

Short Bursts, Big Impact: the Potential of Microlearning with Artificial Intelligence in Education

Breves Rajadas, Grande Impacto: o Potencial da Microaprendizagem com Inteligência Artificial na Educação

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Abstract

Microlearning focuses on breaking down complex content into smaller and more manageable units, an emerging practice within digital culture driven by technological advances. Unlike conventional approaches that rely on long study sessions in structured environments, microlearning adapts to the decreasing attention span associated with the intense consumption of multimodal information. This article investigates the concept of microlearning and presents a theoretical–applied study in which a proof-of-concept implementation based on artificial intelligence is developed to generate and deliver microlearning content through messaging platforms. The prototype demonstrates the technical feasibility of this approach and illustrates how educational content can be dynamically distributed in digital environments. No empirical validation with students was conducted in this stage of the research, as the main objective is to demonstrate the technological implementation and discuss its potential to support educational practices. The results suggest that the integration of microlearning, artificial intelligence, and communication platforms can expand learning opportunities beyond the traditional classroom environment.

Keywords: Microlearning. New methodologies. Digital information and communication technologies.



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Resumo

A microaprendizagem se concentra em desmembrar conteúdos complexos em segmentos menores e mais gerenciáveis, uma prática emergente da cultura digital impulsionada pelos avanços tecnológicos. Ao contrário das abordagens convencionais, que se apoiam em longas sessões de estudo em ambientes estruturados, a microaprendizagem adapta-se à diminuição da capacidade de atenção, provocada pelo consumo intenso de informação em formatos multimodais. Este artigo investiga o conceito de microaprendizagem e apresenta um estudo de natureza teórico-aplicada, no qual é desenvolvida uma prova de conceito baseada em inteligência artificial para a geração e entrega automatizada de conteúdos de microaprendizagem por meio de plataformas de mensagens. O protótipo demonstra a viabilidade técnica dessa abordagem e ilustra como conteúdos educacionais podem ser distribuídos de forma dinâmica em ambientes digitais. Ressalta-se que, nesta etapa da pesquisa, não foi realizada validação empírica com estudantes, sendo o objetivo principal demonstrar a implementação tecnológica e discutir seu potencial para apoiar práticas educacionais. Os resultados indicam que a integração entre microaprendizagem, inteligência artificial e plataformas de comunicação pode ampliar as possibilidades de aprendizagem para além do ambiente tradicional da sala de aula.

Palabras-chave: Microaprendizagem. Novas metodologias. Tecnologias da informação e comunicação.

1. Introduction

Technological advances in the fields of computing, communication, and information have enabled transformations in the learning paradigm (Sachete *et al.*, 2024), which used to be limited to formal settings, such as classrooms. With the widespread adoption of mobile devices, education has begun to transcend these environments (Sachete *et al.*, 2025), expanding into informal contexts, such as the home, and taking on a ubiquitous character. It is within this context that microlearning stands out as an innovative approach, integrating everyday digital practices into pedagogical approaches and reshaping education through digital technology. This strategy fosters autonomy, collaboration, motivation, and self-directed learning. Thus, incorporating the emerging culture stemming from contemporary uses of technology in education can be seen as beneficial and strategic for the development of students' digital skills and knowledge.

Challenging traditional conceptions of teaching, microlearning stands in contrast to conventional notions of long study sessions and inflexible structures (Barbosa, 2018). Thus, the concept is based on the premise of providing small, easily digestible units of information, gaining prominence as a response to declining attention spans and the growing time demands of modern life (Buchem; Hamelmann, 2010; Lopez, 2024). Suited to digital browsing habits, such as the simultaneous use of multiple tabs and hyperlinks, this approach provides a learning experience tailored to individuals' routines (Allela, 2021; Lopez, 2024).

In a world where time is a valuable commodity, traditional models of education often fall short of expectations, and microlearning emerges as a flexible and accessible alternative (Amit; Rosenberg-Kima, 2021). One of the defining characteristics of microlearning is its adaptability to various learning styles and preferences; it can be delivered through a variety of formats, such as short videos, interactive quizzes, or concise articles. Furthermore, this approach is accessible on different devices, including smartphones, tablets, and computers, making education universally available to learners.

This approach enhances the overall learning experience by promoting engagement and reducing cognitive overload (Lopez, 2024). In this sense, it aligns with Bloom's (1973) domain-based learning theories by breaking down large, distal educational objectives into smaller, proximal objectives, and with Mayer's (2002) cognitive theory of multimedia learning (CTML) by proposing principles and strategies for information

exposure. Thus, it enables students to improve their skills without spending long hours in training sessions, aligning professional growth with the realities of busy work schedules (Skalka; Drlik, 2018; Biagiotti, 2025).

Furthermore, this model supports those with family responsibilities, allowing parents, caregivers, and individuals with multifaceted roles to engage in continuous learning without neglecting other aspects of their lives (Skalka; Drlik, 2018). Microlearning redefines education as a continuous and integrated part of daily life, rather than a separate and time-consuming endeavor. Its evolution, stemming from insights from the Microsoft experiment—which revealed that the average human attention span had shrunk to just eight seconds, one second less than that of a goldfish—highlights the resilience and adaptability of education in the face of constantly changing circumstances.

Thus, this study aims to investigate the definition of microlearning and develop a practical implementation that extends learning beyond the traditional classroom environment. To this end, Section 2 presents the methodology. Section 3 discusses conceptual foundations and related research. Section 4 describes the implementation of a proof of concept, illustrating the feasibility and simplicity of applying this concept using free tools. Section 5 addresses the challenges and future trends of this methodology for the coming years, while Section 6 presents the conclusions.

2. Methodology

This study is characterized as a theoretical-applied research project with a qualitative and exploratory approach (Gil, 2008), aimed at understanding microlearning and demonstrating its technical feasibility through a proof of concept based on Artificial Intelligence. The research design adopted is aligned with the study's objective, which is to discuss conceptual foundations and present a functional implementation for the automated generation and distribution of educational content in a condensed format, without including empirical validation with students at this stage.

The research was structured in two complementary stages. First, a literature review was conducted to systematize theoretical contributions and applications of this methodology in different contexts. Studies related to the organization of information into smaller units, mobile learning, instructional design, gamification, cognitive load, and adaptive approaches were considered. This stage made it possible to identify recurring limitations, especially the low level of integration between microlearning, artificial intelligence, and digital communication platforms used in everyday educational practice.

In the second stage, a proof of concept was developed to demonstrate the proposal's operational feasibility. The prototype was implemented in Python and structured into three main components: instructional context input, automated content generation, and message distribution. The process begins when the teacher enters reference material that guides the production of the messages. This content is fed into a language model, which is responsible for generating short microlearning units, formulated in a concise and didactic manner based on the information provided.

The system architecture integrates external services via APIs. Text generation is based on language models accessed via OpenAI, while messages are sent through a communication interface with WhatsApp, using the WhatsGW service. The process involves configuring access credentials, defining the language model, constructing prompts, generating the message, and automatically sending it to previously registered contacts.

To illustrate how the proposal works, historical content on Brazil's independence was used as a context. Based on this material, the system generated short messages addressing relevant aspects of the topic, which were subsequently distributed via the messaging app. The analysis focused on verifying the consistency of the execution flow, the suitability of the messages for the microlearning format, and the feasibility of integrating Artificial Intelligence with communication platforms.

3. Related Work

Microlearning practices have been widely discussed in the literature, both in terms of their conceptual definitions and their forms of application (Raddatz; Piovesan; Irala, 2025). Despite growing interest, there is still no standardization in the use of the term, which reflects the variety of interpretations and adaptations across different educational contexts, ranging from formal institutions to informal and self-directed settings. Microlearning emerged as an innovative approach within the field of distance education. Its roots can be traced back to the concept of “learning in small doses,” in which educational content is divided into small, easily digestible units. This pedagogical methodology has gained prominence due to its adaptability, accessibility, and effectiveness in meeting the needs of learners in diverse contexts.

One of the pioneering works in microlearning is attributed to George A. Miller’s theory of chunking¹ (Miller, 1956), in which he suggests that information can be better retained when presented in small, meaningful chunks. This perspective contributed to the development of instructional strategies centered on concise and focused learning experiences. Building on these contributions, researchers and educators began to explore the application of these principles in the context of distance education.

With the advancement of digital technologies—especially the widespread adoption of smartphones and mobile devices—this approach has become practically feasible. Mobile learning platforms have become channels for delivering educational content in small doses, allowing learners to interact with the materials at their own pace and convenience (Beaudin, 2007). In this context, mobile learning has established itself as one of the primary means of implementing this pedagogical approach, increasing engagement and promoting knowledge retention.

The concept of microlearning has found practical applications in corporate training. Organizations have adopted microlearning modules to provide targeted training to employees, promoting continuous learning and skill development. Positive results in these settings have spurred research into its adaptability across different sectors and segments (Javorcik, 2021).

From a theoretical perspective, authors such as Karl M. Kapp (2012) discuss in his work on “The Gamification of Learning and Instruction” how microlearning can be integrated with gamification elements to create engaging and effective learning experiences. Clark (2016), in turn, investigated cognitive aspects related to information processing, examining how the brain assimilates and consolidates content when exposed to short, focused bursts of attention.

The design and delivery of microlearning content remain the focus of ongoing research. Filatro (2022) has been exploring instructional design principles adapted to microlearning, emphasizing the need for clear objectives, relevance, and interactivity. As the field evolves, educators and instructional designers are seeking innovative ways to implement microlearning in distance education contexts, both asynchronous and synchronous.

Case studies were conducted to assess the impact of this approach on specific educational outcomes (Junco *et al.*, 2025; Zambrano, Medina, 2025). These studies span various disciplines and educational levels, providing insights into its effectiveness in different contexts. From language acquisition (Junco *et al.*, 2025) to the development of technical skills, the versatility of microlearning as a distance education approach has been demonstrated through empirical research (Ovidiu *et al.*, 2021).

¹The chunking theory, proposed by Miller (1956), suggests that human working memory capacity is limited and that information retention can be enhanced when content is organized into smaller, meaningful units of information, called chunks.

In 2019, Morais took a critical look at the state of education, emphasizing contemporary challenges and the emergence of new active teaching methodologies. The core of the research was an analysis of a practical application of the station rotation model, adapted for microlearning, highlighting each stage of its implementation and the resulting outcomes. Morais's research suggests that the findings and methodologies employed can serve as a source of inspiration for other educators, enhancing skill development and promoting an exchange of ideas in academic contexts, while also expanding the framework of innovative concepts and practices available to teachers.

In the study conducted by Salas-Díaz and González-Bello (2023), the main objective was to identify and describe different profiles of college students, focusing on three key aspects: affinity for technology, interest in learning materials, and perceived value of digital learning platforms. Using a quantitative approach that employed online questionnaires and the k-means² cluster analysis technique, two main segments emerged: a predominant group (78%) with high technological affinity, a significant appreciation for educational platforms, and active engagement with learning resources; and a second, less well-defined group (22%). The results indicate that the vast majority of college students tend to favor the use of microlearning technologies and strategies, highlighting the need for continuous improvements in virtual learning environments at universities.

The research conducted by Lopez (2024) aimed to assess cognitive load in microlearning, analyze its perceived effectiveness, investigate the relationship between cognitive load and effectiveness, and explore the possible influence of demographic factors. The study was conducted over four weeks with participants from educational institutions and online platforms in India. The results indicated that the modules using this methodology are highly effective, promoting knowledge retention and learner engagement. Furthermore, the study highlights the importance of properly managing cognitive engagement and minimizing extrinsic cognitive load. Demographic factors, such as participants' prior experience, also had a significant impact on the results obtained.

Therefore, the landscape of microlearning as an approach to distance education is rich and dynamic, with a multifaceted body of research and practical implementations. From its theoretical foundations to its practical applications in diverse settings, this methodology continues to shape the way educators design, deliver, and assess learning experiences in the digital age (Polasek, 2019). With the continuous advancement of technology and teaching theories, the role of microlearning in distance education is likely to undergo significant evolution, bringing with it new opportunities and challenges for researchers, educators, administrators, designers, and learners alike, and redefining the way learning is conceived and information is delivered in the digital environment.

Table 1 – Comparison of Related Work.

Reference	Study Focus	Methodology	Results	Distinguishing Feature
MILLER (1956)	Chunking theory – retention of information in small blocks.	Theoretical research on cognitive processing.	Identification of the capacity to retain information in small blocks.	Theoretical foundation without practical implementation
BEAUDIN	Use of	Experiment using	Demonstration of	Focus on mobile

²K-means is a clustering algorithm widely used in data analysis and machine learning, whose goal is to divide a dataset into k groups (clusters) based on similar characteristics. The method seeks to minimize the distance between the elements in each group and the center of the corresponding cluster, making it possible to identify patterns or profiles within the analyzed data.

et al. (2007)	microlearning in mobile learning for vocabulary acquisition.	mobile devices for language learning.	increased engagement and retention in mobile learning.	learning, without the use of AI.
JAVORCIK (2021)	Use of flashcards as a microlearning tool for English language teaching.	Case study using flashcards in the classroom.	Effectiveness of flashcards in English language learning.	Use of flashcards, without integration with AI or messaging platforms.
KAPP (2012)	Integration of microlearning with gamification for engaging learning.	Analysis of gamification strategies applied to microlearning.	Evidence of increased engagement through gamification.	Integration with gamification, but without the use of AI.
FILATRO (2022)	Instructional design for microlearning, emphasizing objectives and interactivity.	Theoretical study on instructional design for microlearning.	Importance of instructional design for the effectiveness of microlearning.	Emphasis on instructional design, without practical application involving AI.
MORAIS (2019)	Application of the station rotation model in higher education using microlearning.	Case study with practical classroom application.	Effectiveness of the station rotation model for blended learning.	Practical application, but restricted to face-to-face higher education.
SALAS-DÍAZ & GONZÁLEZ-BELLO (2023)	Profiles of university students and their relationship with microlearning strategies.	Quantitative research using cluster analysis to identify student profiles.	Correlation between technological affinity and engagement in microlearning.	Study of student profiles, without practical implementation.
LOPEZ, 2024	Assessment of cognitive load in microlearning.	Quantitative study involving the application of microlearning modules.	Positive impact of microlearning on retention and engagement.	Focus on the cognitive analysis of microlearning.
POLAZEK, 2019	Theoretical and prospective analysis of microlearning in distance education.	Analysis of the evolution and challenges of microlearning in digital education.	Impacts on the design, delivery, and assessment of education.	Future perspectives and challenges.
This work	Practical implementation of AI-based microlearning delivered via WhatsApp.	Development of a practical prototype using AI for microlearning.	Demonstration of the feasibility of microlearning through AI and instant messaging.	Use of AI for personalization and automated delivery of microlearning via WhatsApp.

Source: Authors' Image.

Table 1 presents a comparative summary of related studies, highlighting their focuses, methodologies, results, and distinguishing features in relation to the proposal of this study. Although such research contributes significantly to conceptual and pedagogical advances in the field, recurring limitations are evident in the literature. In many cases, these studies focus on theoretical discussions or exploratory analyses, without addressing technological implementations that demonstrate practical application in real digital environments. Furthermore, there is a predominance of research limited to specific educational contexts or isolated tools, which reduces the generalizability of the proposals and their integration with emerging technologies. Another

recurring issue is the lack of solutions that systematically explore the potential of artificial intelligence to automate the generation and distribution of microlearning content on platforms widely used in students' daily lives.

Overall, the studies analyzed demonstrate significant progress in understanding the topic and in its application in various educational and organizational contexts. However, exploration of the potential of emerging technologies to automate the generation and distribution of educational content remains limited. In particular, research that integrates microlearning, artificial intelligence, and communication platforms present in students' daily lives is still in its infancy. In this regard, the relevance of this study lies in the presentation of a proof of concept that employs artificial intelligence to generate microlearning content and distribute it automatically via messaging platforms, demonstrating the technical feasibility of this approach in technology-mediated educational contexts.

4. Proof of Concept

This section presents the implementation of a proof of concept on artificial intelligence (AI)-guided microlearning. A proof of concept (PoC) is a practical demonstration intended to show the feasibility of a particular idea or theory. In the context of projects, technology, or innovation, a PoC is generally developed to show that a proposal or concept can be implemented in practice, serving as an initial test to verify whether the concept can be transformed into a functional solution. Currently, large language models can understand, interpret, and generate text, with or without prior context. In this proof of concept, instructional material is provided as prior context for the AI, and the AI generates context-based microlearning phrases and sends them to users listed as contacts via WhatsApp.

Figure 1 shows the first part of the code written in Python, which includes the import of libraries that will support the application's functionality and the declaration of initial variables needed for the rest of the code. Based on the code shown in Figure 1, four libraries are required to run the application, namely:

- `openai` – which establishes a connection and enables communication between the code and OpenAI's Application Programming Interface (API);
- `re` – which recognizes and implements the regular expressions needed for string manipulation;
- `json` – which encodes and decodes the JavaScript Object Notation standard (JSON);
- `requests` – which allows you to make HyperText Transfer Protocol (HTTP) calls.

There are three requirements for the code shown below to run:

- The first requirement is the application's runtime environment, which must have Python version 3.12 installed and the OpenAI library version 0.28 installed.
- The second requirement is that the user who wishes to submit microlearning phrases (in our scenario, the teacher) must have an account registered with two web services: OpenAI³ and WhatsGW⁴. The code used in this project utilized free accounts on both services. These two services generate a hash that is used as an API access key, and these are used in the variables on lines 6 and 7.

³<https://openai.com>

⁴<https://whatsgw.com.br>

- The third requirement is that the computer must have the Google Chrome browser installed, as it provides native access to Python. And throughout the execution of the Python code, the browser must be open and the WhatsApp Web⁵ account must be connected to the teacher's WhatsApp account. This allows the code to communicate with the Google Chrome browser after the teacher's phone number—registered on WhatsApp—is entered on line 8.

Based on this, the Large Language Model (LLM) to be used for receiving the prompts sent to the AI must be selected. This model will be responsible for processing the prompts directed at the Artificial Intelligence and subsequently generating micro-learning sentences to be delivered to the students.

Figure 1 – Importing libraries and declaring variables.

```

1 import openai
2 import re
3 import json
4 import requests
5
6 openai.api_key = "ENTER-YOUR-API-KEY-HERE"
7 whatsapp_key = "ENTER-YOUR-API-KEY-HERE"
8 whatsapp_origin = "ENTER-YOUR-WHATSAPP-NUMBER-HERE"
9 model = "gpt-3.5-turbo"
10 student_contacts = ["XXXXXXXXXX", "XXXXXXXXXX"]

```

Source: Authors' Image.

This model is specified on line 9 (GPT-3.5-Turbo is free), and allows you to choose from a variety of different models, such as GPT-3.5, GPT-4, DALL-E, TTS, Whisper, Embeddings, Moderation, and others. Each model is specialized for interpreting different types of prompts (text, images, audio, etc.). Finally, line 10 lists the phone numbers of students who have WhatsApp.

Figure 2 illustrates the entire section that handles communication between the code and OpenAI's AI model. On line 12, the code prompts the teacher to enter the "context," which, in this example, refers to the instructional material or source text for the lesson in question, to be used for generating microlearning sentences. After this context is entered, the code sends two prompts to the AI. The first prompt, found between lines 14 and 21, defines the context and the AI's role, in addition to including the context itself. This allows the AI to understand the topic to be covered and its role in that scenario. The second prompt, located between lines 23 and 30, instructs the AI to generate microlearning based on the previously defined context and role. Lines 32 through 36 contain the code responsible for communication between the source code and the OpenAI API. Finally, the microlearning generated by the AI is received in the "message" variable on line 37.

Figure 2 – Communication Prompts for the OpenAI API.

⁵<https://web.whatsapp.com>

```

1 context = input("Enter the lesson text: ")
2
3 base_prompt = f'''
4 You are an educational assistant for teachers.
5 The lesson text is:
6 '''
7 {context}
8 '''
9
10 chatgpt_question = f'''
11 {base_prompt}
12 Your goal is to read the lesson text provided by the teacher
13 and create a short, engaging microlearning sentence of up to
14 30 words that focuses on an important point from the text.
15 '''
16
17 prompt_chatgpt = openai.ChatCompletion.create(
18     model=model,
19     messages=[
20         {"role": "user", "content": chatgpt_question}
21     ]
22 )
23 message = prompt_chatgpt.choices[0]["message"]["content"]

```

Source: Authors' Image.

Figure 3 shows a section of the code responsible for iterating through the list of student contacts and sending the generated message to all of them (line 39).

On line 40, the address of the WhatsApp messaging service, called WhatsGW, is defined. Between lines 41 and 48, the code uses both predefined data and data generated during execution, including the user's access key for the WhatsGW service, the sender's phone number, the students' contact list, the message type (in this case, text), the message generated by the AI for microlearning, and an indicator to verify whether the message was sent successfully. In addition, there is an error-handling mechanism between lines 49 and 51.

Figure 3 – Communication with the WhatsGw API.

```

1 for contact in student_contacts:
2     url = "https://app.whatsgw.com.br/api/WhatsGw/Send"
3     data = {
4         "apikey": whatsapp_key,
5         "phone_number": whatsapp_origin,
6         "contact_phone_number": contact,
7         "message_type": "text",
8         "message_body": message,
9         "check_status": "1"
10    }
11    response = requests.post(url, json=data)
12    if response.status_code != 200:
13        print("Error:", response.status_code)

```

Source: Authors' Image.

Table 2 presents a collection of microlearning messages generated by the Python implementation discussed earlier, which were sent via WhatsApp. In this experiment, content published on a website about Brazil's independence was used as reference material. By incorporating this context into the system and with the assistance of artificial intelligence, the tool was able to create and send microlearning texts addressing the topic of Brazil's independence via WhatsApp.

Table 2 – Messages generated by the Python tool.

In 1822, Brazil declared its independence, breaking its colonial ties with Portugal after disagreements following the Liberal Revolution of Porto. 21:41 ✓✓	The transfer of the Portuguese court to Brazil in 1807 brought economic, cultural, and scientific changes, stimulating the country's development. 21:41 ✓✓
The Liberal Revolution of Porto in 1820 was decisive, exposing irreconcilable differences between the metropolis and the colony and hastening independence. 21:41 ✓✓	Brazilian resistance to the demands of the Portuguese Cortes grew, culminating in the "Day of Stay" in 1822, when Dom Pedro refused to return to Portugal. 21:41 ✓✓
The Clube da Resistência and the abaixo-assinado opposing Dom Pedro's return demonstrated popular dissatisfaction and strengthened the independence movement. 21:42 ✓✓	José Bonifácio's leadership was fundamental to the independence process, influencing Dom Pedro's decisions and helping shape a Constitution. 21:42 ✓✓
On September 7, 1822, on the banks of the Ipiranga River, Dom Pedro proclaimed Brazil's independence, beginning the war against provinces loyal to Portugal. 21:42 ✓✓	Unlike other American nations, Brazil adopted a monarchy after independence, with Dom Pedro I acclaimed emperor in 1822. 21:42 ✓✓
The First Reign, marked by authoritarianism, led to the drafting of Brazil's first Constitution, granted to meet Dom Pedro I's interests. 21:42 ✓✓	After several years of war, Portugal recognized Brazil's independence in 1824, allowing the country to begin organizing itself as an independent nation. 21:42 ✓✓

Source: Authors' Image.

The material produced can be used by elementary school history teachers to identify where the topic of Brazilian Independence fits into the National Common Core Curriculum (BNCC) for history. In addition, it is possible to explore microlearning; in this specific context, it can be implemented as a hybrid approach aimed not only at engaging students but also as an important resource for at-home activities and for strengthening the learning process.

Although the implementation presented here is intended as a demonstration, it is important to relate it to recurring challenges in the literature on microlearning. One of these concerns the risk of knowledge fragmentation, as content presented in small units can make it difficult to develop an integrated view of the topics studied. To mitigate this problem, the proposed approach uses instructional materials previously defined by the teacher as the basis for generating messages, ensuring thematic coherence throughout the process. Another relevant point concerns technological dependence, since the proposal relies on artificial intelligence services and digital communication platforms. Although this represents a limitation, it also broadens the scope of educational practices by leveraging tools available in students' daily lives. Finally, it should be emphasized that the proposal does not replace the teacher's pedagogical role in curating content, defining the instructional context, and aligning microlearning activities with broader educational objectives.

5. Challenges and Trends

Microlearning has emerged as an alternative to traditional, lengthy courses by providing focused content in small doses. However, like any educational methodology, it presents challenges and trends that shape its effectiveness and development (Septiani; Rosmansyah, 2021).

One of the challenges of microlearning in distance education is the potential for fragmented and superficial knowledge. Breaking content down into smaller modules can result in a loss of the interconnections between ideas that are essential for a comprehensive understanding. Learners may grasp isolated concepts but may struggle to synthesize them into a coherent framework. Striking the right balance between granularity and cohesion remains a delicate task for educators (Draxler, 2021). Furthermore, the scalability of microlearning presents a significant challenge. Although it is adept at catering to diverse learning styles, adapting to various disciplines, and accommodating learners at different paces, ensuring its scalability without compromising depth is a constant concern. Maintaining the substance of education when delivering content in small portions requires careful mediation, curation, and design.

Another challenge revolves around assessment (Roskowski *et al.*, 2023). Traditional methods of assessing student understanding and mastery may not align perfectly with the modular nature of microlearning. Standard metrics for tests and assignments may need to be rethought to effectively measure the effectiveness of microlearning strategies. Continuous assessment methods and innovative assessment tools

are becoming imperative for measuring the true impact of these brief learning modules, both in learning processes and for educational research.

Despite these challenges, microlearning in distance education has shown trends that point to its expansion and adaptation. Among these trends, the growing integration of multimedia elements stands out. As technology advances, modules are increasingly incorporating videos, simulations, and interactive elements to enhance engagement and cater to diverse learning preferences. This diversification of formats not only aids in understanding the content but also makes learning more engaging and memorable.

Adaptive learning (Weber, 2012) is another trend that is reshaping this field. By incorporating artificial intelligence and machine learning techniques, adaptive educational platforms personalize content delivery based on learners' individual profiles (Sachete *et al.*, 2024). This personalization tends to enhance the effectiveness of microlearning, ensuring that each student receives an educational experience tailored to their needs.

At the same time, collaborative approaches have been gaining ground; recognizing the importance of social interaction in the learning process, educators are incorporating collaborative elements into microlearning environments. Discussion forums, group projects, and virtual team activities are being integrated to foster a sense of community and shared learning experiences among remote learners. Finally, the gamification of microlearning represents an exciting trend (Zambrano, Medina; 2025). By incorporating game-like elements, such as points, badges, and challenges, educators are tapping into the innate human desire for competition and achievement. This approach not only boosts motivation but also provides instant feedback, fostering a mindset of continuous improvement among learners.

Despite the limitations discussed, these challenges do not negate the potential of microlearning as an educational approach. On the contrary, they highlight the need for careful instructional design that can integrate learning modules in a coherent manner and align the use of technology with pedagogical practices that promote a broader and more meaningful understanding of the content.

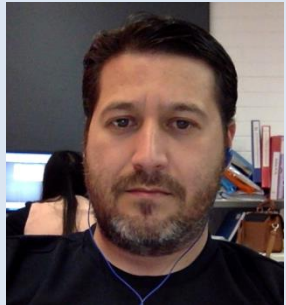
6. Conclusion

The article explores challenges and trends, highlighting the implementation of microlearning in various contexts. An analysis of related studies reveals the conceptual foundations of this approach—such as George A. Miller's principle of “chunking”—and highlights its practical applications, particularly in organizational training programs aimed at rapid and efficient learning. The integration of microlearning into distance education is explored, emphasizing its adaptability to different learning styles and the advantages it can bring to asynchronous learning environments. By implementing a prototype that incorporates artificial intelligence to deliver content in a microlearning format via messaging platforms, the study sought to demonstrate the technical feasibility and accessibility of this methodology. The code, although simple, highlights the potential for incorporating this strategy into various technological environments. In addition, the article highlights trends that may drive the evolution of microlearning, such as the integration of multimedia, adaptive learning technologies, collaborative approaches, and gamification. Such innovations expand the possibilities for engagement and effectiveness, strengthening the role of this approach in face-to-face, hybrid, and distance education.

In conclusion, microlearning can not only respond to contemporary changes in the field of education but also serve as a driver of innovation, promoting greater adaptability in technology-mediated teaching and learning processes. Its growing potential positions it as a strategic component in the redesign of more dynamic, learner-centered educational experiences. Nevertheless, the challenge remains to transition from short, instantaneous learning experiences to deep learning, involving sustained attention and critical reflection across successive layers of complexity, including knowledge, skills, and attitudes.



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