

ORIGINAL

Influence of mobile microlearning on the retention of specialised knowledge in university courses

Influencia del microaprendizaje móvil en la retención de conocimientos especializados en carreras universitarias

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ABSTRACT

The incorporation of mobile technologies in higher education transformed teaching and learning processes, enabling new modalities such as mobile microlearning. This study aimed to determine the influence of mobile microlearning on the retention of specialized knowledge among university students. The research followed a quantitative approach with qualitative elements, based on an empirical, quasi-experimental design, conducted in three Ecuadorian universities: Universidad de las Fuerzas Armadas ESPE, Universidad Agraria del Ecuador, and Universidad de Guayaquil. The sample included 200 students and 30 faculty members. A seven-item questionnaire was administered as a pretest and posttest for students, while semi-structured interviews were conducted with faculty. Pretest results indicated medium or slightly negative levels of knowledge retention through mobile microlearning. Conversely, posttest findings revealed significant improvements, showing highly positive perceptions of comprehension, motivation, and specialized knowledge retention. Faculty interviews confirmed the positive impact of mobile microlearning on student motivation, academic interaction, and digital competence development. In conclusion, mobile microlearning positively influenced the retention of specialized knowledge, establishing itself as an effective, flexible pedagogical strategy aligned with contemporary technological demands in higher education.

Keywords: Mobile Microlearning; Knowledge Retention; Higher Education; Educational Innovation; Educational Technology.

RESUMEN

La incorporación de tecnologías móviles en la educación superior ha transformado los procesos de enseñanza y aprendizaje, permitiendo nuevas modalidades como el microaprendizaje móvil. Este estudio tuvo como objetivo general determinar la influencia del microaprendizaje móvil sobre la retención de conocimientos especializados en estudiantes universitarios. La investigación se desarrolló bajo un enfoque cuantitativo con elementos cualitativos, de tipo empírico y diseño cuasiexperimental, aplicándose en tres universidades ecuatorianas: Universidad de las Fuerzas Armadas ESPE, Universidad Agraria del Ecuador y Universidad de Guayaquil. Participaron 200 estudiantes y 30 docentes. Se utilizó un cuestionario de siete ítems para el pretest y posttest dirigido a los estudiantes, y una entrevista semiestructurada para los docentes.

Los resultados del pretest evidenciaron un nivel medio o ligeramente negativo en la retención de conocimientos mediante el uso del microaprendizaje móvil. Sin embargo, el posttest mostró mejoras significativas, con percepciones altamente positivas en comprensión, motivación y retención del conocimiento especializado. Las entrevistas docentes confirmaron el impacto favorable del microaprendizaje en la motivación estudiantil, la interacción académica y el desarrollo de competencias digitales. En conclusión, el microaprendizaje móvil influyó de manera positiva en la retención de conocimientos especializados, consolidándose como una estrategia pedagógica efectiva, flexible y adaptada a las demandas tecnológicas contemporáneas de la educación superior.

Palabras clave: Microaprendizaje Móvil; Retención del Conocimiento; Educación Superior; Innovación Educativa; Tecnología Educativa.

INTRODUCTION

This study addresses the influence of mobile microlearning on the retention of specialized knowledge in university curricula. It focuses on how short learning formats on mobile devices can affect students' ability to retain information in the short and long term. This topic falls within the field of mobile educational technologies and university learning. It aims to investigate the specific effect of microlearning on the retention of specialized knowledge, an area that has been little explored in the literature.^(1,2)

Over the last decade, mobile learning (m-learning) has gained prominence in higher education, driven by the widespread use of smartphones and tablets among university students. Recent research indicates that students use their mobile devices to access academic resources, search for information, and participate in learning activities.⁽³⁾ In turn, microlearning—short, modular lessons accessed via mobile devices—has emerged as a strategy for adapting to contexts with limited attention spans and high cognitive demands.⁽⁴⁾ Consequently, the combination of mobile learning and microlearning offers an innovative framework for specialized education.

Knowledge retention is one of the most persistent challenges in higher education, especially in disciplines that require highly complex, specialized knowledge. Improving knowledge retention through more effective methods directly impacts future professional performance, technical skills, and the quality of graduates. Several studies show improvements in motivation and engagement when using mobile devices⁽⁵⁾ and demonstrate that microlearning promotes retention by reducing cognitive overload.⁽⁶⁾ Therefore, researching this intersection is critical to designing more effective pedagogical interventions.

However, despite its potential, there are still shortcomings in the implementation of mobile microlearning in higher education for specialized programs. In many contexts, students report low retention rates after traditional intensive courses.⁽⁷⁾ Furthermore, although mobile technology is available, its pedagogical integration and empirical impact on retention remain limited.⁽⁸⁾ This deficiency poses a challenge for institutions and faculty seeking to optimize specialized learning and ensure that knowledge is retained beyond the training phase.

This study adopts a cognitive-constructivist perspective, which views knowledge as an active construction by the student and emphasizes the roles of prior cognitive structure and consolidation processes. It also incorporates cognitive load theory, which posits that instructional design should minimize extrinsic loads and optimize intrinsic loads to improve learning.⁽⁹⁾ From this perspective, mobile microlearning is conceived as a strategy to facilitate the management of cognitive load and promote the construction and consolidation of specialized knowledge.

Within the framework of cognitive-constructivist theory and cognitive load theory, the following key principles emerge: a) meaningful learning, in which new knowledge is based on the student's prior knowledge; b) fragmentation and segmentation of content to facilitate cognitive processing, reducing extrinsic load; c) distributed practice and spaced repetition to promote transfer to long-term memory; and d) self-paced learning, which allows students to manage their own pace, primarily through mobile devices. These principles guide the design of mobile microlearning to maximize retention.

Several studies have explored the impact of mobile learning in higher education. For example, a systematic review of 161 articles found that mobile learning promotes collaboration, accessibility, and self-assessment among university students.⁽¹⁰⁾ Another empirical study, conducted by a university in Ghana, examined the use of mobile devices in higher education and found that infrastructure and user experience influence the effectiveness of mobile learning.⁽¹¹⁾ This research highlights the relevance and challenges of mobile learning in the university setting.

On the other hand, in the field of microlearning, studies indicate that presenting content in short modules improves retention and reduces cognitive fatigue.⁽¹²⁾ Similarly, a systematic review of microlearning in adult learning environments found that this modality promotes knowledge and skill acquisition, although studies in specialized university settings remain scarce.⁽¹⁰⁾ This context underscores the need to investigate how mobile

microlearning works specifically in university programs.

For example, the use of gamified mobile apps has been documented to increase student engagement and academic retention in a university experiment.⁽¹³⁾ Similarly, reviews of microlearning indicate that short modules can counteract Hermann Ebbinghaus's forgetting curve by enabling regular repetition and mobile accessibility.⁽¹⁴⁾ These findings demonstrate that both mobile technology and content segmentation can improve learning outcomes.

In another study, mobile learning among college students was found to be associated with frequent smartphone use for academic activities and students' perceptions that these devices support their education.^(15,16) Furthermore, a review of microlearning in university settings identified that brief, repetitive instructional design promotes student self-regulation and long-term knowledge retention.^(17,18) This evidence supports the hypothesis that integrating mobile microlearning may be particularly relevant in specialized university studies.

This study contributes to existing knowledge by focusing specifically on specialized university programs and medium-term knowledge retention, a relatively unexplored area. Unlike most previous research, which focused on general contexts or introductory courses, this study considers mobile microlearning as the main variable and specialized knowledge retention as the primary outcome. This broadens the generalization of the effects of mobile microlearning in advanced higher education.

Furthermore, this work proposes an empirical design with quantitative measurement of specialized knowledge retention, contributing to methodological rigor in the field of mobile learning and microlearning research. Likewise, by considering the contextual variables of university programs (e.g., content specialization, exposure time, mobile devices), the study seeks to generate evidence applicable to real university contexts. Therefore, this study fills a gap in the literature by combining mobile microlearning with retention in specialized university learning.

The research question can be formulated as follows: To what extent does mobile microlearning influence the retention of specialized knowledge in university students? Therefore, the overall objective of this study is to determine the influence of mobile microlearning on the retention of specialized knowledge in university students. Implementing a mobile microlearning program significantly increases specialized knowledge retention among university students compared to traditional teaching methods.

This study has implications for instructional design, curriculum planning, and educational policy in higher education, as it allows for the evaluation of the impact of mobile and modular interventions in specialized fields of study. The findings can guide faculty and administrators in selecting and designing effective teaching strategies to improve knowledge retention, reduce obsolescence, and increase graduate employability. In addition, it provides empirical evidence in an emerging field that combines technology, microlearning, and higher education.

METHOD

Study design and type

This study adopted a non-experimental, cross-sectional, correlational design with a mixed-methods (quantitative-qualitative) approach to analyze the influence of mobile microlearning on the retention of specialized knowledge among university students. The quantitative approach was used to measure the relationship between mobile microlearning use and knowledge retention. In contrast, the qualitative approach was used to understand faculty perceptions of the effectiveness and applicability of this pedagogical strategy in the university setting.

Study context

The research was conducted at three Ecuadorian universities: the University of the Armed Forces (ESPE), the Agrarian University of Ecuador, and the University of Guayaquil. These institutions were selected because they represent various disciplinary fields—technology, agriculture, and social sciences—and because they have sufficient technological infrastructure to implement mobile microlearning activities. The fieldwork was carried out during the second academic semester of 2025.

Population and sample

The total population consisted of students and teachers from undergraduate and graduate programs in specialized areas.

The sample was a non-probabilistic purposive sample of 200 students and 30 teachers, distributed as follows: 70 students and 10 teachers from ESPE University, 60 students and 10 teachers from the University of Agriculture, and 70 students and 10 teachers from the University of Guayaquil. The selection was based on willingness to participate, access to mobile devices, and previous experience in virtual learning environments.

Data collection instruments

Two instruments designed to collect both quantitative and qualitative data were used:

Student questionnaire: consisting of seven structured questions with a five-point Likert scale (1 = Strongly

disagree; 5 = Strongly agree). The questions assessed:

1. Frequency of mobile microlearning use.
2. Accessibility of content from mobile devices.
3. Level of comprehension and retention of specialized content.
4. Perception of the usefulness of microlearning.
5. Motivation and satisfaction with the methodology.
6. Comparison with traditional methods.
7. Self-perception of improvement in knowledge retention.

Semi-structured interview for teachers: consisting of five open-ended questions aimed at exploring experiences, perceptions, and teaching strategies related to the use of mobile microlearning. Topics covered included microcontent design, teacher-student interaction, technological limitations, and observation of academic performance after implementation.

Validation of instruments

The instruments were validated by a team of three experts, all teachers specializing in higher education and educational technology, who evaluated the clarity, relevance, and consistency of the items. Subsequently, a pilot test was conducted with 20 students and three teachers to determine its reliability using Cronbach's alpha. A value of $\alpha = 0,87$ was obtained, indicating high internal consistency of the questionnaire.

Data Collection Procedure

The questionnaire was administered virtually using online forms distributed to students at the three universities. Participants were informed of the study's objectives and gave voluntary consent to participate. Simultaneously, interviews with teachers were conducted via videoconference and recorded with their prior authorization. The collected data were stored anonymously in an encrypted database for further analysis.

Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics v.27 software. Descriptive statistics (mean, standard deviation, frequency) and inferential tests were applied: Pearson's correlation coefficient to assess the relationship between mobile microlearning use and knowledge retention, and simple linear regression to estimate the magnitude of the influence.

Qualitative interviews were analyzed using thematic content analysis, identifying emerging categories related to perceptions, obstacles, and benefits for teachers.

Ethical considerations

The study adhered to the ethical principles of educational research: informed consent, confidentiality, voluntariness, and anonymity. Participants were informed about the study objectives and the academic use of the information. The research was approved by the Research Ethics Committee of the Armed Forces University (ESPE), ensuring compliance with scientific integrity standards and the rights of participants.

RESULTS

This section presents the results of applying the proposed methodological design to determine the influence of mobile microlearning on the retention of specialized knowledge among university students. The data were organized into pretest and posttest phases, allowing comparisons of perceptions, use, and retention before and after the pedagogical intervention. The analysis considers response frequencies and percentages, as well as the evolution of trends among participating students and teachers.

Pretest results

In the diagnostic or pretest phase, students' initial perceptions of mobile microlearning and its relationship to the retention of specialized knowledge were assessed. This information gathering allowed us to identify the level of familiarity and frequency of use of microcontent before the implementation of the teaching strategy. The results indicate a moderate or slightly negative trend in the assessment of mobile microlearning's benefits, underscoring the need to strengthen its pedagogical integration in the university environment.

The pretest analysis shows a moderately low initial perception of the use and effectiveness of mobile microlearning among participating university students. The percentages obtained indicate that only 35 % frequently use microcontent on their mobile phones, and 27,5 % report that they retain information better when using this methodology. Although 40 % report easy access to resources, the results reflect limited technological and pedagogical appropriation of microlearning. Overall, the data suggest that, before the intervention, students have partial knowledge and cautious attitudes toward mobile learning, which justifies

the implementation of training strategies to strengthen its effectiveness and academic acceptance.

No.	Questionnaire item	Quantity (n)	Percentage	Cumulative percentage (%)
1	I use educational microcontent on my cell phone.	70	35,0	35,0
2	I can easily access learning materials from my mobile device.	80	40,0	75,0
3	Short content helps me better understand specialized topics.	65	32,5	107,5
4	I retain information better when I study using mobile microlearning.	55	27,5	135,0
5	Using mobile microlearning increases my motivation to learn.	60	30,0	165,0
6	I believe that microlearning is more effective than traditional classes.	50	25,0	190,0
7	I would like teachers to incorporate more microcontent into specialized subjects.	75	37,5	227,5
Total	—	200	100,0	—

Post-test results

After implementing the pedagogical strategy based on mobile microlearning, a post-test was conducted to assess changes in university students' perceptions and retention of specialized knowledge. The results show a significant improvement in accessibility, comprehension, motivation, and knowledge retention. Most participants expressed a positive assessment of mobile microlearning's usefulness, confirming its potential as an innovative academic support tool in Ecuadorian university settings.

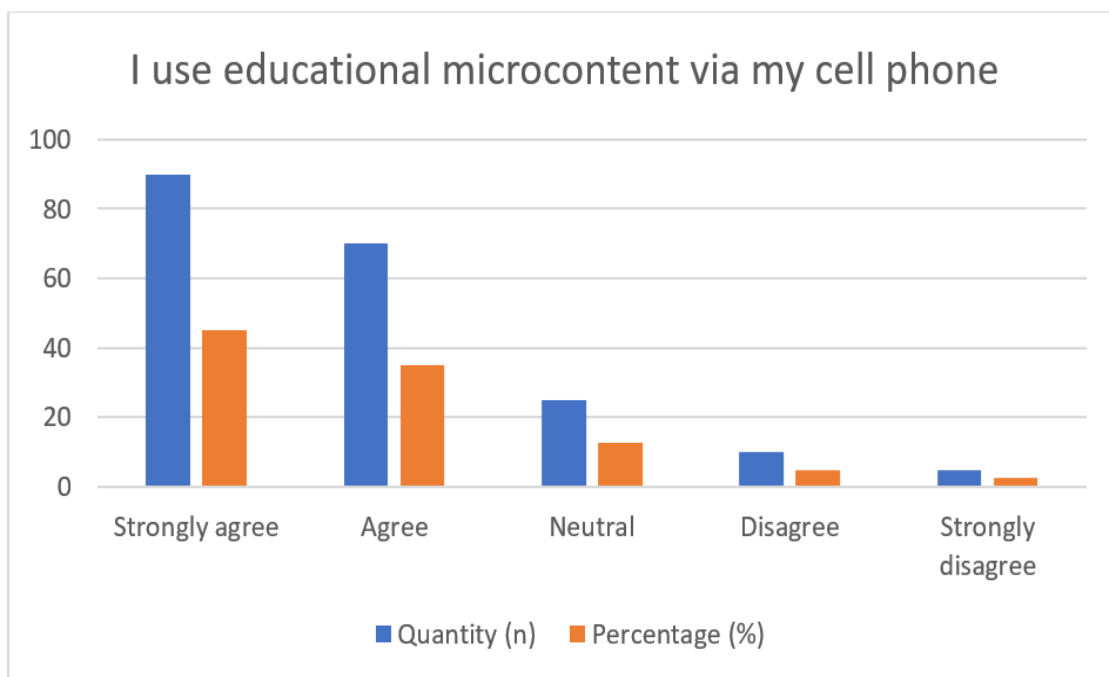


Figure 1. Level of use of educational microcontent via mobile phone among university students after the implementation of mobile microlearning

The results reflect a largely positive adoption of mobile microlearning after the intervention. Eighty percent of students indicated that they frequently use microcontent via mobile phone, compared to 7,5 % who still show resistance. This change shows a significant evolution compared to the pretest, where only 35 % reported active use. There is greater integration of mobile learning into academic routines and a more favorable attitude toward the use of short digital resources, confirming the effectiveness of the program implemented.

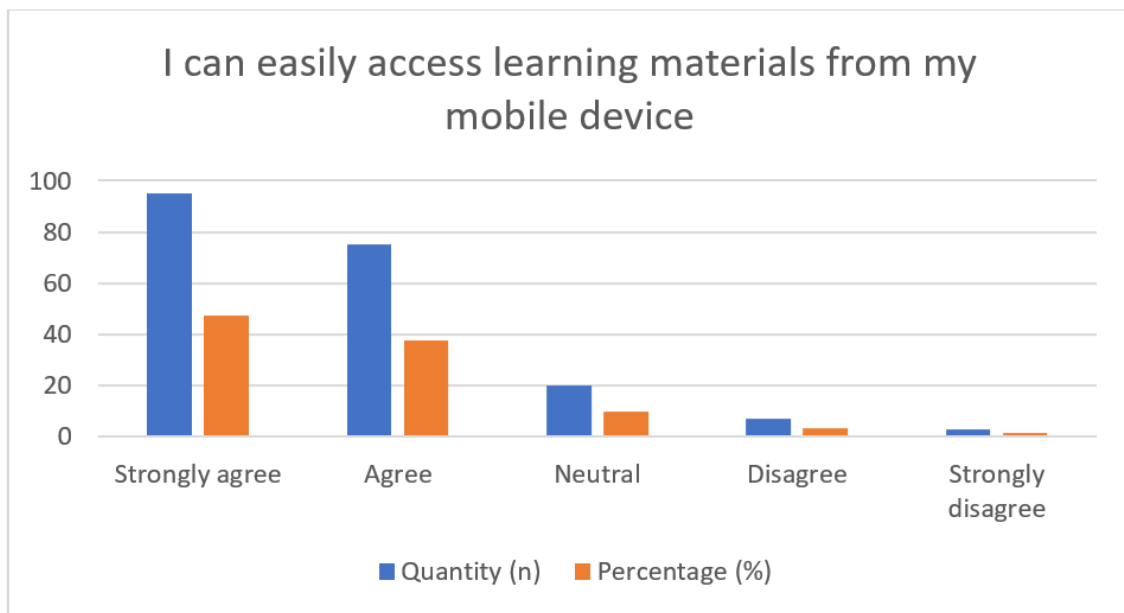


Figure 2. Ease of access to learning material from mobile devices after the educational intervention

The 85 % of students reported having smooth and constant access to educational content from their mobile devices. This result demonstrates better technological adaptation and digital infrastructure after the use of mobile microlearning. Easy and continuous access strengthened learning autonomy and self-management. In addition, the decrease in the percentage of disagreement (from a cumulative 60 % in the pretest to only 5 %) suggests a direct impact of the intervention on the elimination of technological barriers and the consolidation of an academic digital culture.

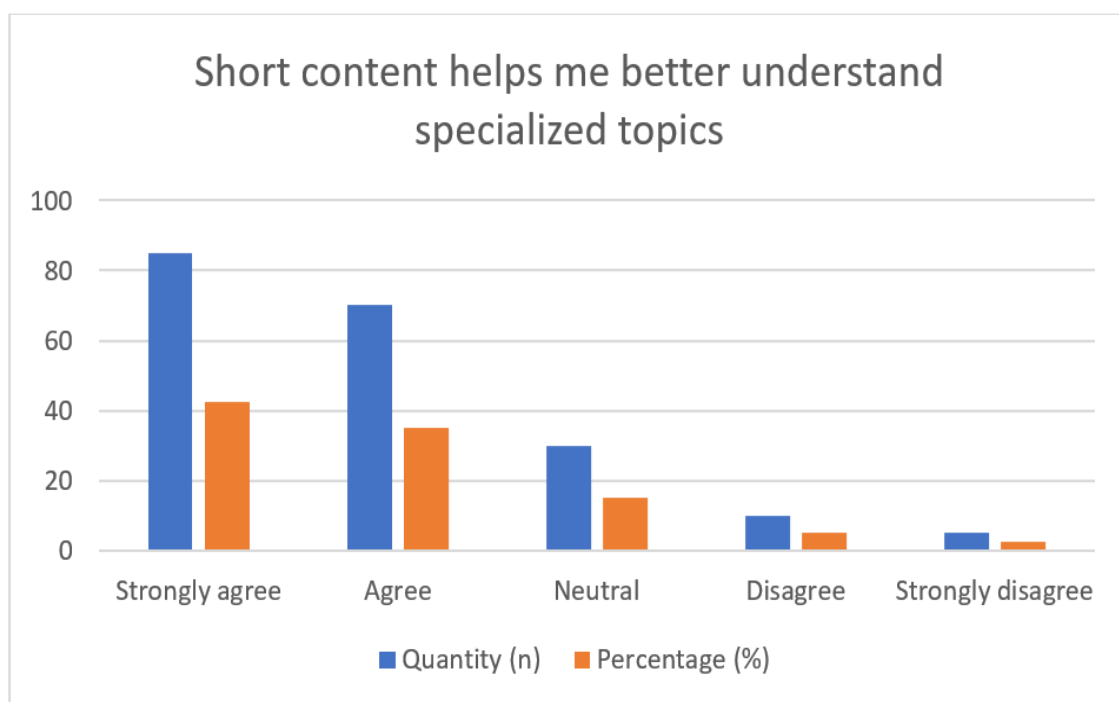


Figure 3. Perception of the usefulness of short content for understanding specialized topics

The 77,5 % of students believe that microcontent facilitated their understanding of complex or specialized topics. This result indicates that content segmentation and modular presentation were effective in reducing cognitive load and improving conceptual assimilation. Compared to the pretest (32,5 %), the increase exceeds 45 %, reflecting the pedagogical effectiveness of microlearning in university contexts. Students positively rated the clarity, brevity, and interactivity of the format, factors that contributed to increased retention and meaningful comprehension.

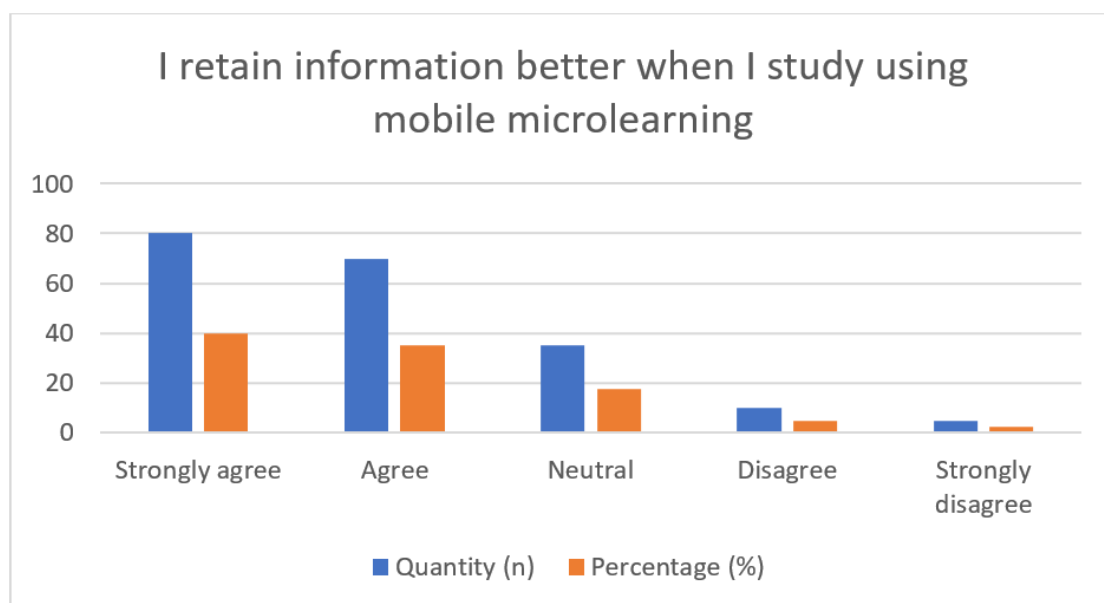


Figure 4. Level of information retention when studying using mobile microlearning strategies

Seventy-five percent of participants reported improved retention when using mobile microlearning. This contrasts sharply with the 27,5 % reported in the pretest, demonstrating a substantial change. The use of short, repetitive microcontent accessible from mobile devices seems to have favored long-term memory consolidation and the comprehension of complex concepts. The consistency between comprehension and retention indicates that the instructional design implemented complied with the principles of cognitive load theory and meaningful learning.

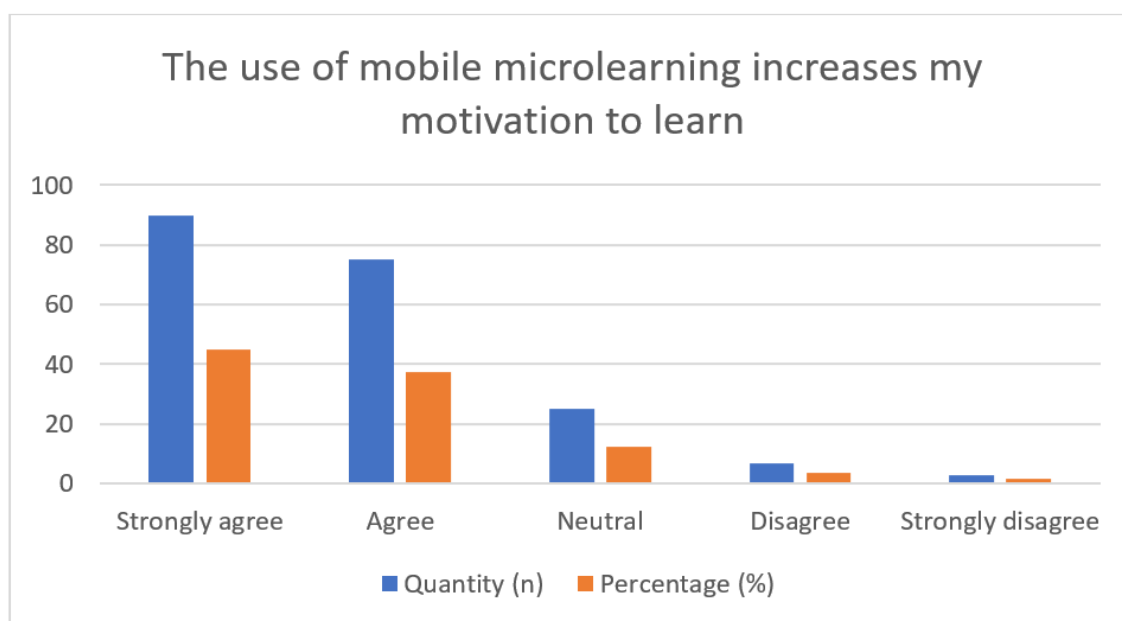


Figure 5. Increase in student motivation through the use of mobile microlearning

The level of motivation showed a notable increase: 82,5 % of students felt more motivated to learn through mobile microlearning. This increase of more than 50 % compared to the pretest suggests that the methodology contributed to generating interest, participation, and academic satisfaction. The possibility of learning at their own pace, from anywhere, and with visually appealing resources had a positive impact on the perception of the learning process. These findings confirm that mobile microlearning not only improves retention but also student self-efficacy and engagement.

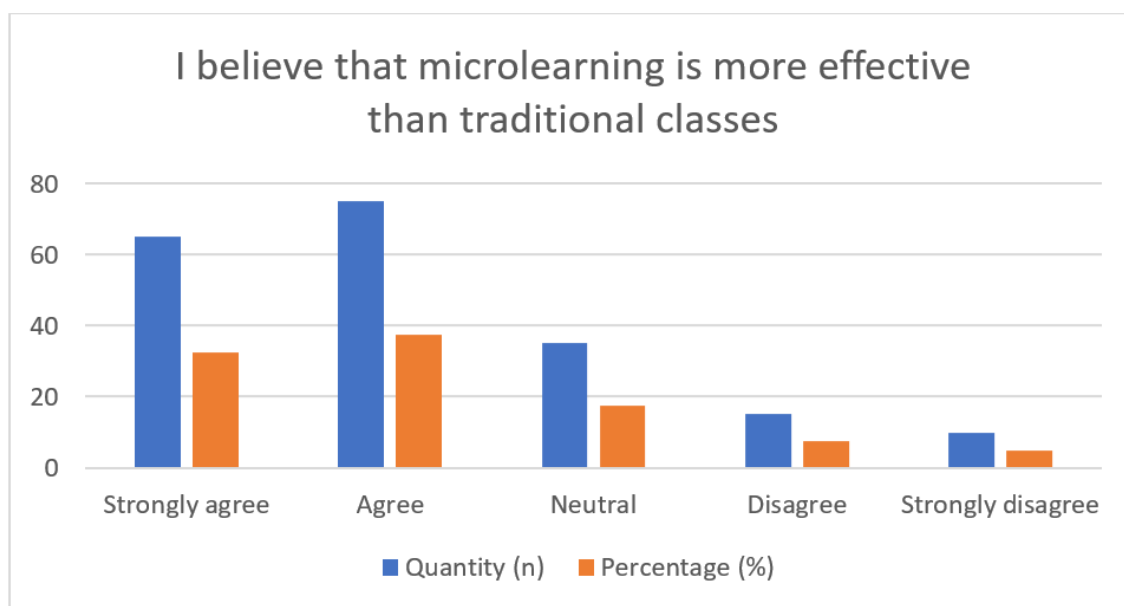


Figure 6. Comparison of perceived effectiveness between mobile microlearning and traditional classes

The 70 % of students perceive mobile microlearning to be more effective than traditional teaching, which shows a substantial change in attitude towards conventional methods. Although 12,5 % still prefer long face-to-face classes, the majority value the flexibility, dynamism, and interactivity of the mobile strategy. This trend reaffirms the positive impact of the digital approach on satisfaction and academic performance, as well as showing that students recognize microlearning as a viable tool for autonomous learning.

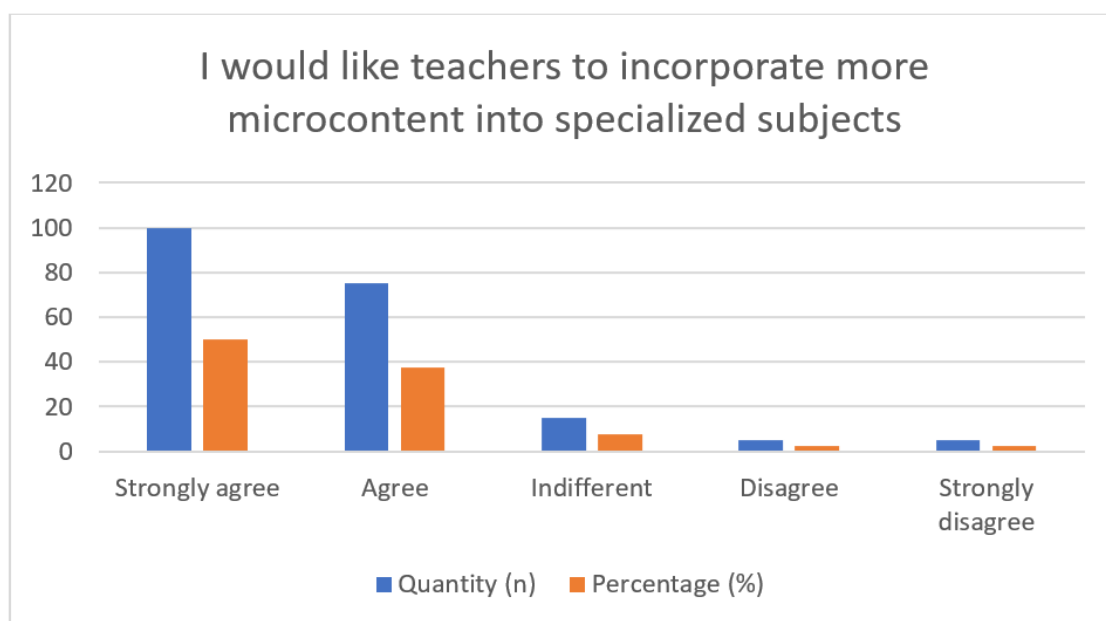


Figure 7. Student preference for the incorporation of mobile microcontent in specialized subjects

The 87,5 % of students expressed interest in teachers permanently incorporating mobile microlearning into specialized subjects. This result confirms the widespread and sustained acceptance of the methodology after the intervention. Students perceive microcontent as a sound, dynamic strategy that can be adapted to their academic needs. In addition, the result indicates an intention to continue the pedagogical approach, suggesting that the positive experience could be consolidated as an institutional practice at the universities participating in the study.

Results of the teacher interview

Participating teachers expressed a highly favorable perception of the implementation of mobile microlearning.

They considered that this methodology promoted student autonomy, strengthening the retention of specialized knowledge and active class participation. They agreed that the accessibility of content on mobile devices enabled greater continuity in learning and strengthened the connection between theory and practice.

A high percentage of those interviewed highlighted that microlearning promoted student motivation and academic self-regulation, as students showed interest in reviewing content even outside of class hours. Teachers valued microcontent for its brevity, specificity, and visual appeal, and for its ability to capture students' attention and sustain their engagement throughout the learning process.

Participants also emphasized the effectiveness of microlearning in reinforcing complex content. According to them, breaking information into short sequences helped students better understand specialized concepts. In addition, they highlighted that this methodology promotes meaningful learning and long-term memorization by combining multimedia resources with practical activities and quick assessments.

All teachers agreed that mobile microlearning increased teacher-student interaction, transforming the classroom dynamic into a more collaborative and participatory environment. The digital tools used (short videos, podcasts, and interactive quizzes) facilitated immediate feedback, allowing content to be adjusted to students' needs in real time.

Another relevant finding was the perception that mobile microlearning strengthens teachers' digital competence. The interviewees noted that although there was initial resistance to change, the training process enabled them to integrate technological resources into their teaching practice effectively. They considered this experience an opportunity for professional development, in line with global trends in educational innovation.

In terms of time management, teachers valued the efficiency of mobile microlearning, as it allowed them to distribute content flexibly without overloading face-to-face or virtual classes. They mentioned that this strategy optimizes the use of academic time, facilitating review and continuous assessment without overburdening students.

Teachers also highlighted that mobile microlearning promotes educational equity by offering learning opportunities for students with varying learning paces and cognitive styles. Being accessible from any device, it promotes inclusion and reduces technological gaps. This approach promotes a more equitable and modern education, consistent with the principles of university social responsibility.

Finally, the interviewees agreed that the experience of applying mobile microlearning represents a positive transformation in teaching practice. They expressed their intention to continue using and refining this methodology, integrating it into their courses as a complement to traditional teaching. They believe that the pedagogical innovation achieved reinforces teaching and learning processes and positions Ecuadorian universities within a framework of sustained educational modernization.

DISCUSSION

This study demonstrated that the application of mobile microlearning significantly improved the retention of specialized knowledge among university students, in line with recent research on the potential of active and digital methodologies in higher education.⁽¹⁹⁾ The post-test results showed a marked increase in the use, understanding, and appreciation of mobile learning. This finding confirms that technological integration promotes memorization and meaningful experience, underscoring the role of mobile devices as key pedagogical mediators in higher education in the digital age.

Furthermore, the results are consistent with the findings of Rozengway et al.⁽²⁰⁾, who demonstrated that brief, repetitive strategies optimize concept retention in complex areas such as embryology. In this study, mobile microlearning enabled content segmentation into cognitively manageable units, thereby improving long-term retention. This evidence suggests that the modular structure of mobile learning helps reduce cognitive overload, allowing students to assimilate specialized information more fully.

Furthermore, the observed improvement in student motivation coincides with the findings of Castillo García et al.⁽²¹⁾, who identified that constant interaction and repeated practice improve skill acquisition and retention. In this study, motivation increased after mobile microlearning, demonstrating a positive relationship between the technological component and self-regulated learning. This aspect is fundamental to strengthening university autonomy, as perseverance and commitment are key to consolidating specialized knowledge.

From an institutional perspective, the research reiterates the arguments of Barbón Pérez and Fernández Pino⁽²²⁾, who highlight strategic training management as a central element for integrating science, technology, and innovation into higher education. The experience with mobile microlearning demonstrates that technological planning must be accompanied by coherent institutional policies that guarantee its sustainability. Teacher training, digital infrastructure, and curriculum design are essential variables for transforming learning environments into more flexible and effective ecosystems.

Furthermore, the findings are supported by the concept of educational internationalization described by Fenoll-Brunet⁽²³⁾, in which adaptation to global technological environments becomes an essential requirement. Mobile microlearning, being accessible and ubiquitous, becomes a tool that transcends the spatial and temporal

barriers of the classroom. In this sense, the research provides empirical evidence on the relevance of innovative pedagogical strategies that prepare students for interconnected and inclusive academic contexts oriented towards continuous learning.

The experience also coincides with the findings of González López et al.⁽²⁴⁾, who highlight the value of collective knowledge construction in digital environments. Mobile microlearning allowed students to share resources, collaborate, and reflect on their own cognitive processes. This participatory dimension strengthens social learning, aligning with educational models focused on interaction and shared knowledge. Consequently, this research demonstrates that the intentional use of technology can promote more active and collaborative learning communities.

In relation to contemporary challenges in higher education, Rosario Pacahuala et al.⁽²⁵⁾ emphasize that digitization requires a review of teaching strategies. The results of this study show that, despite initial limitations, students and teachers have successfully adapted to mobile microlearning. This coincides with the approach of Iglesias Martínez et al.⁽²⁶⁾, who propose that curricula integrate flexible and inclusive methodologies. The Ecuadorian experience confirms that technological innovation can coexist harmoniously with traditional academic needs.

Similarly, the empirical data obtained support the arguments of Lalangui Pereira et al.⁽²⁷⁾, who identified the use of mobile devices as allies of learning, provided that there are clearly defined pedagogical objectives. The results show that mobile microlearning is not only a technological resource but also a teaching strategy that promotes critical thinking and the practical application of knowledge. Its effectiveness lies in the contextualization of content and its immediate accessibility, factors that optimize the contemporary university learning experience.

Finally, the study coincides with the contributions of Olarte-Mejía and Ríos-Osorio⁽²⁸⁾ and Ruiz-Velasco Sánchez and Ortega Barba⁽²⁹⁾, who highlight social responsibility and educational innovation as pillars of academic quality. Mobile microlearning not only promotes cognitive retention but also strengthens equity and digital inclusion in universities. In agreement with Bastidas González⁽³⁰⁾, it is concluded that strategies based on gamification and microcontent represent practical tools for transforming traditional pedagogical processes into a more dynamic, equitable, and meaningful education.

CONCLUSIONS

Mobile microlearning demonstrated a positive, significant impact on specialized knowledge retention, as evidenced by higher levels of comprehension, motivation, and retention in post-test results. Students showed substantial improvement compared to the pretest, confirming that dividing content into micro-units facilitates cognitive assimilation and long-term learning consolidation in the university setting.

The integration of microcontent accessible via mobile devices strengthened autonomy, self-efficacy, and continuity of learning, allowing students to review and consolidate specialized topics anytime, anywhere. This finding demonstrates that mobile learning not only complements traditional teaching but also extends it, promoting a culture of independent study aligned with the current technological demands of higher education.

The qualitative results from teacher interviews indicated strong acceptance and appreciation of mobile microlearning as an innovative teaching strategy. Teachers highlighted improvements in student participation, pedagogical interaction, and understanding of complex content. In addition, they noted that this methodology promotes the development of digital teaching skills, consolidating a more modern, dynamic, and inclusive educational practice.

The comparative analysis between pretest and posttest shows that mobile microlearning enhances both cognitive retention and intrinsic student motivation by offering brief visual resources and interactive activities that reduce cognitive overload. These results confirm that segmented and mobile learning strategies are particularly effective in university courses with a high conceptual load, where gradual assimilation promotes meaningful learning.

Finally, the study concludes that mobile microlearning is a sustainable pedagogical alternative that can be integrated into university curricula and align with the objectives of innovation and educational quality. Its application promotes more flexible, participatory, and equitable learning environments, in line with global trends in educational digitization. Its systematic implementation is recommended as a methodological complement to the teaching of specialized knowledge in Ecuadorian higher education.

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