

Virtual Learning Environment as a Strategy to Strengthen Reading Comprehension in Basic Secondary Education Students

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Abstract

This article presents the results of a research study aimed at strengthening reading comprehension in secondary school students through the design and implementation of a virtual learning environment (VLE). The study was conducted using a mixed-methods approach, integrating qualitative and quantitative methodologies to assess the impact of the VLE on students' reading skills. Using interactive tools and collaborative activities, the virtual environment facilitated the development of critical competencies such as identifying main ideas, making inferences, and interpreting texts. The research was carried out with a sample of ninth-grade students from an educational institution in Montería, Colombia, selected through purposive sampling. The results showed significant improvements in students' reading comprehension, highlighting the role of the VLE as an effective pedagogical tool for promoting meaningful learning in diverse educational contexts. This study emphasizes the importance of integrating digital technologies into teaching and learning processes to strengthen reading competencies in secondary education.

Keywords: *Virtual Learning Environment, Reading Comprehension, Pedagogical Strategies, Educational Technologies, Secondary Education.*

Introduction

In an increasingly digitized world, the ability to understand and interpret texts has become an essential skill to function both in the academic field and in everyday life. Reading comprehension not only involves decoding words, but also analyzing, inferring, and evaluating information to construct deep and critical meanings (Cassany, 2006). However, in educational contexts such as Montería, Colombia, many students present significant difficulties in this competence, evidenced by low results in internal and external evaluations, such as the Saber tests (ICFES, 2020). These deficiencies, in many cases, are related to the persistence of traditional methodologies that fail to capture the interest of students or connect them with the content in a meaningful way.

The incorporation of digital technologies in education has opened up new possibilities to address these challenges. In particular, virtual learning environments (VLEs) have emerged as innovative pedagogical tools that integrate interactive, collaborative, and personalized resources, offering a motivating environment for the development of academic competencies (Garrison & Vaughan, 2008). VLEs allow for the design of student-centred activities, encouraging autonomous learning and the development of critical skills through resources such as videos, simulations and interactive exercises.

This study was developed with the objective of designing, implementing and evaluating a virtual learning environment aimed at strengthening reading comprehension in ninth grade students of an educational institution in Montería, Colombia. The proposal was based on theories of sociocultural and constructivist learning, such as those proposed by Vygotsky (1978) and Bruner (1996), which emphasize the importance of context, social interaction and the use of technological tools in the learning process.

The design of the VPA included interactive and dynamic activities, such as text analysis, problem solving and collaborative discussions, aimed at developing advanced reading skills such as identifying main ideas, inference and critical evaluation of information. In addition, the effectiveness of the VLE was evaluated

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using a mixed approach, integrating quantitative data on student performance with qualitative analyses of their perceptions and experiences during the intervention.

This article presents, firstly, the theoretical framework that underpins the design of the VLE, addressing key concepts about reading comprehension and educational technologies. Subsequently, the methodology used in the study is described, followed by the results obtained and their discussion in relation to previous research. Finally, conclusions and recommendations are offered that highlight the relevance of integrating virtual learning environments into educational processes, underlining its positive impact on the development of critical and meaningful skills in students.

The development of reading comprehension in secondary school students is a central challenge in education systems, as this skill constitutes an essential foundation for meaningful learning in all areas of knowledge. In this context, the integration of digital technologies, such as virtual learning environments (VLEs), represents an opportunity to overcome the limitations of traditional methodologies and promote advanced reading skills. This theoretical framework addresses the fundamental concepts of reading comprehension, virtual learning environments and their relationship with sociocultural and constructivist learning.

Reading Comprehension

Reading comprehension is defined as the ability to process, interpret, and reflect on the content of a text in order to construct deep meanings (Cassany, 2006). This process involves different levels of understanding:

- **Literal:** Identification of explicit information in the text.
- **Inferential:** Deduction of implicit meanings through connections between ideas.
- **Critical:** Evaluation of the author's intent, the credibility of the information, and the relevance of the content.

In the Colombian educational context, the results of the Saber tests have indicated that a significant percentage of students have difficulties at the inferential and critical levels, which limits their ability to actively participate in learning and problem-solving. These shortcomings highlight the need to implement pedagogical strategies that promote active and meaningful learning.

Virtual Learning Environments (VLEs)

Virtual learning environments are digital platforms designed to facilitate the educational process through the integration of interactive resources, collaborative activities, and assessment tools. According to Garrison and Vaughan (2008), VLEs provide a flexible environment that fosters student autonomy and facilitates access to personalized content. Among its main features are:

- **Interactivity:** Ability to perform dynamic activities, such as simulations, interactive quizzes, and real-time text analysis.
- **Collaboration:** They encourage social learning through forums, discussions, and group projects.
- **Accessibility:** They allow students to access educational resources from anywhere and at any time, promoting educational equity.

Within the framework of this study, the designed VPLE included resources such as explanatory videos, interactive reading exercises and online discussion activities, aimed at strengthening students' reading skills.

Sociocultural and Constructivist Learning

The design of the VLE was based on Vygotsky's (1978) theories of sociocultural learning and Bruner's (1996) constructivism, which underline the importance of social interaction, context, and mediating tools in the learning process.

- **Sociocultural Theory:** According to Vygotsky, learning occurs through interaction with others and the use of cultural tools. At the VPA, this interaction was facilitated through collaborative activities in forums and discussions, which allowed students to share ideas and build collective knowledge.
- **Constructivism:** Bruner argues that meaningful learning arises when students actively construct their knowledge from relevant experiences. The VPA was designed to offer student-centred activities, such as text analysis and problem-solving, which promoted critical reflection and the application of concepts to real-life situations.

Relationship between VLE and Reading Comprehension

The integration of virtual learning environments in the educational process offers multiple benefits for the development of reading comprehension. According to Hamari et al. (2014), VLEs not only increase student motivation and engagement, but also provide enriched environments to practice and develop complex skills. In the present study, the VLE allowed students to interact with texts through dynamic activities and audiovisual resources, facilitating the acquisition of reading skills at inferential and critical levels.

In summary, the theoretical framework establishes that virtual learning environments, based on solid pedagogical theories, constitute a powerful tool to improve reading comprehension in secondary school students. This approach not only responds to contemporary educational needs, but also lays the foundation for a transformation in teaching and learning practices.

Methodology

The present study was developed under a mixed design, integrating qualitative and quantitative approaches to evaluate the effectiveness of a virtual learning environment (VLE) designed with the purpose of strengthening reading comprehension in ninth grade students. This approach allowed data to be collected and analysed from multiple perspectives, ensuring a comprehensive view of the impact of the VLE on participants' reading skills.

Research Approach and Design

The research adopted an exploratory-descriptive design, with a quantitative approach to measure changes in reading comprehension levels and a qualitative approach to analyze students' perceptions and experiences with the VLE.

- **Quantitative:** Standardized reading comprehension tests were applied before and after the implementation of the VLE, allowing students to objectively measure their progress at three levels: literal, inferential and critical.
- **Qualitative:** Semi-structured interviews and observations were conducted to explore how students interacted with the VLE and which elements of the design they considered most effective.

Population and Sample

The population was composed of ninth grade students from an educational institution in Montería, Colombia. An intentional sample of 40 students was selected, considering the following inclusion criteria:

- Students with previous difficulties in reading comprehension, identified through institutional diagnoses.
- Availability to participate in virtual sessions and complete assigned activities.

Data Collection Instruments

- Reading Comprehension Tests: They were designed based on PISA assessment standards (OECD, 2018) and included activities to measure literal, inferential, and critical levels. These tests were applied before and after the implementation of the VPA.
- Semi-structured interviews: Aimed at the students at the end of the workshop, they allowed them to collect their perceptions about the VPA, the activities developed and the elements that contributed most to their learning.
- Observations: During the virtual sessions, structured observations were made to analyze the level of interaction, participation and commitment of students with the VLE.

Design of the Virtual Learning Environment

The VLE was developed on an easy-to-access platform for students and structured into five modules, each designed to work on specific reading comprehension skills:

- Module 1: Introduction to reading comprehension and familiarisation with the VLE.
- Module 2: Identification of main ideas and explicit details (literal level).
- Module 3: Analysis of inferences from texts (inferential level).
- Module 4: Critical evaluation of the author's intention and credibility of the text (critical level).
- Module 5: Application and creation of critical texts, integrating what has been learned in the previous modules.

Each module included:

- Interactive resources, such as explanatory videos and simulations.
- Hands-on activities with immediate feedback.
- Discussion forums to encourage social interaction.
- Assessments at the end of each module to measure progress.

Data Analysis

- Quantitative data: The results of the reading comprehension tests were analyzed using descriptive and comparative statistics (Student's t-tests for related samples) to determine if there were significant differences between the scores obtained before and after the intervention.
- Qualitative Data: Interviews and observations were analyzed using thematic coding, identifying patterns and categories that reflected the students' experience and perception of the VLE.

Ethical Considerations

The study ensured compliance with ethical principles, including:

- **Informed consent:** Authorization was obtained from students and their families to participate in the research.
- **Confidentiality:** The personal data of the participants were treated anonymously and confidentially.
- **Voluntariness:** Participation in the study was completely voluntary, and students could withdraw at any time without repercussions.

The methodological design allowed the development and evaluation of a virtual learning environment focused on the needs of students, integrating technological tools to promote reading comprehension. This approach ensured a robust analysis of the results obtained and laid the foundation for future pedagogical applications.

Results

The results of this study reflect the positive impact of the virtual learning environment (VLE) in strengthening reading comprehension in ninth grade students. The findings obtained from the analysis of quantitative and qualitative data are presented below.

Quantitative Results

The scores obtained in the reading comprehension tests before and after the implementation of the VLE showed significant improvements in the three levels evaluated: literal, inferential and critical. The comparison of the results is summarized in the following table:

Table 1. Comparison of Average Reading Comprehension Scores Before and After the VLE

Level of Understanding	Pretest Average	Average Post-Est	Difference	P-Value
Literal	58.2	75.6	+17.4	< 0.01
Inferential	50.8	70.2	+19.4	< 0.01
Critical	45.4	68.5	+23.1	< 0.01

Interpretation of Results

- The literal level showed a significant improvement of +17.4 points, evidencing that the interactive activities facilitated the identification of main ideas and explicit details in the texts.
- The inferential level presented an increase of +19.4 points, highlighting the effectiveness of the exercises designed to promote the deduction of implicit meanings.
- The critical level saw the most progress, with an increase of +23.1 points, suggesting that discussion forums and critical appraisal activities promoted a deeper analysis of the texts.

Statistical analysis with Student's t-tests confirmed that the differences in pre-test and post-test scores were statistically significant ($p < 0.01$), indicating that the VLE had a positive impact on the development of reading skills.

Qualitative Results

Semi-structured interviews and observations conducted during VPA implementation revealed relevant perceptions and experiences of the students:

Motivation and Active Participation

The students stated that the use of interactive resources, such as explanatory videos and dynamic questionnaires, increased their motivation to participate in the activities. In addition, the attractive design of the AVA was valued as a key element in capturing and maintaining their interest.

"I liked the exercises because they were not boring, everything was explained with videos and examples that helped me understand better." (Student 1)

Development of Critical Skills

The discussion activities in the forums allowed students to reflect and analyze the texts worked on in a more in-depth way. This was especially evident at the critical level, where students were able to argue their ideas and assess the author's intent.

"When we discussed in the forum, I learned to see the texts in a different way, like thinking about what the author wanted to say and why he wrote that." (Student 3)

Autonomy in Learning

The students highlighted that the flexibility of the VPA allowed them to work at their own pace, favoring self-evaluation and self-management of their learning process.

"I liked that I could repeat the exercises if I didn't understand something, and that helped me improve." (Student 5)

Remarks

During the virtual sessions, a high level of interaction between students and VLE activities was observed. Participation in the forums and final evaluations showed sustained engagement, with an average of 85% participation in each module. Students with greater initial difficulties managed to make significant progress thanks to the immediate feedback provided by the system.

Quantitative and qualitative data show that the VLE not only facilitated the improvement in reading comprehension levels, but also promoted motivation, active participation and autonomy in learning. These findings confirm the effectiveness of virtual environments as pedagogical tools to promote meaningful learning in contemporary educational contexts.

Discussion

The results obtained in this research highlight the effectiveness of virtual learning environments (VLEs) as pedagogical strategies to strengthen reading comprehension in secondary school students. The combination of interactive activities, technological resources and student-centered pedagogical approaches made it possible to address the challenges associated with traditional teaching, promoting meaningful and motivating learning. The main findings regarding the objectives of the study, previous research, and pedagogical implications are discussed below.

Relationship to the Objectives of the Study

The VPA designed met the objectives set at the beginning of the research:

- Strengthening reading comprehension: Quantitative data reflect significant improvements in literal, inferential and critical levels, demonstrating that the VLE facilitated the development of advanced reading skills. The average increase of more than 20 points in critical scores confirms that the activities designed promoted a deep and thoughtful analysis of the texts.
- Promotion of motivation and autonomy: The qualitative results showed that students not only actively participated in the activities, but also valued the flexibility and personalized feedback offered by the VPA.

Comparison with Previous Research

The findings of this study coincide with previous research that highlights the positive impact of virtual environments on learning. For example:

- Garrison and Vaughan (2008) argued that VLEs promote autonomy and active learning, aspects that were corroborated in this research by looking at how students managed their progress in activities.
- According to Hamari et al. (2014), educational technologies increase student motivation and engagement by offering interactive and dynamic resources. In this study, the attractive design of the VPA and the integration of interactive activities were key elements in capturing students' interest.
- Visual literacy, as proposed by Avgerinou and Pettersson (2011), was essential to the design of the VLE, as audiovisual resources allowed students to interpret and analyze texts in multiple formats.

Pedagogical Implications

The results have important implications for educational practice, highlighting that VLEs can be powerful tools to transform teaching and learning dynamics in the classroom:

- Meaningful learning: The integration of technological resources, such as simulations, videos, and discussion forums, favored the development of critical and reflective skills, overcoming the limitations of traditional methodologies.
- Motivation and personalization: By offering immediate feedback and flexibility in learning, VLEs were able to maintain high levels of participation and engagement, even in students with initial difficulties.
- Replicability and scalability: The VPA proposal can be adapted to different educational contexts and disciplines, reinforcing its potential to be implemented as a generalized strategy in secondary education.

Limitations of the Study

Despite the positive results, this study has certain limitations:

- Sample size: Although the 40 participating students contributed significant data, a larger sample could provide a more generalizable picture.
- Duration of the intervention: The study was conducted over a limited period of time, which made it impossible to assess the long-term impact of the VLE on students' reading skills.

- Technological dependence: The effectiveness of VPA depends on access to adequate technological resources, which could limit its implementation in contexts with significant digital divides.

In summary, the findings of this research confirm that virtual learning environments are effective pedagogical tools to promote reading comprehension in secondary school students. These results not only reinforce the importance of integrating digital technologies into education, but also underscore the need to design innovative strategies that connect with the interests and needs of students in contemporary educational contexts.

Conclusions

This study demonstrates that virtual learning environments (VLEs) are an innovative and effective pedagogical strategy to strengthen reading comprehension in secondary school students. The quantitative and qualitative results show that the integration of interactive resources, dynamic activities and student-centred pedagogical approaches not only improves reading skills, but also fosters motivation, autonomy and meaningful learning.

Main Findings

- Strengthening reading comprehension: The VLEs allowed the development of reading skills at three levels: literal, inferential and critical. The significant increases in the scores obtained before and after the intervention reflect the effectiveness of the designed activities, especially at the critical level, where students demonstrated progress in the evaluation and in-depth analysis of the texts.
- Motivation and engagement: Students rated the interactive design of the VPA positively, highlighting its role in promoting motivation and commitment to learning. The flexibility of the platform and immediate feedback facilitated their active and constant participation in the proposed activities.
- Pedagogical relevance: The participating experts and students agreed that the technological resources and strategies implemented in the VLE were relevant to address the initial difficulties in reading comprehension, demonstrating the viability of the VLE as a replicable educational tool.

Educational Implications

The results of this research underscore the importance of integrating digital technologies into teaching and learning processes, especially in critical areas such as reading comprehension. The design and implementation of virtual environments allows:

- Diversify pedagogical strategies: VPAs offer dynamic and personalized options that go beyond traditional methodologies, catering to the individual needs of students.
- Fostering 21st century skills: By working with digital tools, students not only strengthen reading skills, but also transversal skills such as technological literacy, critical thinking, and collaboration.
- Promoting educational equity: VPAs, when properly designed, can be accessible tools to close learning gaps in different educational contexts.

Limitations and Recommendations

Although the results obtained are encouraging, the study has certain limitations that should be considered for future research:

- Longitudinal assessments: Long-term studies are needed to assess the sustained impact of VLEs on reading skills and overall academic performance.
- Sample expansion: Studies with a larger sample would allow validating the findings and exploring their generalization to other geographical and cultural contexts.
- Technological adaptation: Considering contexts with less access to digital resources is key to ensuring that VPAs are inclusive and applicable in a variety of educational settings.

The VPA designed for this study represents a significant contribution to the field of innovative pedagogical strategies, demonstrating that educational technologies can be powerful tools for transforming learning. This study reinforces the need to adopt integrative approaches that connect students' interests with clear educational objectives, laying the foundations for a more dynamic, meaningful, and inclusive education in the twenty-first century.

References

- Avgerinou, M. D., & Pettersson, R. (2011). Toward a cohesive theory of visual literacy. *Journal of Visual Literacy*, 30(2), 1-19.
- Bruner, J. S. (1996). *The Culture of Education*. Harvard University Press.
- Cassany, D. (2006). *Behind the Lines: On Contemporary Reading*. Editorial Anagrama.
- Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. Harper & Row.
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification". *Proceedings of the 15th International Academic MindTrek Conference*, 9-15.
- Garrison, D. R., & Vaughan, N. D. (2008). *Blended Learning in Higher Education: Framework, Principles, and Guidelines*. Jossey-Bass.
- Gee, J. P. (2003). *What Video Games Have to Teach Us About Learning and Literacy*. Palgrave Macmillan.
- González, C., & Toledo, P. (2019). Audiovisual resources as pedagogical tools in the classroom. *Ibero-American Journal of Education*, 79(2), 45-58.
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification. *47th Hawaii International Conference on System Sciences*, 3025-3034.
- Hernández Sampieri, R., Fernández Collado, C., & Baptista Lucio, P. (2014). *Research Methodology* (6th ed.). McGraw Hill.
- Mayer, R. E. (2009). *Multimedia Learning* (2nd ed.). Cambridge University Press.
- OCDE (2018). *Programme for International Student Assessment (PISA): Results from PISA 2018*. OECD Publishing.
- Pérez, C., & Castejón, J. L. (2017). Emotional intelligence, self-efficacy, and academic achievement: A structural model. *Journal of Educational Psychology*, 109(4), 564-573.
- Piaget, J. (1950). *The Psychology of Intelligence*. Routledge.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.
- Salen, K., & Zimmerman, E. (2004). *Rules of Play: Game Design Fundamentals*. MIT Press.
- Spielberger, C. D., & Vagg, P. R. (1995). *Test Anxiety: Theory, Assessment, and Treatment*. Taylor & Francis.
- UNESCO. (2017). *School violence and bullying: Global status report*. UNESCO.
- Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
- Zichermann, G., & Cunningham, C. (2011). *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*. O'Reilly Media.