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THE EFFECTIVENESS OF MICROLEARNING TO IMPROVE LEARNERS' UNDERSTANDING IN LEARNING : LITERATURE REVIEW

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ABSTRACT
The digital era demands innovative solutions to attention fragmentation and information overload. This Literature Review (LR) aims to synthesize empirical evidence evaluating the effectiveness *of Microlearning* (ML) in improving Learner Comprehension. The method used involved screening 50 potential journals into 18 qualified scientific articles using strict criteria to eliminate non-cognitive studies. The synthesis confirms the superiority of ML, which is rooted in Cognitive Load Optimization. ML effectively reduces the Extrinsic Cognitive Load, thus maximizing the Germane Load for true schema construction. In addition, ML design encourages Active Engagement and retrieval *practices*, which significantly strengthen long-term knowledge retention. Consequently, ML is validated as an essential and adaptive pedagogical solution tailored to the cognitive profile of modern learners and is effective for Universal Learners.

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INTRODUCTIONS

The exponential development of digital technology in the 21st century has fundamentally transformed the social, economic, and educational landscape. The global community now lives in what is referred to as the *information age*, characterized by massive volumes of data and instant accessibility to knowledge. This phenomenon, while bringing great opportunities, simultaneously poses significant challenges: *information overload* and the urgent need for *lifelong learning*. In the professional environment, the demand for (Sankaranarayanan et al., 2023) *continuous upskilling* and *reskilling* is no longer optional, but rather a functional imperative. Educational institutions and training organizations are required to provide a pedagogical framework that is not only effective in transferring knowledge, but also efficient in the use of time, given the limited time allocation of professional learners. Failure to adapt to this new paradigm risks creating a widening competency gap between formal education output and dynamic

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job market needs. Therefore, the search for learning models that can integrate effectiveness with time efficiency has become a major research agenda in contemporary Educational Technology.

Traditional didactic models, which often rely on long learning sessions (e.g., 60–90 minute lectures) and dense material, are proving increasingly ineffective in the face of attention *deficits* experienced by digital learners. Constant exposure to social media and fragmented digital content has trained the brain to process information in short *bursts*. In neurocognitive contexts, these conventional models often overload students' *working memory*, forcing them to process large amounts of information at once. This high cognitive load, particularly the *Extraneous Cognitive Load*—the mental energy wasted from having to navigate the complex structure of the material—inhibits the learner's ability to engage in deep understanding. Consequently, learning outcomes tend to be limited to short-term memory (*rote memorization*) and are prone to rapid decline (*forgetting curve*). The mismatch between the content delivery model and the learner's information processing profile demands radical innovation.

In response to the above cognitive and time-efficiency challenges, the Microlearning (*ML)* approach has emerged as a promising and relevant pedagogical paradigm. (Darwin, 2025) *Microlearning* is broadly defined as the presentation of content in small units (*bite-sized*), short-duration, and focused on one specific learning objective. This format is intrinsically aligned with the *just-in-time* and *on-demand* demands of lifelong learning.

To avoid ambiguity, it is important to establish an operational definition of *Microlearning* in the context of this review. defines it as a learning model characterized by short duration, narrow focus, and diverse formats, often supported by mobile technology. Although the exact duration varies (generally ranging from 2 to 15 minutes), the essence lies in the atomization of content—the breakdown of complex matter into self-contained units. Continuing this conceptual analysis, it is explained that (Dolansinski & Roynolds , 2020) (Cronin & Durham, 2024) *Microlearning* is not just about *size*, but also about instructional intent: each unit must facilitate the achievement of specific and isolated learning objectives. In the context of this review, *Microlearning* is defined as any micro-learning medium in delivering a lesson or a science, including short videos, infographics, *flashcards*, and interactive quizzes that focus on a single dose of information. This definition framework facilitates the synthesis of evidence from a broad spectrum of applications.

The success of *Microlearning* cannot be separated from its ability to interact effectively with the neurocognitive basis of Understanding. By presenting information in small doses, *Microlearning* inherently reduces the risk of *cognitive overload*, which is especially important in environments that require quick and accurate understanding, for example, highlighting the relevance of (Thillainadesan , The Couteur , et al., 2022) *Microlearning* in medical education, where busy professionals need *just-in-time* knowledge updateswithout interrupting a busy work schedule. They affirm that this format is an evidence-based strategy designed to address structural barriers in Understanding.

Therefore, *Microlearning* has shifted from simply a technology trend to a mature instructional design framework. Bibliometric analysis by Sankaranarayanan, Leung, Abramenka-Lachheb, shows a significant increase in academic publications on (Sankaranarayanan et al., 2023) *Microlearning* in a variety of contexts—from higher education to corporate training—underscoring the global acceptance of this model as a valid instructional tool. In this review, the concept of *Learner* is universally defined: it doesn't have to be just the student or students in the school but anyone who is learning to understand something. This inclusive definition allows for an analysis of effectiveness on a broad spectrum, from formal learners in schools to professionals undergoing continuing training.

The crucial dependent variable in this research is Understanding. Often, research measures Comprehension only through *knowledge recall* or *post-test scores* that are immediately carried out. However, this review adopts a more functional and qualitative definition: Comprehension means an easier time for a person to understand what he or she wants to understand using microlearning. This definition goes beyond just mastering content; it touches on aspects of ease of knowledge transfer and improving students' self-efficacy.

We argue that ease of understanding is a more valid and *ecological* metric for learning in the 21st Century. If an instructional method makes the learner feel that the task of Comprehension becomes less challenging and more quickly accomplished, then it has succeeded in achieving its essential didactic goal. This facilitated understanding

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reflects success in reducing cognitive friction, which is a key goal of Microlearning-based instructional design. Consequently, empirical analysis should focus on the cognitive mechanisms that support this ease of understanding, such as the optimization of Germane's Cognitive Load and the reinforcement of retention.

Although previous reviews have confirmed the general efficacy of *Microlearning* (Darwin, 2025; Sankaranarayanan et al., 2023) , there are still critical gaps in the literature. This gap mainly lies in the lack of a synthesis that explicitly links *the mechanisms of Microlearning* with the concept of Facilitated Understanding across the spectrum of Universal Learners. Most reviews tend to generalize effectiveness without providing an in-depth analysis of the cognitive mechanisms that make (Cronin & Durham, 2024) *it easier for a person to understand*. For example, how does a micro dose of content specifically activate the Germane Burden for Procedural Comprehension in Adult Learners compared to Conceptual Comprehension in Adolescent Learners? The answers to these questions are still scattered and unconsolidated. A rigorous and systematic review is needed to identify, analyze, and synthesize empirical evidence that focuses on these core mechanisms, eliminating studies that focus solely on perception or model development (*R&D*).

The main objective of this Systematic Literature Review (LR) is to comprehensively synthesize empirical evidence from qualified studies to evaluate the effectiveness of *Microlearning* in improving Learner Comprehension. This review specifically aims to: (1) Identify cognitive and didactic mechanisms that explain the superiority of *Microlearning* in facilitating Understanding; and (2) Consolidate findings regarding the effectiveness *of Microlearning* in various Universal Learning contexts. The scientific contribution of this LR is to provide an evidence-based theoretical foundation and instructional design framework that educators, curriculum designers, and training organizations can use to optimize the Comprehension process in a digital age constrained by attention and time.

RESEARCH METHOD

This study adopts a Literature Review (LR) design with a qualitative-synthetic approach. This design was chosen because its purpose is to identify, analyze, interpret, and synthesize all concepts, theories, and empirical findings from previous studies, with a focus on building a comprehensive and credible framework of argument regarding the effectiveness of *Microlearning*.

Literature searches are carried out on major academic databases, which are selected to guarantee wide coverage and quality of sources:

- Database: The initial search yielded a total of 50 journals that could potentially be analyzed, obtained from four *main platforms*:
  - Garuda: 10 Journals
  - PubMed: 8 Journal
  - SpringerLink: 14 Jurnal
  - Google Scholar (GScholar): 18 journals
1. Time Frame: The publication is focused on the range of 2017 to 2025 to ensure the relevance of the findings to the context of contemporary pedagogy and digital technology.
2. Research Question (RQ): This research is guided by the main RQ: *"To what extent is microlearning effective in improving students' understanding of learning?"*
3. Search String: A combination of keywords tailored to focus searches on effectiveness: *{"Effectiveness" OR "Effectiveness"}) AND {"Microlearning" OR "Micro-learning"}) AND {"Understanding" OR "Understanding"})*

This procedure is carried out in a systematic but flexible manner, focused on assessing the quality and relevance of substances.

Only articles that meet the following criteria are considered for in-depth analysis:

1. Document Type: A *peer-reviewed* scientific journal that presents relevant research findings, case studies, or reviews (eliminating *preprints*, theses, and books).

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2. Substantive Focus: The article should discuss the effectiveness or impact of *microlearning* on improving Knowledge *Acquisition (Comprehension, Learning Outcomes*).

Of the 50 journals identified, 32 journals were eliminated based on the following substance relevance criteria, to ensure the quality of the arguments in this review:

Table 1. Criteria for Elimination of Scientific Journals

Elimination Codes	Key Focus Eliminated	Scientific Justification (Violating Substantive Focus)
E1	**Non-Cognitive/Perceptual Focus**	Research that measures Motivation, Satisfaction, Perception, or Student Activity, which does not provide direct evidence of improved Comprehension.
E2	**Development/Implementation Focus**	Studies that focus only on *Model Design* (*R&D*), *Instrument Validity*, *Feasibility*, or *Implementation* without measuring cognitive effectiveness outcomes.
E3	**Focus on Procedural Skills**	Studies that test *Microlearning* on clinical/procedural skills (e.g., surgery), as the focus of this LR is on pure cognitive comprehension.

Qualitative data and key findings are extracted narrativeally from the escaped articles (after elimination) and recorded in a matrix The data recorded included: Citations, *Microlearning* Media used, Effectiveness Reviews, and Student Context.

Data analysis was carried out using qualitative Thematic Synthesis. This process involves: (1) Identifying key arguments and findings that support or oppose effectiveness; (2) Grouping findings into interpretive themes (e.g., Cognitive Optimization Mechanisms, Retention Superiority); and (3) Constructing a coherent narrative to build a definitive argument regarding the effectiveness of *Microlearning*.

RESULT AND DISCUSSIONS

This discussion serves to interpret in depth the findings produced from the literature synthesis, starting from methodological justifications to scientific analysis of the mechanism of Microlearning's superiority in improving Student Understanding.

The literature review (LR) process began with the identification of 50 potential sources from various academic databases, including Google Scholar, Garuda, and PubMed. After going through a rigorous qualification stage, only 18 Scientific Journals that definitively met the criteria of measurable cognitive effectiveness and document type.

This justification is at the heart of LR's validity. A total of 32 other sources were eliminated for not meeting key inclusion criteria that demand a focus on the measurable effectiveness of Comprehension. The rigorous identification and screening process of the 50 potential journals is visualized in the Proportions Diagram (Figure 1), showing a highly focused Evidence Matrix for the synthesis of these findings.

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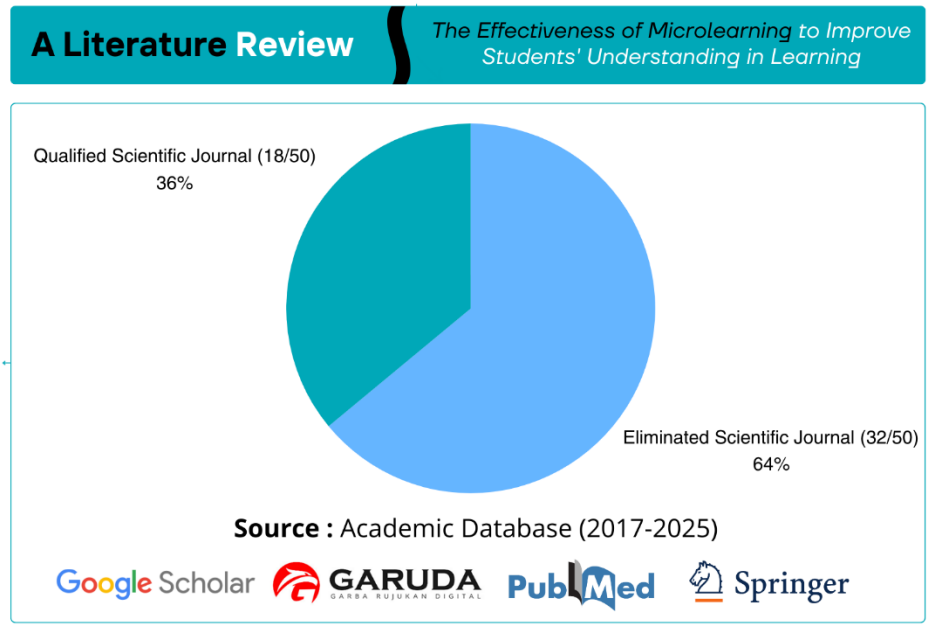
Figure 1. Proportional Chart Infographic (Qualification and Elimination)



Then (Table 2) presents some examples of eliminated journals and their scientific reasons:

Table 2. Example of Eliminated Journals (Internal Validity)

No.	Citation (Author, Year)	Short Title (Main Focus)	Reasons for Scientific Elimination	Violation Criteria
1.	(Arif & Ernawati, 2025)	Students' Perception of the Effectiveness of TikTok-Based Microlearning Learning	The main focus is on the student's *Perception* and *Attitude*, not on the results of measurable cognitive comprehension.	E1: Non-Kognitive/Persepsi
2.	(Norwegian et al., 2021)	Development of microlearning in the course of diffusion of educational innovation	The main focus is on *model development* and curriculum design (*R&D*), without presenting a final effectiveness measurement.	E2: Development/Design Focus
3.	(Jannah et al., 2025)	The Potential of Microlearning Games in Increasing Students' Motivation to Learn Mathematics	The main focus is on *Motivation*, not on *Comprehension* or *Knowledge Acquisition*.	E1: Non-Cognitive/Motivational
4.	(Michlmayr, Mitofsky, Haverkamp, Wittek, et al., 2025)	Design and implementation of a microlearning-based OSCE preparatory curriculum	Focus on *the design* and *feasibility* of the pilot curriculum, not on measurable cognitive effectiveness.	E2: Development/Feasibility

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No.	Citation (Author, Year)	Short Title (Main Focus)	Reasons for Scientific Elimination	Violation Criteria
5.	(Javorcik et al., 2023)	Monitoring and evaluating students' activity in a microlearning course	The main focus is on *Monitoring Activities* and *Experiences*, not the cognitive outcomes of Understanding.	E1: Non-Cognitive/Activity

After the filtration process, the synthesis of 18 qualified journals definitively confirmed that *Microlearning* is a superior strategy. The effectiveness of *Microlearning* is explained in depth through the lens of *Cognitive Load Theory*. This principle divides mental burdens into three categories: Extrinsic, Intrinsic, and Germane. *Microlearning* strategically manipulates these categories to maximize Understanding.

Traditional instructional designs that present complex material in long, dense sessions (e.g., 60-minute lectures) inherently result in a high Extrinsic Cognitive Load. This burden is a waste of mental energy arising from poor design, as learners are forced to sort out essential information from an unorganized structure. (Zhu & others, 2024)

Microlearning, through the presentation of *bite-sized* content (usually 2-10 minutes), effectively separates the complexity of the material. This solution acts as (Zhu & others, 2024) *a cognitive scaffolding* that minimizes *extraneous loads*, so that cognitive energy that would otherwise be wasted on irrelevant *decoding* processes can be saved and diverted. This process directly correlates with findings of improved Conceptual Comprehension reported in mathematics and engineering studies. (Sinaga , 2022; Yendra & others, 2024)

The essence of Understanding is the *increasing ease of a person in understanding*—lies in the Germane Cognitive Load. This burden represents the mental effort required to construct a knowledge schema, integrate new information with existing knowledge, and perform *deep processing*.

With the reduction of extrinsic loads, *Microlearning* ensures that Working Memory capacity is allocated maximally to Germane Loads. It allows learners to engage in high-level cognitive activities, such as analysis, evaluation, and inference, which are the essence of Comprehension. The process of knowledge transfer became "successful" because the material was presented in a challenging but tolerable dose. (Metwally et al., 2024) (Fitri Kholidya et al., 2023; Nowak et al., 2023)

The effectiveness of *Microlearning* is not limited to one level of education; the synthesis confirms its validity as a key strategy for Universal Learners (*anyone who is learning*).

Long-term retention is crucial for true Understanding. *Microlearning* supports superior retention through the principle of *Distributed Practice*. Rather than relying on bulk repetition (learning over a long period of time at once), *Microlearning* encourages learners to repeat and re-access short units of content (e.g., through quizzes or *mobile learning*) within optimal time intervals. This process of active and distributed (Ingram Nissen et al., 2024; Syauqi & others, 2024) *retrieval practice* has been shown to be neurologically more effective in strengthening memory traces, making knowledge more durable (Jaiswal & others, 2021).

In Adult Learners (e.g., Junior Doctors, Nurses, Professionals), *Microlearning* provides urgent time efficiency benefits. Studies on nurses show that (Ichiuji et al., 2022; Thillainadesan , Charlton, et al., 2022) *Microlearning* increases Knowledge Acquisition as well as *Self-Efficacy* (Kim et al., 2024; Tayebi & others, 2025) . This increase *in self-efficacy* is a psychological indicator that learners find it easier to master the material, which confirms the definition of Comprehension adopted in this study (Fitri Kholidya et al., 2023)

The entire above analysis is based on a detailed synthesis of 18 qualified studies. This matrix, which summarizes empirical evidence, is the main methodological foundation of this discussion.

Table 3. Qualified Journal Evidence Matrix (n=18)

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No.	Citation (Author, Year)	Full Title of Scientific Article	Education Level / Research Object	A Brief Review of Effectiveness for Comprehension	Country of Origin
1.	(Ridayanti & Devy Marleni, 2025)	THE EFFECTIVENESS OF DIGITAL MICROLEARNING IN IMPROVING THE UNDERSTANDING OF MIDWIFERY CARE FOR STIKES BULELENG STUDENTS	Higher Education (Midwifery Students)	Measurable effectiveness in improving **the Understanding of Midwifery Care**.	Indonesia
2.	(Kudus et al., 2025)	Microlearning for Youth Understanding of the Lord's Supper	Adolescent / Non-Formal Education	Proven to be effective in improving **Conceptual Comprehension** in non-academic subjects.	Indonesia
3.	(Aditya, 2025)	The Effectiveness of Microlearning Video Implementation in Improving Understanding of Network Infrastructure Administration Subjects at SMK Muhammadiyah Parepare	Vocational Education (SMK)	The implementation of *microlearning videos* **improves the understanding** of network administration.	Indonesia
4.	(Ria et al., 2025)	Quizizz-Assisted Microlearning Model to Improve Students' Activeness and Learning Outcomes in Basic Culinary Subject at SMK PGRI 3 Badung	Vocational Education (SMK)	The Quizizz-Assisted *model* improves **Learning Outcomes** (Comprehension).	Indonesia
5.	(Kurnianto & Khaudli, 2025)	THE URGENCY OF MICROLEARNING IN EFFORTS TO IMPROVE STUDENT LEARNING AT MTS AL-AMIRIYYAH	Secondary Education (MTS)	*Microlearning* is considered an effort **of effectiveness** and knowledge transfer.	Indonesia

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No.	Citation (Author, Year)	Full Title of Scientific Article	Education Level / Research Object	A Brief Review of Effectiveness for Comprehension	Country of Origin
6.	(Mostrady et al., 2025)	Microlearning and its effectiveness in modern education: A mini review	Literature Review (Universal)	The review confirms the effectiveness of *microlearning* in **modern education**.	Slovakia
7.	(Silva & others, 2025)	Contribution of microlearning in basic education: A systematic review	SLR (Basic Education) Review	Consolidation of the contribution of *microlearning* in **primary education**.	Brazil
8.	(Tayebi & others, 2025)	The effects of microlearning on the fertility knowledge and attitude of Iranian nursing students: an interventional study	Higher Education (Nursing/Health)	Microlearning interventions improve fertility knowledge and attitudes.	Iran
9.	(Allela & others, 2020)	Effectiveness of multimodal microlearning for in-service teacher training.	In-service Teacher *Training*.	Very effective. This study tested the multimodal *microlearning* model and showed its impact in improving ***Learning Outcomes*** and ***Self-efficacy*** in participants.	Kenya
10.	(Zhu & others, 2024)	Optimizing cognitive load and learning adaptability with adaptive microlearning for in-service personnel	Profesional (In-service Personnel)	**Optimizing** *cognitive load* for adaptive understanding.	China
11.	(Yendra & others, 2024)	Mobile Multimedia Based-Microlearning and Assessment on Calculus to Improve Student Mathematical Understanding	Higher Education (Calculus Students)	Mobile multimedia *microlearning improves* Mathematical Comprehension**.**	Indonesia

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No.	Citation (Author, Year)	Full Title of Scientific Article	Education Level / Research Object	A Brief Review of Effectiveness for Comprehension	Country of Origin
12.	(Ingram Nissen et al., 2024)	Microlearning: Evidence-based education that is effective for busy professionals and short attention spans	Professional (Konselor Genetik)	Evidence that *microlearning* **is effective** for busy professionals (*universal learners*).	USA
13.	(Nowak et al., 2023)	Microlearning activities improve student comprehension of difficult concepts and performance in a biochemistry course	Higher Education (Biochemistry)	Microlearning activities *increase the* comprehension *of difficult concepts.*	USA
14.	(Fitri Kholidya et al., 2023)	The Influence of Microlearning-Based Online Learning Materials to Improve Learning Outcomes for Curriculum Evaluation and Development Courses	Higher Education (Students)	*Online Learning Materials* based on *microlearning* improve **Learning Outcomes**.	Indonesia
15.	(Ghafar & others, 2023)	Microlearning as a learning tool for teaching and learning in acquiring language: Applications, advantages, and influences on the language	Tertiary/Secondary Education (Language Learners)	Affect language acquisition *and comprehension*.	Canada
16.	(Ichiuji et al., 2022)	The Effect of a Microlearning Module on Knowledge Acquisition in Surgery Clerkship Students	Higher Education (Clinical/Medical)	The *microlearning* module improves Knowledge Acquisition.	USA
17.	(Scott, 2022)	The Effectiveness of the Video-Assisted Microlearning Learning Model on the Ability to Understand Mathematical Concepts of Grade VII Students of	Secondary Education (SMP)	The *video-assisted* microlearning model **is effective in improving understanding of** mathematical concepts.	Indonesia

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No.	Citation (Author, Year)	Full Title of Scientific Article	Education Level / Research Object	A Brief Review of Effectiveness for Comprehension	Country of Origin
		SMPN 5 Air Putih FY 2022/2023			
18.	(Yin & others, 2021)	Conversation technology with micro-learning: The impact of chatbot-based learning on students' learning motivation and performance	Higher Education (Students)	The impact *of chatbot-based microlearning* on **performance** and motivation.	Singapore

The implications of these findings for pedagogical practice and digital content development are profound. The application of *Microlearning* should no longer be seen as a mere media option, but rather as an instructional strategy driven by cognitive data.

Future research should focus on: (1) Differential Effect Testing, i.e. comparing the effectiveness of *Microlearning* on different types of Understanding (Conceptual vs. Procedural) and population (Adolescent vs. Professional); (2) Longer Longitudinal Design to validate Retention; and (3) Integration of Adaptive Technologies (such as AI) to personalize micro content to achieve maximum Cognitive Load optimization. With this focus, scientific contributions can shift from simply validating (Zhu & others, 2024) (Liew et al., 2023) *microlearning* to setting guidelines for the implementation of *best practices* globally.

Given the findings of this literature review that underscore the effectiveness of *Microlearning* in the Universal Learner population, future research efforts need to shift the focus from existence validation to exploration of moderator variables and contextual mechanisms to improve scientific acumen.

Research colleagues are advised to strategically narrow the scope of demographic or cognitive studies—instead of maintaining broad generalizations. Focus should be directed on testing the differential effects of *Microlearning* on specific groups of learners (e.g., Graduate Professionals vs. Elementary School Students) or on specific types of Understanding (e.g., Procedural Comprehension vs. Conceptual Comprehension). This approach will make a sharper contribution to the literature on the cognitive mechanisms of *microlearning*.

Methodologically, it is crucial to adopt an extended longitudinal study design (e.g., Comprehension retention testing for 6-12 months). This is needed to provide stronger evidence of the success of sustainable knowledge transfer, not just instant knowledge acquisition (*immediate post-test gain*). In addition, further research should explicitly include comparative analysis of inter-cultural and educational system contexts, so as to identify the extent to which the effectiveness of *Microlearning* is influenced by contextual variables and local pedagogical practices.

CONCLUSION

This literature review emphatically concludes that Microlearning is a very effective instructional strategy in improving Student Understanding in the learning process, especially in the midst of the challenges of attention fragmentation and the need for efficiency in the digital era. This effectiveness, which was proven to be consistent in the 18 qualified scientific journals reviewed, suggests that this approach is an essential and adaptive pedagogical solution to the cognitive profile of modern learners.

The fundamental success of *Microlearning* lies in its ability to optimize the thinking process through *Cognitive Load* manipulation. Scientifically, it has been shown to reduce *Extraneous Cognitive Load* by breaking down complex

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matter into *bite-sized units* that are easy to digest. The liberated learner's mental capacity is then maximally diverted to the Germane Cognitive Load for the construction of a true Comprehension scheme. This confirmation of success crosses various levels of education, validating its efficacy for Universal Students (students, students, and professionals). Furthermore, the study confirms that multimodal and interactive designs—such as *micro-videos* and *quiz-based learning*—encourage *Active Engagement* and *retrieval practices*, which significantly strengthen long-term knowledge retention.

Although this review provides a strong theoretical foundation, future empirical research is strongly recommended to adopt a longitudinal study design to validate the retention of Comprehension over a longer period of time. In addition, an in-depth exploration of moderator variables (such as the type of Understanding and cultural context) is needed to establish guidelines for the implementation of *Microlearning* that is more personalized and optimal.

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