



Microlearning: Integrating Psychology, Technology and Pedagogical Innovation

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Abstract

Microlearning has emerged as an innovative instructional approach that responds to the changing needs of modern learners. Defined by the delivery of short, targeted content modules, typically between two and ten minutes in length, microlearning supports flexible, accessible, and learner-centered engagement. This paper critically examines the theoretical foundations of microlearning, drawing on cognitive load theory, information processing models, and adult learning principles. It explores practical applications in school education, teacher professional development, and corporate training, supported by empirical research and documented case studies. While microlearning offers several advantages, including improved retention, increased learner engagement, and mobile compatibility, it also presents notable challenges. These include the risk of content fragmentation, limited personalization, superficial engagement, and ethical considerations related to digital delivery. The paper concludes with recommendations for educators and policymakers to implement microlearning effectively as part of comprehensive instructional strategies. Although not a substitute for all forms of learning, microlearning serves as a scalable and impactful complement to traditional educational practices in today's increasingly digital learning environment.

Keywords: Microlearning, digital pedagogy, cognitive load theory, mobile learning, instructional design, adult education, personalized learning, teacher training, educational technology, learner engagement

Introduction

In the rapidly evolving field of education in the 21st century, the demand for learner-centric, flexible, and cognitively efficient instructional approaches has intensified. Among the most significant innovations addressing this need is microlearning, a strategy that delivers educational content in brief, focused segments, typically lasting between 2 to 10 minutes. These modules are designed to target a single learning outcome, fostering quick comprehension, immediate applicability, and sustained engagement. Microlearning represents a shift from traditional content-heavy instruction to streamlined, on-demand, and adaptive learning experiences.

The widespread proliferation of mobile technology and high-speed internet has created unprecedented opportunities for educational access. According to the *Pew Research Center* (2021), 85 percent of adults in the United States own smartphones, a sharp increase from 35 percent in 2011. In India, a *Statista* (2023) ^[18] report revealed that mobile internet users are projected to exceed 900 million by 2025. This expansion has created an infrastructure conducive to digital learning, with a strong preference for content formats that are mobile-compatible, brief, engaging, and accessible. These qualities are integral to microlearning.

This growing demand for microlearning coincides with rising concern over diminishing attention spans, particularly among digital-native learners. A report by Microsoft Canada (2015) indicated that the average human attention span had dropped from 12 seconds in 2000 to 8 seconds in 2013, which was largely attributed to the influence of digital devices and multitasking behavior. While this statistic has been debated in academic circles, it highlights a broader truth. Learners are more likely to disengage from lengthy, passive instruction and instead seek brief, interactive learning experiences that provide instant value.

Microlearning aligns well with cognitive and psychological principles. For example, Miller's Law (1956) suggests that

the average person can retain only 7 ± 2 items in short-term memory. Microlearning addresses this limitation by breaking content into smaller, manageable segments that reduce cognitive overload. In addition, it counters Ebbinghaus' Forgetting Curve through spaced repetition and timely reinforcement. These strategies are known to enhance knowledge retention and long-term memory consolidation, making microlearning both a practical and scientifically grounded instructional method.

The global disruption of education caused by the COVID-19 pandemic further accelerated the adoption of microlearning practices. According to UNESCO (2021) ^[22], more than 1.6 billion learners in over 190 countries were affected by school closures. This led schools and universities to explore alternative modes of delivery, including remote, digital, and blended learning. In India, popular educational technology platforms such as Byju's and Toppr reported a 60 to 80 percent increase in user engagement during this period, with students often spending 30 to 45 minutes daily on app-based learning that was typically structured in short, interactive sessions (Times of India, 2021) ^[20]. Teachers across various educational levels responded by creating short instructional videos, digital quizzes, and mobile-based tasks that supported academic continuity and learner engagement.

Microlearning is also making a significant impact on adult learning and professional development. A report by Deloitte (2020) ^[5] indicated that 94 percent of employees are more likely to remain at organizations that invest in learning and development. Platforms such as LinkedIn Learning and Coursera for Business have successfully implemented microlearning strategies to facilitate upskilling and reskilling. A study by the Training Industry Group (2022) ^[21] found that microlearning can improve knowledge retention by up to 20 percent compared to traditional instruction, making it a preferred strategy in corporate training and continuing education.

Furthermore, microlearning contributes to inclusive and equitable education. Its adaptability to various formats, ability to support different learning styles, and suitability for asynchronous learning make it accessible to students with special needs, those in rural or remote areas, and learners balancing multiple responsibilities. By allowing users to control the pace, timing, and sequence of learning, microlearning promotes learner autonomy and self-regulated learning.

Microlearning is more than a response to digital convenience. It is a research-supported, psychologically informed, and technologically empowered instructional model. As education systems continue to adapt to changing societal demands and the integration of new tools and platforms, microlearning offers a scalable and sustainable approach that fosters engagement, improves retention, and supports continuous learning for students, educators, and professionals alike.

Theoretical Foundations

The pedagogical strength of microlearning is underpinned by well-established theories in psychology and education that explain how individuals acquire, retain, and apply knowledge. Its effectiveness is not merely the result of technological convenience, but a reflection of how learning actually occurs in the human brain. By drawing on cognitive, behavioral, and constructivist frameworks, microlearning aligns with the fundamental principles of human learning and memory.

- **Cognitive Load Theory:** One of the most influential frameworks supporting microlearning is Cognitive Load Theory (Sweller, 1988)^[19], which emphasizes that the human working memory has a limited capacity. When instructional material is too dense or complex, it can overwhelm cognitive resources, leading to reduced comprehension and retention. Microlearning addresses this challenge by breaking content into small, focused units, thereby minimizing extraneous load and enhancing germane processing i.e. the mental effort devoted to understanding and integrating new information. This chunking of content enables learners to focus on one concept at a time, reducing cognitive fatigue and improving learning efficiency.
- **Information Processing Theory:** The Information Processing Model (Atkinson & Shiffrin, 1968)^[1] outlines how information moves through stages: from sensory memory to short-term memory, and ultimately to long-term memory. For learning to be effective, information must be rehearsed and meaningfully encoded. Microlearning promotes these processes by encouraging frequent exposure to concise content, supported by active recall and spaced repetition, both of which are known to strengthen memory consolidation. In this context, microlearning serves as an ideal format for reinforcing key concepts over time, reducing the rate of forgetting as outlined in Ebbinghaus' Forgetting Curve (1885)^[7].
- **Behaviorist Principles and Reinforcement:** Microlearning also draws on principles of behaviorism, particularly the work of B.F. Skinner and Edward Thorndike, which emphasize the role of stimulus-response patterns, repetition, and reinforcement in

learning. Many microlearning modules incorporate immediate feedback, quizzes, and gamified elements to reinforce correct responses and encourage continued engagement. This format is especially effective for developing procedural knowledge and foundational skills, where consistent reinforcement leads to stronger retention and task mastery.

- **Constructivist Learning Theory:** From a constructivist perspective, learning is an active, contextualized process in which individuals construct new knowledge based on prior understanding and real-world experience. Microlearning supports this approach by offering learners autonomy and choice in how they engage with content. Learners can revisit modules, select topics relevant to their immediate needs, and apply knowledge in authentic contexts. The approach resonates with Vygotsky's concept of scaffolding and Piaget's model of incremental learning, both of which emphasize the importance of building knowledge progressively and in relation to learners' cognitive development.
- **Andragogy and Adult Learning Principles** Microlearning is particularly well-suited to adult learners, aligning with Malcolm Knowles' theory of andragogy. According to Knowles (1984)^[13], adults are self-directed, goal-oriented, and motivated to learn when content is relevant to their personal or professional lives. Microlearning caters to these preferences by delivering just-in-time learning that is brief, contextual, and applicable to real-world problems. This approach enhances engagement and allows adult learners to integrate new knowledge into their existing cognitive frameworks without disruption to their daily routines.
- **Alignment with Modern Learner Preferences** Contemporary learners especially those immersed in digital environments exhibit distinct behavioral patterns that further justify the adoption of microlearning. Learners today expect content that is mobile-accessible, on-demand, and highly interactive. A study published in the *International Journal of Educational Technology* (2021)^[9, 10] found that over 70 percent of university students preferred learning through short, focused segments rather than traditional long-form instruction. Microlearning not only caters to these preferences but also aligns with the digital habits formed through social media, video streaming, and app-based engagement. It supports learning in brief moments throughout the day, promoting continuity without demanding extended periods of concentration.

Implementation in Educational Settings

The application of microlearning in education has expanded significantly beyond corporate training and professional upskilling. Its brevity, adaptability, and alignment with cognitive principles make it a compelling instructional strategy for both school education and teacher professional development. When implemented thoughtfully, microlearning enhances engagement, supports differentiated instruction, and enables continuous learning in both synchronous and asynchronous environments.

Application in School Education: In primary and secondary classrooms, microlearning is being used to complement and reinforce traditional teaching methods. Educators increasingly rely on short videos, concept animations, flashcards, interactive quizzes, and micro-assessment tools to break down complex content into digestible parts. This approach is particularly effective in subjects that require frequent practice and conceptual clarity, such as mathematics, science, and grammar. Platforms like Khan Academy, Byju's, and Toppr offer curriculum-aligned microlearning resources that are used by students during lessons, as homework supplements, or for independent revision. The use of such resources supports personalized learning, allowing students to revisit concepts as needed and progress at their own pace. Additionally, microlearning fosters inclusivity, as its modular design can be adapted for students with varying cognitive and learning needs, including learners with attention-deficit disorders or specific learning disabilities.

Teacher Education and Professional Development

Microlearning is proving to be a powerful tool for teacher training and continuing professional development (CPD). Rather than attending lengthy in-service sessions, teachers can engage with short, focused learning units tailored to specific competencies, such as integrating technology, implementing formative assessments, or applying differentiated instructional strategies. Professional learning platforms such as Swayam, Coursera, and Teachmint increasingly offer microlearning modules in the form of video tutorials, podcasts, infographics, and interactive scenarios. These formats support just-in-time learning, enabling teachers to access resources when confronted with practical classroom challenges. A study published in the *Journal of Educational Change* (2022) ^[12] reported that teachers who engaged in microlearning-based CPD experienced higher satisfaction and retention of skills compared to those in traditional training formats, especially when content was linked to real-world teaching contexts.

Use in E-Learning Platforms and Mobile Applications

The integration of microlearning into digital platforms has revolutionized content delivery in both formal and informal education. Tools such as Google Classroom, Edmodo, Moodle, Quizizz, and Nearpod enable educators to design and assign short, interactive lessons with embedded assessments. These platforms allow students to engage with content asynchronously and track their own progress through feedback and performance analytics. Mobile applications also play a significant role in expanding the reach of microlearning. Apps like Duolingo (language learning), Photomath (problem-solving), and YouTube Shorts for Education offer content in bite-sized formats that are optimized for smartphones. A report by *Statista* (2023) ^[18] indicated that over 70 percent of students worldwide access educational content through mobile devices, highlighting the potential of mobile-friendly microlearning to reach learners regardless of geographical or socio-economic barriers.

Support for Blended and Remote Learning Environments:

Microlearning has shown particular value in blended and remote learning settings, especially during the COVID-19 pandemic when traditional schooling was

severely disrupted. According to UNESCO (2021) ^[22], over 1.6 billion learners were affected globally, prompting educators to explore alternative instructional models. Microlearning emerged as a solution to address screen fatigue, loss of motivation, and reduced engagement associated with prolonged online sessions. Educators responded by developing short, focused video lessons, distributing them via platforms like WhatsApp, Telegram, and YouTube, and supplementing them with brief quizzes or reflection tasks. This approach proved effective in maintaining academic continuity while respecting learners' varied home environments and access to digital infrastructure. As a result, microlearning became a sustainable strategy for asynchronous learning, supporting learners who needed flexibility in time and pace due to household responsibilities or internet constraints. Microlearning application ranges from classroom instruction and teacher development to mobile-based learning and remote access, offering a scalable, inclusive, and cognitively sound model of instruction. When embedded within well-structured pedagogical frameworks, microlearning enhances the reach and relevance of education in both formal schooling and lifelong learning contexts.

Benefits of Microlearning

Microlearning offers a variety of advantages that enhance the teaching and learning process across educational settings. Grounded in cognitive science and supported by instructional design principles, microlearning is particularly effective for diverse learners in both formal education and professional development contexts. The following key benefits demonstrate why microlearning is increasingly favored by educators, learners, and organizations worldwide.

Improved Retention and Memory Consolidation

One of the most significant cognitive advantages of microlearning is its ability to enhance long-term retention. The delivery of content in small, manageable units helps reduce cognitive overload and supports the transfer of information from short-term to long-term memory. A study published in the *Journal of Applied Psychology* (2017) ^[11] found that learners retained up to 20 percent more information when content was presented in short segments compared to traditional formats. Microlearning also reinforces memory through techniques such as spaced repetition and active recall. By encouraging learners to engage with content multiple times in short bursts, it counters the effects of forgetting, as described in Ebbinghaus' Forgetting Curve. This leads to stronger neural encoding and more durable learning outcomes.

Increased Engagement and Motivation

Microlearning is well-suited to the behavioral patterns of contemporary learners who often struggle to maintain attention during long instructional sessions. Its short and focused nature holds attention more effectively and promotes consistent engagement. *The International Journal of Educational Technology in Higher Education* (2021) ^[9, 10] reported that student engagement significantly increased when lessons were kept under ten minutes and included multimedia or interactive components. Additionally, gamified features such as quizzes, badges, leaderboards, and progress trackers contribute to learner motivation. These

elements provide immediate feedback and a sense of accomplishment, reinforcing positive learning behaviors. This aligns with Skinner's theory of operant conditioning, which emphasizes the role of reinforcement in learning.

Flexibility and Accessibility

Microlearning offers flexibility in how, when, and where learning occurs. Learners can access content using various devices such as smartphones, tablets, or computers, making it possible to learn in short intervals throughout the day. This convenience is particularly valuable for working professionals, adult learners, and students with competing responsibilities. Its compatibility with mobile devices also supports accessibility in rural or low-resource environments. According to a *UNESCO ICT in Education* report (2022)^[23], mobile-based microlearning has played a key role in supporting education continuity in areas with limited internet infrastructure. Short, low-bandwidth content allows learners to engage with material despite technological constraints.

Support for Inclusive and Personalized Learning

Microlearning supports inclusive education by accommodating diverse learning needs and preferences. Its modular structure and customizable pathways allow learners to select content based on their interests, proficiency level, or pace of learning. This makes microlearning highly adaptable for differentiated instruction. For learners with special needs, attention difficulties, or learning disabilities, the short duration and focused objectives reduce cognitive stress and enhance clarity. Microlearning aligns with Universal Design for Learning (UDL) principles by offering multiple means of representation, engagement, and expression. For example, concepts can be delivered through visual, auditory, and text-based formats, and assessments can include interactive or creative response options.

Suitability for Hybrid and Online Learning Environments

Microlearning is highly compatible with digital education models such as blended, hybrid, and fully online learning. It can be delivered asynchronously through platforms like Moodle, Google Classroom, or Microsoft Teams, and incorporated into synchronous sessions to reinforce or preview concepts. Educators often use short video lessons, micro-quizzes, and flashcards as part of flipped classroom models or formative assessment strategies. In professional settings, platforms such as Coursera for Business and LinkedIn Learning use microlearning to upskill employees efficiently. According to a 2022 report by Training Industry, microlearning modules lasting between five to seven minutes led to higher completion and application rates than longer instructional formats. This demonstrates its effectiveness in supporting both foundational knowledge and just-in-time learning.

Microlearning enhances learning by improving retention, increasing engagement, providing flexible access, supporting inclusion, and adapting to modern instructional environments. These benefits, grounded in both research and practice, make microlearning a valuable and sustainable approach for educators, institutions, and learners across age groups and educational contexts.

Challenges and Limitations

While microlearning has demonstrated significant promise in enhancing learner engagement, retention, and accessibility, it also presents notable limitations that must be critically examined. These challenges pertain to content depth, instructional coherence, technological dependency, and ethical design. A thoughtful approach is necessary to ensure that the adoption of microlearning does not compromise educational quality or equity.

Inadequacy for Complex and Higher-Order Learning

Microlearning is best suited for reinforcing basic concepts, delivering factual content, or providing procedural guidance. However, it is often insufficient for teaching complex ideas that require critical thinking, synthesis, and reflective inquiry. Subjects that demand deep understanding, such as philosophical reasoning, abstract mathematics, or scientific research methods, benefit from sustained engagement and extended instructional time.

Therefore, microlearning should be positioned as a complementary tool rather than a standalone solution. It can support preliminary understanding or revision but should be integrated within broader pedagogical models that facilitate deep learning.

Fragmentation of Content and Learning Gaps

The modular nature of microlearning, while flexible, may lead to a fragmented understanding of subject matter. Learners who access content non-sequentially or without sufficient scaffolding may struggle to perceive the connections between concepts. This is particularly problematic in disciplines that rely on cumulative knowledge structures.

To mitigate this risk, educators should organize microlearning units within clearly defined learning pathways. Structured sequencing, cumulative assessments, and periodic synthesis tasks can help students consolidate fragmented content into a coherent body of knowledge.

Limited Personalization and Algorithmic Shortcomings

Although microlearning platforms often advertise adaptive features, many fail to offer true personalization. Learners with varying backgrounds, prior knowledge, or cognitive needs may receive uniform content that does not align with their individual learning trajectories. In some cases, reliance on algorithm-based recommendations can reinforce content bubbles or overlook learners who require alternative approaches.

Improving personalization involves incorporating learner diagnostics, offering branching scenarios based on performance, and allowing for customizable pacing. Equitable access to personalized microlearning also requires careful attention to content inclusivity and language diversity.

Dependency on Technology and Infrastructure

Microlearning typically requires reliable internet access, digital devices, and familiarity with technological tools. In low-resource environments or among learners with limited digital literacy, these requirements create barriers to participation. According to UNESCO (2022)^[23], millions of students globally remain excluded from digital education due to inadequate infrastructure or connectivity.

To ensure equitable access, institutions must prioritize investments in digital infrastructure and develop offline-accessible versions of microlearning modules. In addition, capacity-building programs for both educators and learners are essential to support meaningful engagement with digital learning environments.

Risk of Superficial Engagement

The brevity and self-contained nature of microlearning can lead to surface-level engagement. Learners may focus on completing tasks quickly rather than understanding the underlying principles or reflecting on their applications. This trend is exacerbated when content is consumed passively or without opportunities for deeper interaction.

To address this limitation, microlearning should be accompanied by reflective prompts, follow-up discussions, or application-based tasks. Integrating formative assessments and encouraging metacognitive awareness can also promote deeper processing of content.

Ethical and Pedagogical Considerations

The increasing resemblance of microlearning content to social media formats raises ethical and pedagogical concerns. While short videos and gamified elements may boost engagement, there is a risk that educational content will prioritize entertainment value over instructional integrity. Additionally, the commercial pressure to produce attention-grabbing materials may result in oversimplification or distortion of complex topics.

Ethical microlearning design must balance appeal with academic rigor. Content creators should ensure that modules are grounded in sound pedagogy, culturally responsive, and designed to promote sustained learning rather than passive consumption.

Microlearning is a valuable instructional tool with wide-ranging benefits, but its limitations require careful management. Effective implementation demands thoughtful instructional design, equitable access, and integration within broader educational frameworks. By recognizing and addressing these challenges, educators and institutions can harness microlearning's potential without compromising the depth, inclusivity, or integrity of the learning experience.

Conclusion and Recommendations

Microlearning has emerged as a dynamic instructional strategy that aligns with the evolving demands of contemporary education. Rooted in cognitive and behavioral learning theories, and enabled by advancements in technology, microlearning offers an efficient, accessible, and learner-centered approach to education. Its capacity to deliver content in short, focused segments makes it particularly effective for enhancing engagement, promoting retention, and supporting flexible learning pathways.

As demonstrated through theoretical analysis, microlearning is well-suited for a wide range of contexts, including school education, higher education, teacher professional development, and workforce training. Its compatibility with mobile platforms and asynchronous learning environments extends its reach to diverse populations, including remote and underserved communities. However, it is essential to acknowledge that microlearning is not a comprehensive solution for all instructional needs. Complex learning tasks, critical thinking development, and in-depth conceptual

understanding require complementary methods and sustained instructional design.

Microlearning contributes significantly to modern teaching and learning by promoting autonomy, responsiveness, and scalability. It offers immediate applicability, particularly for just-in-time learning and reinforcement of core skills. When embedded within broader instructional frameworks, microlearning enhances the overall quality of learning experiences by catering to varied learner needs, time constraints, and technological preferences.

Recommendations for Educators and Institutions

To ensure effective implementation of microlearning, the following recommendations are proposed:

- **Embed microlearning within blended learning models:** to balance short, focused modules with longer, inquiry-based and collaborative learning activities.
- **Design content with clarity, relevance, and structure:** ensuring that each module addresses a specific learning objective and is part of a cohesive learning sequence.
- **Utilize microlearning for formative assessment, skill reinforcement, and review:** especially in subjects that benefit from repetition and practice, such as mathematics, language, and science.
- **Adopt mobile-friendly and low-bandwidth solutions** to maximize accessibility for learners across varied geographic and socio-economic contexts.
- **Invest in training educators and content developers** to create engaging, evidence-based microlearning materials that are pedagogically sound and technologically effective.

Microlearning offers a flexible and evidence-informed approach to education that aligns with the cognitive, behavioral, and technological realities of modern learners. When integrated thoughtfully into broader instructional strategies, it can enhance learning efficiency, increase engagement, and promote equitable access to education. Continued innovation and research in this field will further define its role in shaping the future of teaching and learning.

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