This reinforces the conclusion that the intervention was more effective at one of the institutions.

The effect size tells us that, although students started at similar skill levels (pretest), there was a considerable change in the posttest, especially at the Liceo Naval Quito Educational

Unit, where students improved significantly more than their peers at the León Cooper Educational Unit.

- **Correlation Analysis**

Correlation Analysis is a statistical technique used to evaluate the strength and direction of the linear relationship between two quantitative variables (Rodgers, 1988).

1. León Cooper Educational Unit:
Correlation Coefficient (r): 0.934
p-value: 8.78e-12
2. Quito Naval High School Educational Unit:
Correlation Coefficient (r): 0.872
p-value: 1.39e-08

Correlation Coefficient (r): The correlation coefficient (r) measures the strength and direction of the linear relationship between pretest and posttest scores.

An r value close to 1 indicates a strong positive correlation, meaning that students who scored high on the pretest tended to score high on the post-test, and vice versa.

The p-value is extremely small in both cases, indicating that the observed correlation is statistically significant. That is, the probability of this correlation occurring by chance is very low.

At both institutions, there is a strong positive correlation between pretest and posttest scores. This suggests that posttest scores are highly correlated with pretest scores, which could reflect consistency in student performance over time or the effectiveness of the intervention in improving the skills of those who were already performing at a higher level.

- **Analysis of Variance (ANOVA)**

ANOVA result:
F-statistic: 1.99
p-value: 0.162

F statistic: Used to determine whether there are significant differences between group means. A higher F value suggests a greater difference between the means of the groups being compared.

The P-value of 0.162 is greater than the common significance threshold (0.05). This indicates that there is no statistically significant difference between the combined means of the pretest and posttest scores of the two institutions.

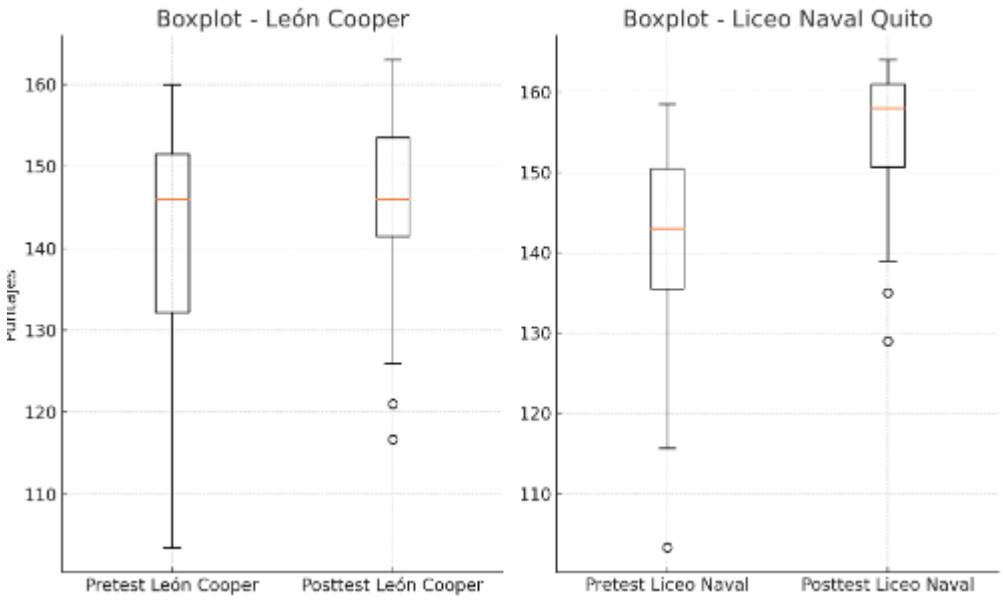
Although there may be some differences in individual scores between institutions, when pretest and posttest scores are combined, the differences are not large enough to be considered statistically significant.

The analysis of variance suggests that, when the pretest and posttest scores are considered together, there are no significant differences in the overall performance between the students of the León Cooper Educational Unit and the Liceo Naval Quito Educational Unit.

- **Box and Whisker Plots**

Figure 3 allows the distribution of a data set to be visualized. These graphs provide information about the median, quartiles, outliers, and symmetry of the distribution (Tukey, 1977).

Figure 3
Box and Whisker Plots



Note: Comparative analysis of pretest and posttest

At the León Cooper Educational Unit, the boxplots show that the median of the pretest scores is around 145, with a distribution of results that varies between 120 and 160, and some outliers below 110. After the intervention, in the posttest, the median increases slightly, and the distribution of scores becomes more concentrated, although outliers below 120 persist.

For its part, at the Liceo Naval Quito Educational Unit, the pre-test median is close to 140, with a dispersion of scores that ranges between 110 and 160, highlighting a very low atypical value of around 100. After the intervention, the post-test median rises significantly to around 155, and the distribution narrows, suggesting greater uniformity in the scores, although some atypical values below 130 are still observed.

1.4 CODA Assessment

For the selection of digital educational resources, the CODA evaluation was applied, to know which DERs meet the technological standards and pedagogical effectiveness necessary to achieve the desired learning results, thus ensuring both quality and relevance for the educational context.

Table 5

CODA Assessment-Version 1 Likert Scale

Digital Educational Resources	Qualification	20-29 Not acceptable	30-39 Acceptable	40-49 Well	50 Very good
		★★	★★★	★★★★	★★★★★
ABC tree	46.12			X	
Genially	45.75			X	
Youtube Education	45.11			X	
Long live reading	44.53			X	
Educaenvivo	44.53			X	
Wordwall	43.73			X	
Cokitos	43.02			X	
Edpuzzle	41.54			X	
Kahoot	41.42			X	
Educaplay	38.91		X		
Cristic	36.33		X		
Duolingo	32.46		X		
Smile and learn	31.77		X		
Mobbyt	31.58		X		
Quizlet	26.75	X			
Pipoclub	26.16	X			

Note: The results are presented considering first those who obtained the highest score.

The resources were classified into four categories based on the score obtained: Not acceptable (20-29), Acceptable (30-39), Good (40-49), and Very good (50).

Resources Rated "Very Good": None.

Resources rated as "Good": Arbol ABC, Genially, Youtube Edu, Viva leer, Educaenvivo, Wordwall, Cokitos, Edpuzzle, and Kahoot. This indicates that these resources

meet good technological and pedagogical standards, being recommended for implementation in the educational context.

Resources rated as “Acceptable”: Educaplay, Cristic, Duolingo, Smileandlern, and Mobbyt. These resources are of quality, meeting the standards necessary to be effective in the educational context, although they may have some areas for improvement.

Resources Rated as "Not Acceptable": Quizlet (26.75) and Pipoclub (26.16) According to the evaluation, these resources do not meet the minimum standards to be considered in the educational process, they present significant limitations in their pedagogical and technological effectiveness that could affect their use in the classroom.

According to these results, 9 of the 16 digital educational resources not only meet the required technological standards but are also aligned with pedagogical needs, which maximizes their positive impact on the educational process.

Discussion

The results obtained in this study provide solid evidence of the positive impact of digital educational resources (DER) on the development of communication skills in high school students. These findings align with the growing international evidence that highlights the effectiveness of digital technologies in education, particularly in improving language skills (Sánchez et al. 2022; Real 2019). However, it is essential to critically assess these results, considering both their scope and limitations, as well as their interpretation in light of previous studies and the hypotheses raised in this research.

Statistical analysis reveals that the DER-based educational intervention had a significant impact on improving oral and written comprehension and expression skills in students in the experimental group. This result is confirmed by the Student t-test, where the calculated t value falls within the rejection zone, indicating that there is a statistically significant difference between the pretest and posttest scores in the group that used DER. This observation suggests that the integration of digital technologies in the educational process can offer a substantial improvement in communicative skills, in line with what was proposed by Vygotsky (2020), who argues that learning is a social process enriched by interaction with appropriate tools.

The improvement in communication skills observed in the experimental group can be attributed to the ability of DERs to offer interactive and personalized materials that capture students' attention and encourage their active participation in the learning process (Ministerio

de Educación Nacional 2021). These resources allow for more meaningful learning, where students not only receive information but also interact with it, which reinforces their understanding and ability to express themselves. This finding is consistent with previous studies that highlight the effectiveness of DERs in early childhood education (González 2019; Vernon and Alvarado 2014), and reinforces the hypothesis that DERs have a positive impact on the development of language skills.

Despite the positive results, it is necessary to acknowledge some limitations that might have influenced the findings. First, the quasi-experimental design used in this study, although appropriate for the conditions of the research, may limit the ability to generalize the results to other educational contexts. The selection of the two educational institutions in Quito, while providing a controlled environment for the intervention, might not represent the diversity of school contexts in Ecuador or other countries with different socioeconomic and cultural characteristics.

Furthermore, although the intervention was effective in improving communication skills in the experimental group, the variability in post-test scores suggests that not all students benefited uniformly from DERs. This could be related to individual differences in familiarity with digital technologies, personal motivation, or even the home environment, factors that were not controlled in this study but could have a significant impact on the results. Such variability highlights the importance of considering a more personalized approach in the implementation of DERs, adapting educational strategies to the specific needs of each student (Hernández Sampieri 2014).

Another critical aspect to consider is the assessment of the quality of the DERs used in the intervention. Although a CODA assessment was applied to select the resources, some of them received ratings that placed them only as "good" or "acceptable". The effectiveness of the intervention could have been limited by the quality of these resources, suggesting that a more rigorous selection based on stricter pedagogical and technological standards could further improve the results.

The findings of this study have important implications for educational practice, especially in preschool and primary education. Evidence suggests that DERs can be powerful tools for improving communication skills, provided they are implemented appropriately and accompanied by teacher training that enables educators to maximize their potential. This implies not only an investment in technologies but also the ongoing professional development

of teachers to ensure that they can effectively integrate these resources into their pedagogical practices (Castro et al. 2023).

In terms of future research, it is necessary to expand the study to include a more diverse and representative sample, which would allow the findings to be validated in different educational contexts. In addition, additional research could further explore the factors that moderate the impact of DERs, such as student motivation, family support, and the technological infrastructure available in educational institutions. It would also be valuable to investigate the long-term impact of DER use on the development of communication skills, to determine whether the observed benefits are maintained and translate into broader academic and social improvements.

It is suggested that the relationship between the quality of DERs and educational outcomes be investigated in more detail. The classification of resources based on the CODA assessment provides a first approximation, but future studies could develop more sophisticated assessment frameworks that consider not only technological and pedagogical aspects but also their ability to adapt to the changing needs of students and their alignment with curricular objectives.

Although this study demonstrates the significant potential of DERs to improve communication skills in high school students, further research and refinement of both resources and implementation strategies are essential to maximize their impact in the current educational context.

Conclusion

This research has allowed us to explore in depth the impact of digital educational resources (DER) on the development of communication skills in high school students, demonstrating that the integration of these tools in the classroom can mean a significant improvement in oral and written comprehension and expression. This study not only reinforces the importance of technology in contemporary education but also offers concrete evidence of its effectiveness in a specific context such as that of educational institutions in Quito.

One of the most relevant contributions of this research is the confirmation that DERs can act as catalysts in the teaching-learning process, by offering interactive and adaptive environments that facilitate the development of essential linguistic skills from an early age. The students who participated in the intervention demonstrated significant improvements in

their communication skills, suggesting that the systematic and well-designed use of these resources can substantially transform the educational experience.

Through a mixed methodological approach, this study has managed not only to quantify the impact of DERs but also to understand the qualitative dynamics underlying this process. The combination of quantitative and qualitative methods has allowed us to obtain a more complete and nuanced view of how DERs influence students' communicative development, offering valuable insights for future studies and pedagogical applications.

In terms of practical implications, the findings suggest that the implementation of DERs in the educational curriculum should not be seen simply as a technological trend, but as a pedagogical strategy with the potential to close learning gaps and improve educational quality in varied contexts. Furthermore, the research suggests that to maximize the impact of DERs, it is necessary to accompany their implementation with an adequate teacher training process and with a technological infrastructure that guarantees equitable access to these tools.

Another fundamental aspect is the need to adapt digital educational resources to the specific characteristics and needs of students. The variability observed in the post-intervention results indicates that, although DERs are effective, their impact can be maximized when they are adjusted to the particularities of the educational context and the individual characteristics of students. This opens a path for future research aimed at developing more personalized models of digital teaching.

Furthermore, this study contributes to the field of education by providing an intervention model that can be replicated or adapted in other educational institutions, both locally and internationally. The quasi-experimental approach used has proven effective in evaluating the impact of pedagogical innovations in real-life settings, offering a methodological framework that can be adopted in future research.

The research confirms that DERs are not simply support tools, but fundamental components that can redefine how communication skills are developed in the early years of schooling. Having achieved the stated objectives, which included demonstrating the positive impact of DERs and generating empirical evidence on their effectiveness, this study is positioned as a significant contribution to the field of education, providing solid foundations for the implementation of educational policies that effectively integrate digital technologies into teaching-learning processes.

This study not only demonstrates the effectiveness of DERs in developing communication skills but also underlines the importance of their strategic and adaptive

integration into the educational system. The research opens new perspectives for the use of technology in education, offering a clear path for future research and practical applications that seek to improve educational quality and equity through digitalization.

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