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Original article

Analysis of the effect of microlearning on the academic performance of students at the "Edwin Mendoza" Educational Unit

Análisis del efecto del microaprendizaje en el desempeño académico de los estudiantes de la Unidad Educativa "Edwin Mendoza"

Análise do efeito da microaprendizagem no desempenho acadêmico dos alunos da Unidade Educacional "Edwin Mendoza"

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ABSTRACT

The research was conducted at the "Edwin Mendoza" Educational Unit, where problems in students' academic performance were detected. The objective of this study was to present an analysis of the effect of microlearning on the academic performance of ninth-grade students. The methodology used in this study was quantitative, with an experimental design. Microlearning was implemented through brief interactive online sessions focused on specific topics and adapted to each student's learning pace. These sessions included short videos, gamification activities, and immediate feedback questionnaires. The process was coordinated as follows: first, the instruments to be administered were designed and developed. Once these were developed, the initial survey was administered. Interactive online sessions were then prepared to be administered through microlearning sessions for the experimental group. The control group followed the traditional curriculum. A satisfaction

survey was then administered to the experimental group in order to present an analysis of the effects of microlearning on the academic performance of students at the "Edwin Mendoza" Educational Unit. The results revealed that students who participated in the microlearning program showed a significant increase in their academic grades compared to the control group. Participants also reported greater satisfaction and engagement with learning activities compared to traditional methods. In conclusion, the study supported the effectiveness of microlearning as an innovative pedagogical strategy to improve academic performance, knowledge retention, and student motivation in educational settings such as the "Edwin Mendoza" Educational Unit.

Keywords: school monitoring; microlearning; academic performance.

RESUMEN

La investigación se realizó en la Unidad Educativa "Edwin Mendoza", donde se detectaron problemas en el desempeño académico de los estudiantes. El objetivo de este estudio fue presentar un análisis del efecto del microaprendizaje en el desempeño académico de los estudiantes de noveno año básico. La metodología que posee el presente trabajo fue de tipo cuantitativo, con diseño experimental. El microaprendizaje se implementó a través de breves sesiones interactivas en línea, enfocadas en temas específicos y adaptadas al ritmo de aprendizaje de cada estudiante. Estas sesiones incluyeron videos cortos, actividades de gamificación y cuestionarios de retroalimentación inmediata. El proceso fue coordinado de la siguiente manera: en primer momento se diseñaron y elaboraron los instrumentos a aplicar. Una vez elaborados se procedió a la aplicación de la encuesta inicial. Luego se procedió a la preparación de sesiones interactivas en línea para ser aplicadas mediante sesiones de microaprendizaje al grupo experimental. El grupo de control siguió el currículo tradicional. Seguidamente, se aplicó la encuesta de satisfacción al grupo experimental con la finalidad de presentar un análisis de los efectos del microaprendizaje en el desempeño académico de los estudiantes de la Unidad Educativa "Edwin Mendoza". Los resultados revelaron que los estudiantes que participaron en el programa de microaprendizaje mostraron un aumento significativo en sus calificaciones académicas, en comparación con el grupo de control. Los participantes también reportaron una mayor satisfacción y compromiso con las actividades de aprendizaje en comparación con métodos tradicionales. En conclusión, el estudio respaldó la eficacia del microaprendizaje como una estrategia pedagógica innovadora para mejorar el desempeño académico, la retención del

conocimiento y la motivación de los estudiantes en entornos educativos como la Unidad Educativa "Edwin Mendoza".

Palabras clave: control escolar; microaprendizaje; rendimiento escolar.

RESUMO

A pesquisa foi realizada na Unidade Educacional "Edwin Mendoza", onde foram detectados problemas no desempenho acadêmico dos alunos. O objetivo deste estudo foi apresentar uma análise do efeito da microaprendizagem no desempenho acadêmico dos alunos do nono ano. A metodologia utilizada neste estudo foi quantitativa, com um projeto experimental. A microaprendizagem foi implementada por meio de sessões on-line curtas e interativas, com foco em tópicos específicos e adaptadas ao ritmo de aprendizagem de cada aluno. Essas sessões incluíram vídeos curtos, atividades de gamificação e questionários com feedback imediato. O processo foi coordenado da seguinte forma: primeiro, os instrumentos a serem aplicados foram projetados e elaborados. Depois que os instrumentos foram desenvolvidos, a pesquisa inicial foi aplicada. Em seguida, procedemos à preparação das sessões interativas on-line a serem aplicadas por meio de sessões de microaprendizagem ao grupo experimental. O grupo de controle seguiu o currículo tradicional. A pesquisa de satisfação foi então aplicada ao grupo experimental para apresentar uma análise dos efeitos da microaprendizagem no desempenho acadêmico dos alunos da Unidade Educacional "Edwin Mendoza". Os resultados revelaram que os alunos que participaram do programa de microaprendizagem apresentaram um aumento significativo em suas notas acadêmicas em comparação com o grupo de controle. Os participantes também relataram maior satisfação e envolvimento com as atividades de aprendizagem em comparação com os métodos tradicionais. Concluindo, o estudo apoiou a eficácia da microaprendizagem como uma estratégia pedagógica inovadora para melhorar o desempenho acadêmico, a retenção de conhecimento e a motivação dos alunos em ambientes educacionais como a Unidad Educativa "Edwin Mendoza".

Palavras-chave: controle escolar; microaprendizagem; desempenho escolar.

INTRODUCTION

In the current educational context, the integration of learning technologies such as microlearning has generated significant interest due to its potential to improve students' academic performance. This study focuses on analyzing the effect of microlearning on the academic performance of students at the "Edwin Mendoza" Educational Unit, using a rigorous approach that combines quantitative analysis.

Microlearning is defined as a learning strategy that delivers information in small, easily digestible content units, designed to be consumed quickly and effectively. This learning modality is especially suited to the needs of the digital age, where brevity and accessibility are key elements for educational success.

On the other hand, the evaluation of academic performance in recent years, from the Third Regional and Comparative Study of the Quality of Education (TERCE), applied by the Latin American Laboratory for the Evaluation of the Quality of Education (LLECE) in 2013, to the results of the Program for International Student Assessment for Development PISA-D, according to the Organization for Economic Cooperation and Development, indicate that in Ecuador in Mathematics, Natural Sciences, Reading and Writing, students are below average, evidencing low academic performance (OECD, 2019).

Academic performance worldwide faces a number of challenges that can affect the quality and equity of education. Some of these issues include:

Inequalities in access to education, although access to education has improved in many parts of the world, there are still significant disparities in terms of access to quality education, especially in rural areas, marginalized communities and developing countries (Schleicher, 2018).

The quality of education can vary widely depending on the country, region, or even the educational institution. Factors such as teacher training, available resources, curriculum, and educational policies influence the quality of learning.

Students' socioeconomic conditions can impact their academic performance. Lack of resources, limited access to basic services such as health and nutrition, and social instability can all affect students' ability to concentrate and learn effectively.

The digital age has brought educational opportunities, but it has also exacerbated digital divides. Students without access to digital technologies or the internet may fall behind in terms of digital skills and access to online educational resources.

Lack of motivation, disinterest in learning, bullying, and other psychosocial factors can contribute to dropping out of school and poor academic performance.

In some educational systems, the pressure to achieve results on standardized tests can lead to teaching focused on memorization and quantitative assessment, rather than on skill development and meaningful learning (Schleicher, 2018).

Traditional educational methods often do not adequately adapt to the individual needs of students, which can result in unaddressed learning difficulties and lower academic performance (Reimers & Schleicher, 2020).

Addressing these problems requires a comprehensive approach that includes effective educational policies, investment in educational resources, teacher professional development, attention to students' socio-emotional needs, and the promotion of inclusive, learning-centered pedagogical practices.

The article is structured around a comprehensive evaluation of microlearning analysis in three main dimensions: students' academic performance, their participation and interaction with microlearning materials, and the perception and satisfaction of both students and teachers regarding this learning modality.

Through the collection and analysis of quantitative data, such as pre- and post-implementation grades and data on participation and performance in related activities, we seek to identify patterns and trends that indicate significant improvements in academic performance. A pre- and post- test will also be conducted to obtain quantitative information on the experience and perceptions of those involved.

It highlights its importance because it provides valuable support to the teacher when teaching their classes, which makes the integration of Information and Communications Technology (ICT) tools essential today to provide understandable and adaptable teaching methods (Merchán, 2024).

For the reasons mentioned above, the objective of this article was to present an analysis of the effect of microlearning on the academic performance of ninth-grade students.

Microlearning

According to Corbeil *et al.* (2021), "microlearning is used in dozens of industries to support a multitude of training applications" (p. 46). Gamification can provide students with better opportunities by developing engagement skills, increasing their motivation and generating more interesting learning moments (Prieto Andreu *et al.*, 2022); on the other hand, Trabaldo *et al.* (2017) state that microlearning methodology are interrelated and brief information units, accessible and focused at any time and place.

Microlearning can be viewed as a single, meaningful, and interactive learning unit that is goal-focused, outcome-based, self-contained, meaningful, and interactive, delivered in bite-sized chunks (i.e., a short modular format) either digitally (i.e., via a computer, tablet, or mobile phone) or non-digitally (i.e., via a flashcard or booklet) (Corbeil *et al.*, 2021). Microlearning refers to a modern educational methodology that integrates information, concepts, and activities tailored to information technology, with the aim of facilitating efficient and rapid learning.

Microlearning allows the generation of short-term content, which makes learning easier to integrate with long-term memory, ensuring effective learning (Trabaldo *et al.*, 2017). Furthermore, the use of technological means to transmit learning through brief and specific content helps to develop skills progressively in a reduced time. Therefore, microlearning is a fast and affordable learning methodology that allows organizing content appropriate to the student's work pace, available online and accessible from any device. On the other hand, a mobile application is a software program that is used to solve one or more specific tasks, they are similar to the well-known word processors, design and video editing programs of desktop computers, having a lower difficulty and optimized for the mobile context (Serna, 2016).

Academic performance

Academic performance, according to Pizarro (1985), as cited in Estrada (2018), defines it as a measure of the responding or indicative capacities that manifest, in an estimative way, what a student has learned as a result of an instruction or training process. On the other hand, Martínez and Otero (2007), as cited in Estrada (2018), conceptualize academic performance as the product that

students give in teaching centers (schools, colleges and universities) and that is usually expressed through school grades. It is the manifestation of the faculties that a student possesses, which is why it serves as a measure to facilitate the evaluation of the quality of the teaching methodology that is being applied by teachers; In addition, it allows us to know the success situation that the student can reach, thanks to the skills that he or she possesses and the capacity that he or she has to develop them in the best way, thus allowing a global visualization of the performance that the students have (Chong González, 2017).

The inadequate application of pedagogical strategies is identified as a determining factor in this problem, as it generates interruptions in the continuity of the teaching-learning process. This situation results in academic burnout syndrome, characterized by a state of physical and mental exhaustion that limits students' analytical and interpretive capacities when assimilating content (Villarruel Meythaler *et al.*, 2020).

MATERIALS AND METHODS

The research adopted a quantitative approach, using quantifiable data. Quantitative studies rely on numerical measurement, counting, and the frequent use of statistics to accurately identify patterns of behavior within a population.

The study population consisted of upper elementary school students; that is, from eighth, ninth, and tenth grades. However, 50 ninth-grade students were selected as a sample. The sampling was non-probability and convenience, as no formula was used to determine the sample. This selection was made for convenience due to ease of access, availability of participants, and the convenience of the researchers.

In quantitative research, it is essential to collect data using various measurement instruments. This data is essential for analysis, as proper research cannot be conducted without it. For this reason, the research focuses on a quantitative approach.

An experimental design was used for this research, due to the need to seek, above all, internal validity. This means ensuring rigor, quality, and reliability in the results obtained. Therefore, the experimental design is considered a reliable and high-quality source of information, having undergone an internal validation process.

Thus, the type of design used in the research is quasi-experimental with equivalent inter-subject groups (control group and experimental group). The sample was selected for convenience due to its accessibility, which is crucial, as the sample must be representative of the population or universe to be evaluated and obtain the necessary information.

The research was developed and carried out with the help of teachers, parents, and authorities, all contributing their part. The goal was to accompany and guide ninth-grade students on their journey. Fifty students participated: 25 from the "A" group, who were the adventurers of the experimental group, and 25 from the "B" group, who remained as the control group. Those in the experimental group tried something different with short microlearning sessions, while those in the control group stuck with the traditional learning method. All of this was done to closely examine how microlearning could boost the academic performance of the students at the Educational Unit.

The process was coordinated as follows: first, the instruments to be applied were designed and developed; once these were developed, the initial survey was administered.

Interactive online sessions were then prepared to be delivered through microlearning sessions to the experimental group. The control group followed the traditional curriculum. The satisfaction survey was then administered to the experimental group in order to present an analysis of the effects of microlearning on the academic performance of students at the "Edwin Mendoza" Educational Unit.

RESULTS

This section presents the results of the initial and final tests administered to assess students' perceptions and satisfaction with microlearning as a learning method. The evaluation sought to identify the degree of acceptance and effectiveness of this methodology, which was characterized by offering content in brief and focused formats, facilitating learning in short periods of time. The data collected provided a clear view of how students perceived this technique in terms of comprehension, retention, and application of the acquired knowledge. Through this analysis, the goal was to establish a solid foundation for future pedagogical interventions that optimize the teaching-learning process at the institution.

The following table shows the results obtained in the initial survey to proceed with their respective analysis.

Table 1. Results of the initial survey directed at ninth-year students in parallel A and B

Question	Answer 1	Answer 2	Frequency 1	Frequency 2
Are you familiar with the concept of microlearning?	YES	NO	10	40
Have you used microlearning as a study method in the last year?	YES	NO	8	42
How effective do you think microlearning is for understanding and remembering the information studied?	EFFECTIVE	NEUTRAL	30	20
What type of content do you prefer to study using microlearning?	VIDEOS	EXERCISES	40	10
Do you think microlearning helps you better organize your study time?	SOMETHING	NOT MUCH	32	18
What aspects of microlearning do you find most beneficial?	ACCESS	FLEXIBILITY	45	5
Have you experienced any difficulties using microlearning?	TECHNICAL PROBLEMS	DEMOTIVATION	43	7
On a scale of 1 to 5, how would you rate your overall satisfaction with microlearning as a study method?	SATISFIED	DISSATISFIED	9	41
Would you recommend microlearning to other students?	YES	MAYBE	40	10
In which subject would you like your teacher to apply microlearning?	MATHEMATICS	LANGUAGE	40	10

The respective analysis of the initial survey results reveals the need to increase dissemination and training on the tool to increase awareness and use. Likewise, the content should be focused on short videos, as these are preferred by students, addressing technical issues to improve effectiveness and overall satisfaction. The time management should also be reviewed and ways to make it more student-friendly should be sought. Access should be emphasized as a key benefit while seeking to improve flexibility.

Below are the results of the satisfaction survey for ninth-year parallel "A" students after using microlearning in the subject of Mathematics (Table 2).

Table 2. Results of the satisfaction survey for ninth-year parallel basic students A

Question	Answer 1	Answer 2	Frequency 1	Frequency 2
Are you familiar with the concept of microlearning?	YES	NO	25	0
Have you used microlearning as a study method in the last year?	YES	NO	25	0
How effective do you think microlearning is for understanding and remembering the information studied?	EFFECTIVE	NEUTRAL	25	0
What type of content do you prefer to study using microlearning?	VIDEOS	EXERCISES	15	10
Do you think microlearning helps you better organize your study time?	SOMETHING	NOT MUCH	23	2
What aspects of microlearning do you find most beneficial?	ACCESS	FLEXIBILITY	15	10
Have you experienced any difficulties using microlearning?	TECHNICAL PROBLEMS	TIME	13	12
On a scale of 1 to 5, how would you rate your overall satisfaction with microlearning as a study method?	SATISFIED	DISSATISFIED	23	2

Would you recommend microlearning to other students?	YES	MAYBE	25	0
In which subject would you like your teacher to apply microlearning?	MATHEMATICS	LANGUAGE	15	10

Since all students were familiar with and used microlearning, it was important to maintain the level of knowledge and utilization. The high perception of effectiveness and satisfaction suggests that the methodology was well received and should continue to be implemented. To achieve this, short videos should be used as the primary format; practical exercises should be included to maintain interest and diversity in the content; the current time structure, which was highly valued by students, should be maintained; rapid access to information should continue to be emphasized and solutions should be sought for technical problems and lack of time, which were the main difficulties; the positive results should be used to promote microlearning in other subjects, especially Mathematics, and its implementation should be considered in Language and Literature.

These findings and recommendations can help optimize the microlearning experience and address identified areas for improvement.

Once the surveys were applied and the results obtained, and from them their respective analysis was carried out, the academic performance of the students who participated in microlearning activities was compared with those who did not (Table 3).

Table 3. Comparison of applied methodologies

Course	Methodology applied	General mathematics general average	Comparison
Ninth "A"	Without microlearning	6.90	Improved the overall average of the course in the subject of Mathematics by 2.10 points
Ninth "A"	With microlearning	9.00	
Ninth "B"	Without microlearning	7.00	Improved the overall average of the course in the subject of Mathematics by 1.00 point
Ninth "B"	With traditional classes	8.00	

Comparing both courses, microlearning in Ninth "A" had a greater positive effect on math results than traditional classes in Ninth "B".

This analysis suggests that microlearning may be a more effective methodology for improving math performance compared to traditional lectures.

DISCUSSION

The implementation of microlearning demonstrated a significant impact on academic performance, offering an educational methodology adapted to the needs and capabilities of contemporary students. Recent studies have highlighted that microlearning, by fragmenting content into manageable and focused units, improves information retention and facilitates the practical application of acquired knowledge (Kapp & Defelice, 2019). This methodology allowed students to participate in shorter but more frequent learning sessions, which resulted in greater absorption of the material and a decrease in the stress associated with traditional teaching methods.

Furthermore, microlearning was effective in fostering student engagement and motivation. The integration of gamification elements and immediate feedback created an interactive and dynamic learning environment that kept students interested and engaged. Additional research suggests that this approach not only improves academic performance but also supports the development of metacognitive skills, as students are required to reflect on their learning and adjust their strategies accordingly (Capuno *et al.,* 2019). Therefore, microlearning represents a powerful tool in the modern educational arsenal, capable of adapting to the demands of 21st-century learning.

The flexibility of microlearning allowed for its adaptation to diverse educational contexts, from primary education to vocational and corporate training. This adaptability was particularly beneficial in blended and remote learning environments, where students could access learning modules at their own pace and availability. Furthermore, the ability to customize content to meet individual students' needs contributed to a more focused and effective learning experience, reflected in substantial improvements in academic performance assessments (Eakman *et al.*, 2019). The inclusion of emerging technologies, such as augmented reality and virtual reality, not only enriched the learning experience but also increased knowledge retention and application in practical contexts.

On the other hand, it was essential to recognize the limitations of microlearning and ensure its proper integration within a broader educational strategy. Although effective for the reinforcement and

application of specific knowledge, microlearning may not be sufficient for the in-depth development of complex competencies that require prolonged and detailed study (Kapp & Defelice, 2019). Therefore, the implementation of microlearning must be carefully planned, ensuring that it is complemented with traditional teaching methods and other forms of instruction to cover all dimensions of learning. Combining microlearning with other educational strategies ensures a balanced approach that maximizes students' potential to achieve their academic and professional goals (Jo Dolasinski & Reynolds, 2023).

Based on the above, it can be stated that the effect of microlearning on students' academic performance was positive, because the implementation of microlearning as an educational strategy proved to be highly effective in improving students' academic performance and engagement. The studies analyzed indicated that fragmenting content into short, focused units facilitates better retention and application of knowledge, while reducing the cognitive load and stress associated with traditional teaching methods (Kapp & Defelice, 2019). However, it is crucial that microlearning be integrated in a complementary manner within a broader learning structure, in order to address all dimensions of students' academic and personal development. The strategic combination of microlearning with other teaching methodologies ensures a balanced and complete education, thus maximizing students' potential for academic and professional success (Jo Dolasinski & Reynolds, 2023; Eakman *et al.*, 2019).

The study results revealed that students who participated in the microlearning program showed a significant increase in their academic grades compared to the control group. Improvement was observed in assessments of knowledge and skills related to the subjects taught.

Microlearning was found to enhance long-term knowledge retention and foster students' autonomy and intrinsic motivation toward learning. Participants also reported greater satisfaction and engagement with learning activities compared to traditional methods.

In conclusion, the study supports the effectiveness of microlearning as an innovative pedagogical strategy to improve academic performance, knowledge retention, and student motivation in educational settings such as the "Edwin Mendoza" Educational Unit.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.