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Microlearning: The "OG" or Hot New Trend?

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Noteworthy events and innovations highlight the development of microlearning into one of the fastest-growing educational trends today.

OG [noun, slang]: *someone or something that is an original or originator and especially one that is highly respected or regarded* —**Merriam-Webster**⧉

Microlearning is one of the fastest-growing educational trends today, yet it is not a new concept. According to one source, it may be one of the oldest forms of learning, invented the moment people started to share information.[1] The earliest examples of microlearning include scratched or carved symbols and drawings—on bone, stone, and wood—that passed on basic survival techniques such as how to start a fire, gather food, escape from the elements and enemies, and discover which plants or berries to avoid.[2] The concept of microlearning spread like wildfire during the Late Middle Ages (AD 1300 to 1500) as reading and writing became more widespread. But it wasn't until the era of the World Wide Web in the mid-1990s, paired with the rapid growth of social media and the widespread adoption of smartphones, that microlearning was

able to reach the masses. Today, the popularity of microlearning as an instructional/training technique has escalated to a global scale and, based on recent estimates, has a promising future. Consider the following statistics:

- In a 2017 survey, 79% of organizations were currently using (38%) or planning to begin using (41%) microlearning to support their employees.

- In 2018, microlearning accounted for 60.7% of all e-learning.

- In 2020, microlearning adoption grew by 40% during the COVID-19 pandemic.

- According to one prediction, mobile learning will become the microlearning mode of choice by 2025.[3]

Considering its origins and longevity throughout human history, one could argue that microlearning is the "OG," an original that is becoming more widely accepted and respected in the education and talent-development industries.

Origins, Milestones, and Trends in Microlearning

Over time, multiple technological, conceptual, and theoretical innovations have emerged to advance the theory and practice of microlearning to where it stands today. Attempting to provide a comprehensive history of microlearning by somehow untangling it from *e-learning*, and *learning* in general, would be an ambitious undertaking beyond the scope of this article, since these concepts are inextricably intertwined. Thus, we will focus

here on highlighting noteworthy events and innovations that are specific to microlearning.

1880s

In 1885, research by the German psychologist Hermann Ebbinghaus led to his *Forgetting Curve.* This core concept of microlearning design helps to explain how people lose up to 50% of what they learn within an hour and up to 80% within a matter of days or weeks. Despite the dramatic drop in knowledge retention after relatively short periods of time, Ebbinghaus observed that through *spaced repetition*, a technique whereby relevant information is reviewed at spaced intervals, memory loss could be dramatically reduced. This helped set the stage for instructional solutions that were designed to promote longer-term knowledge retention.[4]

1950s

Programmed learning, championed by the behavioral psychologist B. F. Skinner in the mid-1950s, is "characterized by self-paced, self-administered instruction presented in logical sequence and with much repetition of concepts." It is based on the theory that "learning in many areas is best accomplished by small, incremental steps with immediate reinforcement, or reward, for the learner."[5] In much the same way, microlearning is a skills-based approach that involves the learning of new information in bite-sized, highly focused lessons or modules that are designed to inform, teach, or boost knowledge acquisition or retention. Microlessons are typically self-paced, and usually self-initiated, but they can be part of a programmed instructional sequence. The significance of programmed

learning (also known as programmed instruction) to microlearning is that it is a "self-teaching method" designed to "allow individual learners to proceed at their own pace, mastering a body of knowledge through small steps."[6]

1956

Miller's Law, developed by the cognitive psychologist George A. Miller, posited that humans can hold about seven, plus or minus two, items of information in working memory. While Miller's 1956 blockbuster article "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," is one of the most widely cited articles in the cognitive and psychological sciences, Nelson Cowan has argued that it may have "inadvertently stymied progress" on research related to "item capacity limits in working memory"—until the surge of research on visual working memory beginning in the late 1990s. Cowan further posited that perhaps the most significant contribution of Miller's article to the theory and practice of microlearning was the concept of *chunking*, or the grouping of information into smaller, digestible units of information.[7] Today, research on the limits of working memory in the context of e-learning and multimedia design is ongoing. The research on working memory also has implications for the design and development of web-based and multimedia-based microlessons.

1960s

The Economics of Human Resources (1963), by Héctor Correa, is considered to be the first publication to use the term *microlearning*. According to Google Books, the book provides a

"systematic analysis and measurement to the study of the interrelation of human variables--as considered in sociology, demography, psychology, nutrition, health, and educational sciences." In the book, Correa addressed the concept of "micro-learning" in the context of the study of the production of education:

> The production function of education postulated to exist has frequently been used by psychologists and educators. It is known to them by the name of learning curves. In economic terminology, these learning curves may be said to refer to a micro level of aggregation. The simplest examples of a micro-learning curve refer to a simple skill, such as a manual operation, and how a person learns such an operation when he is taught how to perform it.

Although the book focused on the economics of education, Correa observed that with regard to microlearning, an "interesting application may be made of the methods of economic theory to the determination of optimum learning time," suggesting that when someone is learning a skill, "several aptitudes are involved, and for each of these full capacity is reached at a different moment during the learning process" when time is considered as the variable.[8]

In 1968, Dwight W. Allen and his colleague Arthur W. Eve published an article about a teaching technique that Allen had developed while a professor at Stanford and that he dubbed *microteaching.* He used the technique, whereby students took turns teaching 10-minute lessons to each other, for training preservice and in-service teachers. The microlessons were videotaped, and feedback was provided. After reviewing the

video and reflecting on suggestions and comments from the class, students would reteach a revised version of the lesson.[9] Though the process has evolved through a host of technological advancements over the years, including virtual reality and simulated reality technologies, a version of microteaching is still in practice in many teacher-preparation programs today.

1990s

Prior to 1990, the internet was generally the realm of scientists and computer/tech enthusiasts. Communication consisted of mostly text-based messages posted on bulletin board system (BBS) networks. Then in 1990, Tim Berners-Lee, a computer scientist at the European Organization for Nuclear Research (known as CERN), "added an exciting hypertext and multimedia layer to the Internet and called it the *World Wide Web*," thereby making the internet accessible to mainstream society. In 1993, the National Center for Supercomputing Applications (NCSA) at the University of Illinois released Mosaic, one of the first user-friendly web browsers. It provided a fun and easy way to navigate the web, with an immediate impact on the growth of the web. By the end of 1994, the web had more than 10,000 servers and 10 million users. In that same year, the first International World Wide Web conference was held at CERN in Switzerland. 1994 was proclaimed the "Year of the Web."[10]

Over the next few years, popular use and growth of the internet made e-learning possible, revolutionizing how people learn. The 1990s became the era of the learning management system (LMS) and online "universities."[11] Today, nearly all microlearning is delivered via online learning.

Meanwhile, the advent of search engines for the web in the late 1990s made searching for any information fast, effortless, and fun. The first popular search engines were Yahoo! Search and AltaVista, both released in 1995, followed by others including Ask Jeeves (now Ask.com), Google, and MSN Search (now Bing).

By 2020, due to its advanced search algorithms and simple, unassuming interface, Google ascended to the head of the search engine pack, making the phrase "*Google it*" a household term. Today, nearly all of the world's published information is available at our fingertips, allowing anyone, anywhere to use a search engine on a computer or mobile device to access quick answers to burning questions. According to DataReportal's *Digital 2021: Global Overview Report*, of the 4.66 billion global internet users in January 2021, 98% use a search engine at least once per month. Google's internet search traffic alone accounts for more than 90 percent of the global search market. [12]

2001

Wikipedia was founded by Jimmy Wales and Larry Sanger on January 15, 2001, as a free, crowdsourced, online encyclopedia built on a wiki platform to enable people to collaboratively create, edit, and manage content. Its popularity grew quickly, and within two months, it expanded internationally with the first non-English subdomain. In January 2021, on its 20-year anniversary, the English Wikipedia reached one billion edits. Despite its growing popularity, Wikipedia's reputation became tarnished through controversy due to uneven or flawed coverage of some topics. By 2006, educators and politicians

were calling for its ban in K-12 and higher education, deeming it dangerous and untrustworthy. Yet a 2010 report, *How College Students Evaluate and Use Information in the Digital Age*, found that Wikipedia remained popular among students of all ages, with nearly 75% reporting that they used Wikipedia for research. Today, many educators are beginning to change their attitudes about Wikipedia and consider it a valuable tool for teaching digital literacy, understanding the peer-review process, and critically analyzing the credibility of online sources. With over 60 million articles and counting, Wikipedia is one of the most referenced sites on the web. When people do a quick online search for a topic, Wikipedia is usually the top result, making it ideal for self-directed learning.[13]

2004

Facebook was initially founded by Mark Zuckerberg, a Harvard University sophomore, on February 4, 2004, as a social media platform for connecting Harvard students with one another. It quickly outgrew its original purpose to become one of the most influential social media platforms in history. As the "go-to social media site for a generation of internet users," Facebook became one of the "major forces" to bring the internet into the "highly-participatory phase full of user-generated content" we know today as Web 2.0. Accordingly, it didn't take long for Facebook to find its way into formal education and professional development settings as a medium for establishing social networks among learners and peers to promote personalized, self-directed, and collaborative learning opportunities. Its ubiquity as a media-rich social platform that supports text, graphics, audio, video, and threaded conversations positions Facebook as an obvious choice for sharing microcontent

through small, well-defined messages. Today, many microlearning service providers offer social media integration with spaced repetition as an important feature of their products for anytime, anywhere mobile learning.[14]

2005

While the terms *microlearning* and *microteaching* date back to the 1960s, it was not until 2005 that the concept of microlearning within the context of e-learning was popularized by Theo Hug, through "Microlearning: A New Pedagogical Challenge (Introductory Note)," presented at the world's first conference on microlearning held June 23–24, 2005, in Innsbruck, Austria. In his introductory note, Hug provided a justification for the conference as a "starting point" for discussions of "microlearning, microcontent, and microknowledge," which he characterized as "bits and pieces from different discourses and practices." He continued: "We are going to explore the field, figure out crucial topics, present work in progress and sound out the situation and perspectives of learning and living in mediated environments." A few years later, in his 2007 "Outline of a Microlearning Agenda," Hug attempted to define microlearning: "We advocate speaking of microlearning in terms of special moments or episodes of learning while dealing with specific tasks or content, and engaging in small but conscious steps. These moments, episodes and processes may vary depending on the pedagogies and media involved, but the measures of scale of the amount of time and content involved can be made fairly constant." For his contributions to the modern thinking on microlearning, Hug is regarded as one of the founders of modern thinking on microlearning.[15]

On February 14, 2005, frustrated by how hard it was to find and share videos online, three former PayPal employees—Chad Hurley, Steve Chen, and Jawed Karim—founded YouTube. As Hurley explained in an early interview, "People were collecting video clips on their cell phones . . . but there was no easy way to share." With the rapid adoption of smartphones and social media, YouTube took off. By September, the site had its first video with 1 million views. By July 2006, more than 65,000 new videos were being uploaded daily. Today, with over 2.6 billion active users and over 1 billion hours of content viewed daily, YouTube has become one the largest video-sharing platforms on the internet. And since videos exist for just about any subject imaginable, YouTube has become the go-to source for just-in-time learning by students and workers—in the classroom, at work, or while on the go. With the average length of videos coming in at about 11.7 minutes (as of December 2018), YouTube is also an ideal platform for microlearning.[16]

2006

Twitter was conceived by Jack Dorsey, Noah Glass, Biz Stone, and Evan Williams in 2006, as a "short message service (SMS) on which one could share small blog-like updates with friends." Founded as a public microsharing network for connecting, sharing, and discovering information delivered in 140-character byte-sized messages known as *tweets*, it grew quickly from 20,000 tweets per day in 2007 to over 500 million tweets today. With more than 400 million users, combined with the burgeoning e-learning and social learning trends, it was only a matter of time before Twitter and other social media services caught the eye of academicians and talent development personnel. Today, Twitter is advancing just-in-time learning and

networking as "its openness makes it a prime platform to support students as they join a wider conversation about a topic with people globally, which may include professionals and academics."[17] Even those with little or no social media experience are finding Twitter an appropriate social learning platform for informal and collaborative learning opportunities. And because of character limits (having increased from 140 to 280 characters in 2017), Twitter is an ideal platform for facilitating self-directed or programmed learning in small, spaced bites.

Driven by a primary objective of upholding free speech principles to the platform, which he claimed had been mismanaged, Elon Musk acquired Twitter on October 28, 2022. The chaotic transition resulted in 1.75 million users leaving the platform in November 2022. Since his acquisition, Musk's intentions for the platform have expanded, shifting toward a more ambitious goal of transforming Twitter into a super app resembling WeChat, with diverse functionalities that enable users to engage in a multitude of activities ranging from socializing with friends to purchasing groceries.[18] Toward that end, Musk rebranded Twitter as X on July 24, 2023. Despite the initial decline, Musk asserted in April 2023 that the count of daily active users was rebounding and totaled over 8 billion minutes of user engagement per day, which he declared a new record.[19]

2007

Perhaps the single most influential event to launch the modern era of microlearning was the release of the iconic iPhone on June 29, 2007. "Every generation or two, a technological

advancement is made that is so significant it radically changes the foundation, direction, and momentum of society."[20] Such was the case with the iPhone. Before the iPhone, smartphones were not very powerful or "smart." They typically had small LCD screens, a rudimentary operating system, and basic software for web browsing, taking photos and videos, and listening to music. Some had QWERTY-styled keyboards for text-messaging and email but not much else. Though not the first smartphone to have a large screen, the iPhone made an immediate impact, and the world has never been the same. In 2014, Matthew Jones wrote:

> It has made almost the entirety of the world's knowledge available at a moment's notice, reduced the time it takes to discover news and current events from days or even weeks to mere seconds, facilitated the ever-growing, central role of social media in our everyday lives, and spawned an industry worth $58.7 billion/year that employs 19 million people around the world.[21]

The iPhone transformed all smartphones. As of April 2023, there are roughly 6.92 billion smartphone users globally, roughly 86.29% of the world's population, with nearly 59.16% of website traffic coming from mobile devices.[22] With the rapid adoption of smartphones between 2007 and today, mobile learning and microlearning skyrocketed.

2008

Khan Academy, founded by Sal Khan in 2008, started out four years earlier as a side project for Khan to tutor his cousin in math remotely by phone. As the word spread, keeping up with

the demand for his tutoring services while holding down a full-time job became an issue. "He decided to begin recording videos and posting them on YouTube in 2006 so everyone could watch at their own pace. More and more people started watching, and Sal has been making videos ever since." Khan Academy has revolutionized the way students from around the world learn with free online educational materials. Free for students and teachers, Khan Academy "offers practice exercises, instructional videos, and a personalized learning dashboard that empower learners to study at their own pace in and outside of the classroom," in all subjects and test preparation from K-12 through early college. As of February 2023, videos on the Khan Academy YouTube channel have been viewed over 2 billion times by more than 7.74 million subscribers worldwide. With most videos under 5 minutes long, Khan Academy has become a go-to site for students and workers for accessing microcontent on almost any topic for just-in-time learning.[23]

Massive Open Online Courses, or MOOCs, which emerged in 2008, were built on the ideological principal of education for all. The first recorded course was "Connectivism and Connective Knowledge" (CCK08), developed by Stephen Downes and George Siemens. Launched at the University of Manitoba in Canada, the course attracted 25 students attending in-person classes and 2,300 online participants. The breakthrough for MOOCs came in 2011 when Sebastian Thrun and Peter Norvig offered the online course "Introduction to Artificial Intelligence" for free, enrolling over 160,000. The rapid expansion of MOOCs reached its pinnacle in 2012, earning the title of "The Year of the MOOC" by the *New York*

Times. Today, there are more than 150,000 courses from more than 1,200 colleges and universities around the world.[24]

Although the word *massive* might seem contradictory to the concept of microlearning, MOOCs and mircrolearning share many characteristics. *Massive* does not refer to the length of the course but rather to its potential to attract large audiences. When viewed in this context, MOOCs and microlearning align in terms of featuring open accessibility, catering to anyone online, and offering mass-scale learning, quick learning experiences, and optional resources rather than rigid, lengthy curriculums. According to the e-learning agency ELM: "MOOCs regularly make use of microlearning concepts like short videos, sharing via social media, and quizzes."[25]

2010

Although the Apple iPad, released on January 27, 2010, was not the first tablet to hit the market, it was the first with a touchscreen. Positioned as a distinct category between smartphones and laptops, the iPad excelled in web browsing, email, multimedia consumption, and gaming, making it an ideal tool for mobile learning. Subsequently, other tablets such as the Samsung Galaxy Tab, Motorola Xoom, HP TouchPad, and Amazon Kindle Fire emerged. The tablets market experienced significant growth driven by increasing demand from multiple sectors including health care, education, and entertainment. Tablet sales surged during the 2020 COVID-19 pandemic, and today there are over 1.28 billion tablet users worldwide.[26]

2011

Although the origins of cloud computing can be traced to the 1960s, the cloud gained traction in the mid-2000s with the launch of Amazon Web Services (AWS) and its scalable, cost-effective infrastructure in 2006. Over the next few years, tech companies such as Microsoft, IBM, and Google entered the market, further advancing cloud computing development and research. The year 2011 marked a significant milestone for cloud computing as the release of IBM's SmartCloud and Apple's iCloud propelled widespread adoption. Today, cloud computing is a widely adopted technology, offering benefits such as flexibility, scalability, cost-efficiency, availability, and improved accessibility to the storage and sharing of digital media, which when paired with mobile computing, enables seamless access to a variety of content, including microlearning content, from multiple devices, anytime, anywhere.[27]

2012

Learning analytics experienced increased recognition and implementation in education in the late 2010s, as pedagogic theory and advanced analytical strategies and technologies emphasized the use of analytics to enhance the learning process. In 2012, a turning point for learning analytics came when the NMC and EDUCAUSE *Horizon Report: 2012 Higher Education Edition* predicted its ubiquitous implementation in higher education within three years. At the same time, cloud hosting of the LMS increased educators' access to data.[28] Today, in the context of microlearning, learning analytics can be used to inform instructional design, personalize learning experiences, and improve educational outcomes. It can play an important role in collecting and analyzing learners' data, tracking performance, providing adaptive recommendations,

evaluating content effectiveness, measuring engagement, offering predictive insights, facilitating feedback and support, and aiding in program evaluation.

2014

Microcredentials, in the form of badges, originated from the convergence of historical and gamification influences, adapting to meet self-directed learners' requirements that coincided with the emergence of MOOCs. Although pinpointing a specific event that ignited its growth in the field of learning and development is difficult, **Google Trends** ⬈ shows a notable increase in interest between 2014 and 2017. The ever-widening gap between what students are learning in higher education and the skills they will need to work and thrive in today's increasingly technological world has been one of the driving factors fueling the rise in microcredentials in recent years. The start of the COVID-19 pandemic in 2020 accelerated the trend: "As the pandemic took hold, interest in new learning models and digital offerings boomed." These converging factors, combined with a growing need to reskill nearly 50% of the global workforce due to digitalization, have opened the door to employers' acceptance of microcredentials to address the growing skills gap. In fact, in a 2021 U.S. survey, "71% of employers responded that online credentials were equal to or better than those earned through traditional means." And as we have witnessed since the start of the pandemic, the demand for remote and hybrid work is continuing to grow and does not appear to be going away anytime soon. As a result, we can expect "a significant shift towards more online learning," since remote workers will require additional upskilling or reskilling to perform their jobs. Institutions of higher education have taken

notice of this growing trend and are beginning to develop their own microcredentials to compete in the burgeoning alternative credential market. According to one estimate, over 40% of American adults have earned some type of alternative credential. The trend will continue to grow.[29]

2016

Although AR (Augmented Reality) and VR (Virtual Reality), known together as Extended Reality (XR), are rooted in early pioneering devices from the 1960s, the year 2016 marked a turning point in XR. The release of Pokémon Go revolutionized the adoption and perception of AR, while the commercial viability of the Oculus Rift CV1, the first consumer VR headset, played a significant role in popularizing both AR and VR technologies. Today, these technologies have advanced significantly, allowing consumers to experience immersive simulations, interactive visualization of complex concepts, virtual field trips to inaccessible locations, collaborative learning in virtual spaces, scenario-based learning, gamification, and adaptive learning. By incorporating AR and VR, microlearning can provide immersive, interactive, and personalized learning experiences that foster engagement, retention, and the practical application of knowledge and skills. [30]

2018

Gamification involves integrating gaming elements, including challenges and rewards, into learning activities. Although its roots can be traced back to 1908 when the Boy Scouts introduced challenge-based badges, its popularity surged in

recent years with the rise of mobile devices and technological advancements. For instance, in 2012, the Mozilla Open Badges 1.0, an online digital badge system, played a significant role in showcasing learners' achievements and contributed to the recognition of the potential for gamification in non-gaming contexts. In 2018, gamification gained widespread traction across non-gaming fields like social media, fitness, education, finance, and workplace training, allowing non-gamers to embrace and experience gamified elements. Gamification and microlearning have emerged as popular and innovative approaches to online training in recent years, offering engaging and effective methods to enhance the learning experience. When combined, gamification and microlearning can enhance the learning experience, promote active participation, and facilitate skill development in various contexts.[31]

2022

One of the most significant events to impact the world of education happened on November 30, 2022, with the release of ChatGPT (Chat Generative Pre-trained Transformer), an artificial intelligence large language model (LLM) chatbot capable of answering questions, writing articles, creating poetry, and generating programming code. Its impact was immediate: within five days, it had attracted over one million users. Since its release, ChatGPT and other generative AI apps have elicited a range of reactions among teachers and faculty ranging from curiosity and intrigue to nervousness and fear. Today, educators at all levels are experimenting with how to effectively harness the potential of generative AI technology while skillfully navigating its implications for teaching and learning. In learning and development contexts, ChatGPT can

accelerate the rapid e-learning development process by converting legacy courses into modern formats that support e-learning and mobile learning, update existing content, create assessments, and translate course content into multiple languages. Users can leverage ChatGPT and other generative AI tools as a resource for on-demand learning and support while on the job or on-the-go. The advances and possibilities ahead for these tools are still to be seen, and their interaction with microlearning will no doubt progress dramatically.[32]

2023

On June 5, 2023, Apple introduced the Apple Vision Pro, marking the company's entry into the world of AR. Positioned primarily as an AR device, the Vision Pro headset offers the versatility to seamlessly transition between augmented and full virtual reality. Equipped with multiple built-in cameras, the headset allows users to perceive the real world while incorporating 3D objects into their surroundings. When connected to a computer, it serves as a multidimensional display, enabling users to engage in work and recreational activities within a virtual space. The headset supports Bluetooth accessories like keyboards and trackpads, enhancing computing capabilities in the virtual environment. Despite entering a nascent market that has yet to fully flourish, the Apple Vision Pro has received acclaim from industry experts and insiders.[33]

In Summary: Microlearning Today and Tomorrow

According to **Google Trends** ⬈ data collected on July 7, 2023, for the term "microlearning," there has been a significant increase in interest in microlearning since July 2010 (see figure 1).

Figure 1. Google Trends Data for "Microlearning," July 2010 to July 2023
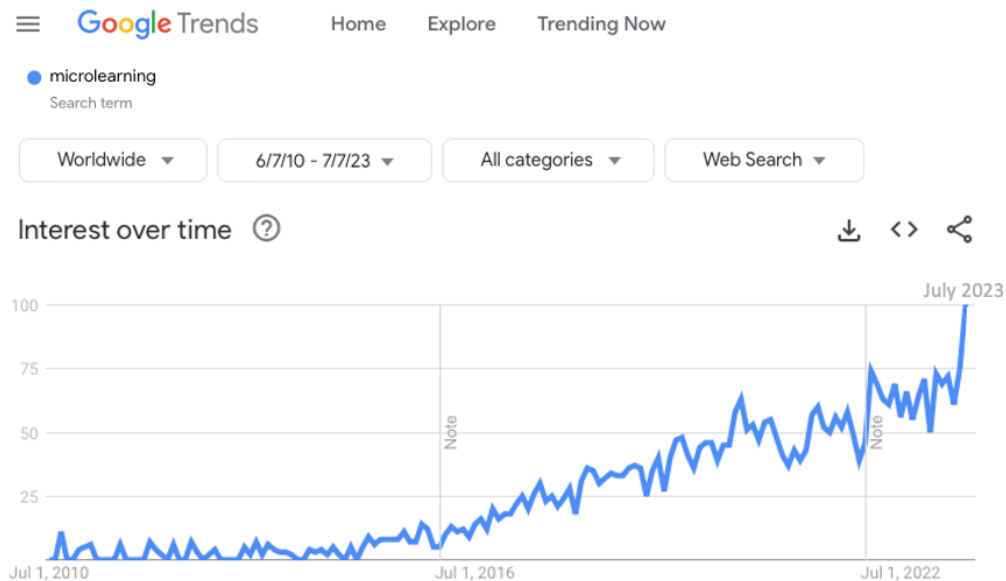
With the converging technological, conceptual, and theoretical innovations that have emerged in the Modern Era, microlearning has woven itself into the fabric of our daily lives. With roughly 86% of the global population being connected to the internet via their smartphones, access to the world's information is literally at our fingertips. Furthermore, starting with Apple's Siri in 2011, Microsoft's Cortana in 2013, Amazon's Alexa in 2014, and Google Assistant in 2016, how people access information and learn has once again been revolutionized, this time by the rise of voice-activated digital assistants powered by artificial intelligence.[34] Every time we use a computer, mobile device, or smart speaker to search the

web, watch a video, read the news, or ask Siri, Alexa, or Google Assistant to provide the answer to a question, we are engaging in some form of microlearning. Accessing content on the go will become even easier and more immersive as AR and VR glasses and headsets pair with people's smartphones. Smart speakers are also changing the way people interact with their digital assistants at home and at work. Through the Internet of Things (IoT), smart homes and offices enable users to control appliances, lighting, temperature, and other systems. Smart devices make it easy for users to engage with digital assistants to search the web without having to access a computer or smartphone. In 2022, 55% of U.S. households included a smart speaker, and 72% of people who used voice-activated search devices indicated that the speakers had become a part of their daily routine.[35]

In their book chapter "Microlearning in the Workplace of the Future," Johnny Hamilton, Darci Hall, and Theresa Hamilton forecast that microlearning will increasingly meet the needs of a workforce requiring upskilling and reskilling more often and more quickly. The authors added that workplace learning will change as a result, in part, of the expectations set by social media and online commerce for much more interactive, personalized, social, and engaging experiences. As a result, learning will shift from *push* to *pull:* instead of pre-prescribed instruction being pushed to employees, learners will pull what they need, when they need it--making microlearning an ideal learning resource. For example, artificial intelligence or virtual reality simulations "can be taken over a period of time in short, episodic intervals (microlearning) in which workers generate demonstrated performance data."[36] In addition, AI and VR/AR microlearning "boosts confidence in the application of learning"

because the simulation platforms "are available as a safe, secure space for practice."[37]

Hamilton, Hall, and Hamilton predict the following areas of development with microlearning: brain-computer links; integration of smart clothing; nanotechnologies; and the ubiquitous worldwide internet.[38]

- *Brain-computer interfaces*, or BCIs, allow people to control machines with their thoughts. Though still in their infancy, BCIs hold immense promise. In medicine, they can be used to help people with disabilities or to facilitate human-computer interactions. In the future, they may have other applications in industry, defense, and space exploration, such as to control industrial robots and machinery, fly drones hands-free, and facilitate AR and VR without a headset.[39] Brain-computer interfaces could facilitate just-in-time microlearning anytime, anywhere, just by thinking about the topic.

- *Smart clothing*, created by embedding Bluetooth-enabled technologies into garments, has the potential to "become the next interface between the real and the digital world, replacing or extending smartphones and other portable connected devices." Capable of communicating "biometric information such as heart rate, temperature, breathing, stress, movement, acceleration, or even hormone levels," smart clothes may be able to optimize professional growth, safety, and wellness by providing insight into emotions and stress levels throughout the day, preventing work-related injuries, and monitoring vulnerable groups such as babies and the elderly.[40]

- *Nanotechnologies*, like tiny computer processors that can fit on a 10-nanometer chip, make electronics smaller and much more powerful. In medicine, microscopic computing devices called *nano-computers,* can be ingested or implanted into the body to diagnose and treat illnesses, support organ functions, and perform tasks the body can no longer handle without assistance. By directly interacting with the brain, *nano-computers* could also replace traditional computers and handheld devices, offering users a wide range of computing and communication functions while on the move. By leveraging implanted nano-computers, individuals could one day effortlessly access the entirety of human knowledge, reminiscent of *The Matrix* movies, without relying on external computing devices.[41]

- The vision behind the *ubiquitous worldwide internet* is to seamlessly use satellite, cellular, and local area networks to provide fast, reliable, and secure connectivity to everyone and everything, regardless of location.[42] Such a network has the capability of extending just-in-time, on-demand microlearning to everyone everywhere.

Each of these technologies—brain-computer interfaces, smart clothing, nanotechnologies, and the ubiquitous worldwide internet—can bring humans one step closer to accessing the world's vast knowledge base without the need for computers.

As images of the future of formal and informal education and professional development begin to emerge, microlearning as an on-demand, anytime/anywhere, instructional and training technique has a significant role to play. Already, organizations

in fields ranging from K–12 and higher education to business and healthcare have begun building their microlearning repertoires. They are using a variety of existing and emerging technologies—including multimedia, social media, artificial intelligence, augmented reality, and virtual reality—to make learning more personal, social, engaging, and ubiquitous. We have highlighted key origins, trends, and theories underpinning one of the oldest yet fastest-growing instructional trends in educational technology today. Clearly, microlearning is not a hot new trend that only recently exploded onto the education and talent-development scene but is, indeed, the "OG."

Notes

1. **"The History of Microlearning and Its Current Trends,"** ⬈ Growth Engineering (website), July 4, 2019. ↩

2. Lauren Freeman, **"Evolution and History of Microlearning"** ⬈ (video), September 20, 2017. ↩

3. ATD Research, *Microlearning: Delivering Bite-Sized Knowledge,* ⬈ research report (April 2017); Krishna Rungta, **"100+ Must Know Online Learning Statistics in 2023,"** ⬈ Guru99 (website), last updated June 3, 2023, accessed June 16, 2023; **"4 Eye-Opening Statistics That Reveal the Value of Microlearning for Company Training,"** ⬈ Axonify (website), May 23, 2022; Mitch Denton, "10 Interesting Statistics about eLearning in 2022," Archy Learning (website), accessed September 1, 2022. ↩

4. Hermann Ebbinghaus, *Memory: A Contribution to Experimental Psychology,* trans. Henry A. Ruger and Clara E. Bussenius (1885; New York: Dover, 1964). ↩

5. **"Programmed Learning,"** ⬈ *Britannica,* accessed October 10, 2022. ↵

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