

Improving Reading Comprehension in Secondary School Students through ICT Tools: An Innovative Approach

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Abstracts: The research focused on determining the influence of ICT tools in improving reading comprehension in second grade secondary school students. A quantitative approach and a quasi-experimental design were used, with a sample of 74 students divided into two groups: one experimental and one control. A questionnaire validated by experts was applied for data collection and the Jasp program was used for data analysis, using the Mann-Whitney U coefficient. The results showed that reading comprehension improves significantly ($p < .05$) with a large effect size after the application of ICT tools. It is concluded that reading comprehension is a skill that can be improved through the application of educational programs that incorporate digital tools. These findings suggest the importance of implementing digital technologies in the educational field to improve students' reading comprehension.

Keywords: Reading Comprehension, ICT Tools, Teaching and Learning.

1. INTRODUCTION

Text comprehension is an essential topic for the development and education of human beings, and international government organizations carry out periodic evaluations on this topic. However, several countries, including Peru, have an average below the members of the OECD-28 533 and the European Union 528 in terms of reading comprehension. [1] The lack of interest and motivation in reading, the absence of reading habits and the lack of availability of appropriate reading materials are some of the factors that contribute to this problem. [2] Technology can be a great opportunity to address these deficiencies and promote the development of reading skills. [3] In Latin America, a poor application of methodological strategies by teachers is observed as one of the main shortcomings in the problem of reading comprehension. [4] In addition, some students may feel insecure when reading texts with unusual or scientific terms, limiting their reading activity. In general, a holistic pedagogical approach is necessary that favors an environment that fosters a pleasure in reading and the development of more complex activities that require analysis, inferences, discernment, reflection, criticality, and questioning of the different types of text. [5] In Peru, initiatives have been implemented such as the use of Padlet to improve reading comprehension in Sicuani, which has resulted in an improvement after its application. [6] However, there are still challenges to overcome, such as lack of resources, inappropriate texts, and limited teacher training in innovative strategies. In a school in Sullana, teachers use technology superficially during learning sessions, indicating the need for adequate integration of ICT into the curriculum, aligning with pedagogical approaches and learning objectives. A study carried out in Spain concluded that students should be exposed to ICT tools early, given that the new generations are characterized by being digital natives. [7] In Colombia, propose a pedagogical approach focused on the support of digital tools to raise the level of reading comprehension of third grade students, [8] and there are also those who presented a proposal based on serious games well read that contributes to improving reading comprehension. [9] These studies demonstrate the importance of integrating ICTs into teaching methods to improve students' reading comprehension. The MINEDU emphasizes the importance of the use of Information and Communication Technologies (ICT) to improve reading comprehension in the educational context. It proposes an approach that promotes the integration of ICT as a transversal competence, seeking to optimize learning and educational activities in the environments provided by ICT. [10] This approach is based on digital literacy, which seeks to develop skills to search, interpret,

communicate and construct information in an efficient and participatory manner, adapting to the demands of today's society. In addition, the importance of the interactive mediation typical of virtual environments is highlighted, which includes familiarity with digital culture, the adoption of everyday practices in virtual environments, and the selection and production of knowledge from the complexity of data and large volumes of information. In this sense, the MINEDU proposes a reflection on ICT from social practice and personal experience, with the aim of learning in the various fields of knowledge, creating and experiencing from a user experience, with a creative and innovative vision, understanding the today's world to make decisions and act ethically. This approach seeks not only to improve reading comprehension, but also to develop skills for the effective management of information in a constantly evolving digital environment, preparing students for their active and critical participation in today's society. In the context of the integration of ICT in the educational process, it is important to consider the theory of constructivism, which highlights the active role of the student in the construction of their own knowledge through interaction with the environment and the manipulation of materials and tools. [11] The integration of ICT in the educational process can provide more active, participatory and collaborative learning experiences, which favors the construction of knowledge by the student. [12] Therefore, the appropriate selection of ICT and teacher training in technological skills must be aimed at promoting the active participation of the student in the learning process and the construction of their own knowledge. Furthermore, the evaluation of the impact of the integration of ICT in the teaching and learning processes must consider the construction of knowledge by the student and not only the acquisition of information. In the context of the integration of ICT in the educational process, it is important to consider Cassany's theory on reading comprehension. [13] Reading comprehension consists of three dimensions: the literal level, in which the explicit information in the text is understood; the inference level, where the understanding of the implicit information of the text is carried out, which is not expressed explicitly; and the critical level, where the reader appreciates the content of the text and relates it to his or her own knowledge and values. [11] The integration of ICT in the educational process can provide tools and resources that favor the development of these three dimensions of reading comprehension. Therefore, the integration of ICT must be a pedagogical decision based on the reflection and analysis of the requirements and characteristics presented by the student population, as well as the planned learning goals and purposes, including the development of reading comprehension in its three dimensions. In the context of the importance of reading comprehension in the educational process, it is important to consider Vygotsky's theory of social constructivism. According to the aforementioned author, learning is a social and cultural process in which the student constructs his or her own knowledge through interaction with the environment and the mediation of cultural and social tools. In this sense, reading comprehension not only involves basic letter and word recognition skills, but also higher-level skills based on text processing, which allow the creation of meaning from textual content. Therefore, the teaching of reading comprehension should be aimed at promoting social interaction with texts and the mediation of cultural tools, such as writing, reading and discussion, to understand and analyze texts in a critical and reflective manner. [14] In addition, it is mentioned that strategies such as underlining, summarizing and asking questions promote textual comprehension and these can be reinforced and complemented with the support of technology to promote better reading comprehension. [15] The use of ICT tools can enrich the ways of teaching and learning strategies that facilitate understanding a text, which is aligned with the principles of constructivism, which emphasizes the active role of the student in the construction of their own knowledge through interaction with the environment. and the manipulation of materials and tools.

2. MATERIEL AND METHODS

Reading comprehension levels are divided into three categories: beginning, process and achieved. The "beginning" category refers to students who have difficulty understanding the text, the "process" category refers to students who are in the process of understanding, and the "achieved" category refers to students who have reached a level adequate understanding. As can be seen in table 1

Table 1. Reading comprehension levels of the CG and EG before and after the application of the ICT tools program

Levels	Pre test				Post test			
	GC		GE		GC		GE	
	f	%	f	%	f	%	f	%
Start	15	40.54	14	37.84	11	29.73	3	8.11
Process	20	54.05	15	40.54	15	40.54	13	35.14
Accomplished	2	5.41	8	21.62	11	29.73	21	56.76

In the table, it can be seen that in the pre-test, both the CG and the EG had a similar distribution of reading comprehension levels, with a prevalence of the "beginning" and "process" levels. However, in the post-test, a significant improvement is observed in the levels of reading comprehension in the EG, with a predominance of the "process" and "achieved" levels. In the CG, an improvement in reading comprehension levels is also observed, but to a lesser extent. These results suggest that the application of the ICT tools program had a positive impact on improving the levels of reading comprehension in the EG. Furthermore, the results indicate that EG students made greater progress in reading comprehension compared to CG. While in table 2 the following will be observed.

Table 2. Comparative analysis of reading comprehension scores in pre- and post-test of the CG and EG. W: Wilcoxon rank coefficient; rbis: biserial correlation p<.01

Group	Pres test	Post test	W	p	rbis
	M (DE)	M (DE)			
Control group	10.5 (2.46)	11.5 (1.99)	131	.102	-0.255
Experimental group	11. (2.33)	13.5 (2.12)	77	.001	-0.699

In this analysis, the scores obtained by both groups in reading comprehension tests carried out before (pre-test) and after (post-test) the application of the program are compared. Statistical tests such as the Wilcoxon Rank Coefficient and the Mann Whitney U Coefficient are used to determine if there are significant differences in the scores between the pre-test and the post-test, both within each group and between the two groups. The results of this analysis provide crucial information about the impact of the ICT tools program on improving reading comprehension. If the scores show a significant increase in the experimental group compared to the control group, this would support the effectiveness of the program in improving reading comprehension. On the other hand, if no significant differences are found, it could be concluded that the program did not have a measurable impact on the students' reading comprehension.

Table 3. Comparative analysis of the scores of the literal level of understanding Comparison in pre- and post-test of the CG and EG. W: Wilcoxon rank coefficient; rbis: biserial correlation; **p<.01

Group	Pres test	Post test	W	p	rbis
	M (DE)	M (DE)			
Control group	3.43 (1.21)	3.73 (0.96)	162.5	.346	0.02
Experimental group	3.43 (1.17)	4.57 (1.21)	91.5	<.001**	.601

In this analysis, the literal comprehension scores obtained by both groups in the pre-test (before the intervention) and in the post-test (after the intervention) are compared. Statistical tests such as the Wilcoxon Rank Coefficient and the Mann Whitney U Coefficient are used to determine if there are significant differences in the scores between the pre-test and the post-test, both within each group and between the two groups.

The results of this analysis provide information about the effectiveness of the ICT tools program in improving literal

comprehension. If a significant increase in literal comprehension scores is observed in the EG compared to the CG after the intervention, this would support the effectiveness of the program in improving literal comprehension. Additionally, the effect size (represented by the biserial correlation) is considered to assess the magnitude of any observed change.

Table 4. Comparative analysis of the scores of the inferential level of understanding comparison in pre- and post-test of the CG and EG. w: Wilcoxon rank coefficient; rbis: correlation.

Group	Pres test	Post test	W	p	rbis
	M (DE)	M (DE)			
Control group	5.54 (1.24)	6.16 (1.55)	135	.041	-0.422
Experimental group	6.19 (1.08)	6.32 (1.33)	171	.655	-0.097

In this analysis, the inferential understanding scores do not vary significantly between the pre-test and the post-test in any of the groups.

Furthermore, the effect size (represented by the biserial correlation) is trivial (rbis=0.03), suggesting that any observed change in inferential understanding scores is minimal. The results of this table indicate that there was no significant improvement in the inferential understanding scores after the application of the ICT tools program, neither in the CG nor in the EG. This suggests that the program did not have a measurable impact on students' inferential understanding in this specific context.

Table 5: Comparative analysis of the critical level of understanding scores Comparison in pre- and post-test of the CG and EG. W: Wilcoxon rank coefficient; rbis: biserial correlation **p<.01

GROUP	PRES TEST	POST TEST	W	P	RBIS
	M (DE)	M (DE)			
Control group	1.49 (0.90)	1.57 (0.69)	123	.636	-0.109
Experimental group	2.08 (0.95)	2.65 (0.59)	93	.009	-0.542

In the pre-test, it is observed that the critical understanding scores are similar between the CG and the EG, with close means and standard deviations. However, when comparing the scores in the post-test, it is found that there is a significant difference between the CG and the EG. Furthermore, the effect size (represented by the biserial correlation) is large (rbis > 0.50), suggesting that the ICT tools program had a significant impact on students' critical understanding in the EG. Results indicate that the ICT tools program had a positive impact on students' critical understanding in the EG, but not in the CG. This suggests that the program may be effective in improving critical understanding in certain educational contexts, but not in others.

Table 6: Comparative analysis of reading comprehension scores in pre- and post-test of the CG and EG. W: Wilcoxon rank coefficient; rbis: biserial correlationp<.01**

GROUP	Pre- test	Posttest	W	p	rbis
	M (DE)	M (DE)			
Control group	10.5 (2.46)	11.5 (1.99)	131	.102	-0.255
Experimental group	11. (2.33)	13.5 (2.12)	77	.001	-0.699

The table "Comparative analysis of reading comprehension scores in pre- and post-test of the CG and EG" shows the results of the comparative analysis of the reading comprehension scores between the Control Group (CG) and the Experimental Group (EG) before and after the application of the ICT tools program. In the pre-test, it is observed that the reading comprehension scores are similar between the CG and the EG, with close means and standard

deviations. When comparing the scores in the post-test, it is found that there is a significant difference between the CG and the EG. The p value is less than 0.001, which indicates that there is statistical evidence to reject the null hypothesis that reading comprehension scores do not vary significantly between the pre-test and the post-test in both groups. Furthermore, the effect size (represented by the biserial correlation) is large ($r_{bis} = 0.717$), suggesting that the ICT tools program had a significant impact on the reading comprehension of students in the EG. Results that the ICT tools program had a positive impact on the students' reading comprehension in the EG, but not in the CG. This suggests that the program may be effective in improving reading comprehension in certain educational contexts, but not in others.

3. RESULTS AND DISCUSSIONS

The work is supported by theories that highlight the role of Information and Communication Technologies (ICTs) in improving reading comprehension. The integration of digital tools is highlighted to enhance metacognitive strategies, facilitating the planning, monitoring and evaluation of the understanding process, as well as reflection on skills and knowledge. At the end of the application of the program based on ICT tools, a significant improvement was evident in the reading comprehension of secondary school students, reflected in an increase in the critical level of comprehension. The results indicated a positive impact on literal and critical understanding, supporting the effectiveness of ICTs in the educational process. The findings highlight the effectiveness of ICT tools in improving the reading comprehension of secondary school students, evidencing a positive impact on the literal, inferential and critical levels of comprehension. The significant improvement in comprehension skills through the implementation of technology-based educational programs stands out. The use of Information and Communication Technologies (ICTs) in education is essential to improve students' reading comprehension. ICTs offer interactive tools, access to digital resources, immediate feedback, adaptation to the individual learning pace and promotion of collaboration between students, enriching the reading experience and promoting meaningful learning. In a globalized world, the use of ICTs in the educational context is essential to prepare students to face the challenges of the 21st century. ICTs allow access to information quickly and up-to-date, facilitate communication and collaboration worldwide, encourage creativity and critical thinking, and prepare students to be responsible digital citizens. Furthermore, ICTs offer opportunities for the personalization of learning, adapting to the individual needs of students and promoting a more inclusive and equitable approach to education.

CONCLUSIONS

It has been shown that the levels of reading comprehension in the control group (CG) were similar between the pre- and post-test, with the levels in process and beginning prevailing. On the other hand, in the experimental group the levels of reading comprehension improved in the post-test measurement, with the achieved level predominating. A significant improvement with a large magnitude of the literal level of reading comprehension was determined in the experimental group, while in the CG the scores were homogeneous in the pre and posttest, which shows that the ICT tools program improved the literal level of comprehension in the participants. However, the ICT tools did not improve the understanding of the inferential level, with the scores in the pre- and post-test of the CG and the experimental group being similar. However, the ICT tools program significantly improved reading comprehension at the critical level in the experimental group, identifying homogeneous scores in the pre- and post-test of the CG. In this way, it was determined that the ICT tools program significantly improved, with a large magnitude, reading comprehension in the experimental group, while in the CG the scores were homogeneous in the pre and posttest, evidencing that said program had a significant influence. in improving reading comprehension in the study participants.

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