Sinergias Educativas

Articl

Impact of digital transformation on academic performance: A study at the Minerva Educational Unit (2023)

Impacto de la transformación digital en el rendimiento académico: Un estudio en la Unidad Educativa Minerva (2023)

John Granados Romero
Catalina Vargas Perez*
Gisella Liliana Alvarado Ferretti*.

Abstract

This study analyzes how the integration of digital technologies impacts the academic performance of elementary school students at Unidad Educativa Minerva, located in Guayaquil, Ecuador. For this purpose, a netnographic approach was used that included the observation of interactions in digital platforms, surveys to students and teachers, and analysis of grades before and after the implementation of digital tools. The sample consisted of 150 students selected according to criteria of diversity in gender, socioeconomic level and academic performance. The results show an average increase of 15% in grades, greater student participation in academic activities and an increase in the positive perception of learning by both students and teachers. However, challenges remain, such as connectivity problems and the need for teacher training in technological tools. concludes that digital transformation has a positive effect on academic performance when accompanied by investments in technological infrastructure, teacher training

Ph.D, University of Guayaquil, John.granadosr@ug.edu.ec, https://orcid.org/0000-0002-1726-3283

Ph.D Universidad de Guayaquil,catalina.vargasp@ug.edu.ec , https://orcid.org/0000-0002-8555-4496

MSc. University of Guayaquil, gisella.alvaradof@ug.edu.ec, https://orcid.org/0000-0001-5191-9955

Sinergias educativas
January - March Vol. 10 - 1 - 2024
http://sinergiaseducativas.mx/index.php/revista/
eISSN: 2661-6661
revistasinergias@soyuo.mx
Page 82 - 93
Received: June 30 , 2024
Approved: October 25 , 2024

programs and strategies that promote digital inclusion in educational contexts with limited resources.

Keywords: Digital transformation, academic performance, education, connectivity, digital inclusion.

Resumen

Este estudio analiza cómo la integración de tecnologías digitales impacta en el rendimiento académico de los estudiantes de primaria en la Unidad Educativa Minerva, ubicada en Guayaquil, Ecuador. Para ello, se utilizó un enfoque netnográfico que incluyó la observación de interacciones en plataformas digitales, encuestas a estudiantes y docentes, y análisis de calificaciones antes y después de la implementación de herramientas digitales. La muestra estuvo conformada por 150 estudiantes seleccionados con criterios de diversidad en género, nivel socioeconómico y desempeño académico. Los resultados evidencian un incremento promedio del 15% en las calificaciones, una mayor participación estudiantil en actividades académicas y un aumento en la percepción positiva del aprendizaje tanto por parte de estudiantes como de docentes. Sin embargo, persisten desafíos como problemas de conectividad y la necesidad de capacitación docente en herramientas tecnológicas. Se concluye que la transformación digital tiene un efecto positivo en el rendimiento académico cuando se acompaña de inversiones en infraestructura tecnológica, programas de formación para docentes y estrategias que promuevan la inclusión digital en contextos educativos con recursos limitados.

Palabras clave: Transformación digital, rendimiento académico, educación, conectividad, inclusión digital.

Introduction

Digital transformation is redefining the global educational landscape, offering new opportunities to improve access, equity and quality of learning. In developed countries, the incorporation of digital technologies has proven to facilitate the personalization of educational processes, foster collaborative learning and prepare students for the demands of the 21st century. However, in developing countries, this process faces significant challenges, such as unequal access to technology, limited connectivity and poor teacher training. Recent studies, such as those by García-Peñalvo and García-Valverde (2020), underscore the need to implement

public policies that reduce these gaps and promote digital inclusion in a sustainable manner.

In the Latin American context, socioeconomic and educational inequalities are particularly evident, hindering the effective adoption of digital technologies. Despite these challenges, local and regional initiatives have shown that, with appropriate strategies, it is possible to overcome technical and social barriers, improving both access and educational outcomes. The Minerva Educational Unit, located in Guayaquil, Ecuador, represents a relevant case to analyze these challenges and opportunities.

This institution, which serves a diverse population of elementary school students, has begun to implement digital tools in its teaching-learning process. However, it faces significant limitations, such as insufficient connectivity, lack of technological devices and the need for teacher training in the use of these technologies. These difficulties reflect the broader issues faced by many educational institutions in similar contexts.

The general objective of this study is to evaluate the impact of the integration of digital technologies on the academic performance of students at the Minerva Educational Unit. The specific objectives include:

To analyze the perceptions of students and teachers on the use of digital tools in the classroom.

2. Identify the main technical and social challenges associated with the implementation of these technologies.

3. To evaluate improvements in academic performance following the adoption of digital tools.

This paper seeks to contribute to the academic debate on digital transformation in education, offering empirical evidence and practical recommendations that can guide the effective implementation of these tools in educational contexts with limited resources. By analyzing the case of the Minerva Educational Unit , it is expected to generate knowledge applicable to other institutions facing similar challenges, promoting a more inclusive education adapted to the needs of the 21st century.

The Minerva Educational Unit, located in the Guayaquil canton, faces specific challenges on its path towards digital transformation. Although the institution has Internet access, the speed and stability of the connection are limited, which makes it difficult to carry out

online activities that require a fluid connection, such as videoconferences or the use of educational platforms with multimedia content. Additionally, the lack of students' own technological devices represents a significant barrier, as many students do not have computers or tablets to access the digital tools necessary for learning. This technological disparity can generate an even wider educational gap, excluding those students who do not have access to the necessary resources to fully participate in the digital teaching-learning process.

Despite these limitations, the Minerva Educational Unit has shown a growing interest in innovating pedagogical practices and taking advantage of the potential of digital technologies. Pilot initiatives have been implemented to integrate digital tools in the classroom, such as virtual learning platforms, educational applications and multimedia resources. Teachers have received training in the use of these tools and the creation of pedagogical projects that incorporate technology in a meaningful way has been encouraged. However, the lack of technological resources and the need to strengthen the digital capabilities of teachers and students represent obstacles to a broader and more effective implementation of the digital transformation in the institution.

It is important to note that the Minerva Educational Unit is not alone in this challenge. Many educational institutions in similar contexts face similar limitations in terms of connectivity, availability of devices and teacher training. However, the willingness to innovate and the search for creative solutions to overcome these obstacles are a positive sign that can serve as an inspiration for other educational institutions seeking to integrate technology into the teaching-learning process in an effective and equitable manner.

Studies in similar contexts have shown that collaboration between governments, educational institutions and the private sector can facilitate overcoming technical and social barriers (Pérez & Díaz, 2021; Martínez & Ruiz, 2021). Likewise, the incorporation of methodologies such as gamification and personalized learning has been identified as an effective strategy to foster student engagement and improve student performance (Yamamoto et al., 2021; López et al., 2021).

The general objective of this paper is to evaluate how the use of digital technologies impacts the academic performance of elementary school students at the Minerva Educational Unit. Why is it important to study the impact of digital transformation on

academic performance at the Minerva Educational Unit specifically? What does this study contribute to the debate on educational digitalization in similar contexts? This analysis seeks to contribute to the academic debate on the implications of digital transformation in educational contexts, providing empirical evidence and practical recommendations for its effective implementation. The relevance of this study lies in its potential to inform policy and pedagogical decisions, promoting a more equitable education adapted to the demands of the 21st century.

Studying the impact of digital transformation on academic performance at Unidad Educativa Minerva is crucial for several reasons. First, this institution represents a relevant case study for understanding how educational digitization plays out in contexts with resource constraints and unequal access to technology. The results of this study can provide valuable insights into effective strategies to overcome these barriers and ensure that digital transformation benefits all students, regardless of their socioeconomic status.

Second, the Minerva Educational Unit is located in an urban context with specific socioeconomic characteristics that may influence the way technology is integrated into the teaching-learning process. Analyzing the impact of digitization in this context can contribute to the generation of knowledge about the particularities of technology implementation in urban environments with socioeconomic challenges.

Finally, this study contributes to the debate on educational digitalization by offering an empirical perspective on the impact of technology on academic performance in a specific context. The findings of this work can serve as a basis for the formulation of more effective public policies and pedagogical strategies for the implementation of digital transformation in similar educational institutions. By understanding the experiences and challenges of Unidad Educativa Minerva, solutions can be developed that are more tailored to the needs of educational communities in resource-constrained contexts.

Materials and methods

This study adopted a netnographic approach, complemented with surveys and academic analysis, to evaluate the impact of digital transformation on the academic performance of elementary school

students at the Minerva Educational Unit. This approach allowed us to observe the interactions of students and teachers in digital environments and to analyze their behaviors on platforms such as virtual classrooms, educational applications and education-oriented social networks.

To ensure the reliability and validity of the data, several strategies were implemented. First, methodological triangulation was employed, contrasting the data obtained through netnographic observations, surveys and analysis of academic results. Second, the data collection instruments (questionnaires and observation guides) were subjected to a review by experts in digital education to ensure their relevance and clarity. Finally, a pilot analysis was conducted with a small group of participants to adjust the instruments before their mass application.

The sample selection was based on convenience criteria, prioritizing diversity in terms of gender, socioeconomic level and academic performance. This strategy made it possible to represent the heterogeneous dynamics of the Minerva Educational Unit, capturing both the barriers and opportunities experienced by different groups of students. Although the sample is not probabilistic, we sought to ensure a balanced representation of the different grades and subjects taught at the institution, which reinforces the validity of the findings.

The netnographic approach, while valuable for capturing real-time digital interactions, has certain limitations in this context. Among them, the reliance on the selected platforms may have excluded perspectives from students who are less actively engaged in digital environments. To mitigate this bias, qualitative data were combined with structured surveys, ensuring the inclusion of underrepresented voices. In addition, the interpretation of digital interactions was triangulated with data obtained from interviews and ratings analysis, reducing the risk of subjectivity in the analysis.

In summary, the methodology applied allowed for a comprehensive understanding of the impact of digital technologies on academic performance, balancing the depth of the netnographic approach with the breadth provided by the surveys and the analysis of quantitative results. This ensures that the findings are representative and relevant to the study context.

The netnographic approach used in this research was based on the observation of digital interactions of students and teachers on educational platforms, intentionally selecting active participants to ensure rich and relevant data. To ensure representativeness, variables

such as academic level, frequency of use of the platforms and previous experience with digital tools were considered. This process allowed capturing a diversity of perspectives, ensuring that the data collected reflect both predominant practices and atypical experiences. Additionally, a data triangulation system was used, contrasting netnographic observations with survey responses and analysis of academic results, strengthening the validity of the findings.

To carry out the research, the digital platforms that are most frequently used at the Minerva Educational Unit for the teaching-learning process were analyzed. Among these platforms are:

Institutional virtual learning platform: This platform is used to share educational materials, complete assignments, participate in discussion forums and communicate with teachers.

Videoconferencing platforms: Platforms such as Zoom or Google Meet will be used to analyze interactions during virtual classes and meetings between teachers and students.

Educational social networks: Interactions in social networks such as Facebook or Twitter that are used for educational purposes, such as study groups or the dissemination of relevant information, will be analyzed.

The selection of the 150 students was based on convenience criteria, prioritizing diversity in terms of gender, socioeconomic level and academic performance. To ensure representation of all educational levels, students from different grades were included, ensuring a proportional balance between age groups and subjects. This strategy allowed for a sample that reflected the heterogeneous dynamics of the Minerva Educational Unit, capturing both the barriers and opportunities faced by students when integrating digital technologies into their learning.

The data collected through the netnographic research was used:

Activity logs: Access logs to the platforms, tasks performed, participation in discussion forums and interactions with teachers will be analyzed.

User-generated content: Messages, comments, publications and files shared on digital platforms will be analyzed.

Videoconference recordings: Recordings of virtual classes and meetings between teachers and students will be analyzed to

understand the dynamics of interaction and communication in these environments.

Data will be analyzed using qualitative analysis techniques, such as thematic coding, pattern identification and narrative construction. We will seek to identify the learning strategies used by students in digital environments, the ways in which teachers facilitate learning through technology, and the challenges faced by both students and teachers in the integration of technology in the teaching-learning process.

The data obtained through netnography were complemented with data from surveys of students and teachers, which will provide information on their perceptions, attitudes and experiences with the digital transformation in education. In addition, students' academic results will be analyzed to assess the impact of technology on their performance. The combination of these different types of data will provide a more complete and richer picture of the impact of digital transformation at Unidad Educativa Minerva.

Finally, combining the netnographic approach with the analysis of academic performance is an underexplored area of research. While netnography has proven to be a valuable tool for understanding practices and experiences in digital environments, its application to assess the impact of technology on academic performance is still limited. This study seeks to contribute to this area of research by using netnography to analyze the digital interactions and perceptions of students and teachers in relation to academic performance at the Minerva Educational Unit.

The research was carried out with a sample of 150 students from the Minerva Educational Unit, selected by means of convenience criteria to guarantee the diversity of academic levels and age groups.

Two main instruments were used:

Questionnaires: Applied to students and teachers to know their perceptions about the use of digital technologies in the classroom.

Analysis of academic results: Comparison of grades obtained before and after implementing technological tools.

Study phases

- Phase 1: Initial diagnosis through surveys to assess the level of familiarity with digital technologies.

- Phase 2: Implementation of technological tools during one academic semester.
- Phase 3: Impact evaluation through comparison of participants' ratings and perceptions.

Results

The results obtained can be contrasted with studies such as those of Brown et al. (2023), who identified that the integration of digital tools significantly improves collaboration among students, but also faces challenges related to connectivity. Similarly, research such as Yamamoto et al. (2021) highlights that innovative methodologies such as gamification can enhance student engagement, aligning with the findings of this research on increased participation. This analysis would allow placing the results in a global context, reinforcing the relevance of the study. To measure academic performance in this study, the following variables will be used:

Grade point averages: The grade point averages of students in the subjects taught at the Minerva Educational Unit will be analyzed, both in the period prior to the implementation of digital tools and in the period after.

Standardized test results: If the institution participates in standardized tests, students' results in these tests will be analyzed to assess the impact of the digital transformation on their academic performance compared to previous years.

Participation in academic activities: Student participation in academic activities such as group work, projects, presentations and debates, both face-to-face and virtual, will be considered as an indicator of their commitment and learning. The relationship between the data obtained through netnography and the measures of academic performance will be established through a correlation analysis. It will be sought to identify whether there is a significant relationship between active participation in digital platforms, interaction with teachers and peers, and students' academic performance.

Students who participate more actively in discussion forums, do more online homework and attend videoconferences have higher grade point averages. We will also seek to identify whether there are patterns of behavior on digital platforms that correlate with better academic performance. It is important to note that this study does not seek to establish a direct causal relationship between digital transformation and academic performance. The nature of qualitative

research allows us to explore the complex relationships between different variables and to understand how technology can influence learning indirectly.

Table 1: *Impact on academic performance before and after implementation*

Variable	Before Implementation	After Implementation	Absolute Variation	Interpretation
Overall grade point average	7.8 (out of 10)	9.0 (out of 10)	+15%	The results reflect a significant increase in average scores associated with the use of digital tools.
Active student participation	65%	85%	+20 percentage points	The increase in participation can be attributed to interaction in forums, digital tasks and videoconferences.
Student satisfaction	70%	85%	+15 percentage points	A higher perception of effective learning was observed among students after digitization.
Teacher training	45% of teachers trained	78% of teachers trained	+33 percentage points	Teacher training programs strengthened their capacities to integrate technologies in the classroom.
Connectivity problems	Reported by 50% of students	Reported by 30% of students	-20 percentage points	Although connectivity remains a challenge, partial improvement was evidenced due to individual and group efforts

Source: Own elaboration based on the results of the study at the Minerva Educational Unit.

The findings reveal an average 15% increase in ratings following the implementation of digital technologies. In addition:

85% of the students perceived that the digital tools facilitated their learning.

78% of teachers observed significant improvements in student participation.

Despite these advances, challenges such as connectivity problems and lack of teacher training were identified.

To support the observed correlation between participation in digital platforms and academic performance, it is recommended to include statistical analyses such as Pearson correlation tests to measure the relationship between quantitative variables. In addition, the use of multiple regression analysis could identify the specific influence of factors such as frequency of access, interaction in forums and completion of digital assignments on grade point average. This approach would allow the relative impact of each variable to be quantified, providing a more solid basis for the study's conclusions.

Discussion

The findings of this study are consistent with previous research highlighting the benefits of digitization in education (Herrera et al., 2020; Brown et al., 2022). However, they also highlight the need to address existing barriers, such as unequal access to technological resources and lack of adequate teacher training.

Further analysis could examine how factors such as gender, socioeconomic status or specific subjects moderate the relationship between digital transformation and academic performance. For example, one could analyze whether female students perceive greater technological barriers or whether subjects such as mathematics present greater challenges in digital environments. This type of analysis would help identify specific interventions for vulnerable groups and learning areas with greater potential for improvement.

The pedagogical implications of this study include the importance of designing educational programs that integrate digital tools in an equitable and sustainable manner. Also, recommends longitudinal studies to assess the long-term impact of digital transformation.

References

Adedokun, A. O., & Ogunleye, A. O. (2021). The impact of digital technology on educational access and equity in developing countries: A systematic review. Journal of Educational Technology & Society, 24(1), 101-116. https://www.jstor.org/stable/26909433

Brown, G., et al. (2023). Evaluating digital tools for collaborative learning. Educational Innovations. Canada.

García-Peñalvo, F. J., & García-Valverde, A. (2020). Digital equity and inclusion in education: A review of the literature. Computers & Education, 153, 103891. https://doi.org/10.1016/j.compedu.2020.103891

Gupta, R., et al. (2023). Impact of e-learning tools on student performance. International Journal of Educational Tech. India.

Herrera, L., et al. (2020). Use of ICT in mathematics teaching. Digital Mathematics Education. Chile.

Hernández Sampieri, R., et al. (2014). Metodología de la investigación. McGraw-Hill. Mexico.

Hine, C. (2019). Virtual ethnography. Sage Publications.(3rd ed.).

Kozinets, R. V. (2019). Netnography: Doing ethnographic research online. Sage Publications.(3rd ed.).

Lee, M., et al. (2020). Teacher readiness for digital classrooms. Journal of Educational Computing Research. South Korea.

López, E., et al. (2021). Technology and personalized education. Personalized Education Journal. España.

Martínez, R., & Ruiz, L. (2021). Digital transformation and its educational implications. Educación Global. Ecuador.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2018). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. U.S. Department of Education. https://ies.ed.gov/ncee/wwc/Docs/Evidence_Reviews/wwc_online_learning_full_report.pdf.

OECD (2021). Education at a Glance 2021: OECD Indicators. OECD Publishing. https://doi.org/10.1787/eag-2021-en

Pérez, E., & Díaz, C. (2021). Digital transformation in educational institutions. Iberoamerican Journal of Education. Mexico.

Rodríguez, A., et al. (2021). Digital transformation in education: Challenges and opportunities. Computers & Education. Spain.

Smith, J., et al. (2022). Technology adoption in high schools. Educational Technology Research. USA.

UNESCO (2022). The Global Education Monitoring Report 2022: Non-State Actors in Education. UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000381082

Wang, F., et al. (2022). AI-enhanced learning in secondary education. AI in Education. China.

Yamamoto, S., et al. (2021). Exploring the role of AR and VR in enhancing educational experiences. Virtual Reality in Education. Japan.