Optimizing Microlearning for Mobile Learning

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Abstract

Microlearning, delivered through mobile devices, can increase levels of interactivity and engagement by using high-impact learning strategies in rich-media environments. Podcasts, PowerPoint presentations, infographics, videos, flashcards, and collaborative spaces are all suitable delivery tools with which one may create engaging learning experiences. Today's learners are social, mobile, global, digital, and visual; they embrace the possibilities of technology to facilitate their learning. Microlearning leverages familiar, modern learning technology in short bursts to motivate and stimulate learners while they are on the go. This chapter provides suggestions for practical strategies, tools, and best practices in multimedia design. In doing so, it aims to help educators and learning professionals create and deliver microlearning mechanisms that are optimized for mobile learning.

Keywords: Microlearning, mobile learning, best practices

Introduction

In today's fast-paced digital world, technology can act as both a catalyst and an inhibitor of learning. The rapid developments in the technological landscape of the education and workplace sectors may transform teaching and learning methods from being dominated by long input sessions to, instead using bite-sized chunks known as *microlearning* experiences. This learning strategy allows learners to multitask anytime and anywhere (Coakley et al., 2017; Kukulska-Hulme & Traxler, 2005). Microlearning involves fairly small, focused learning units that consist of condensed learning events (Hug et al., 2005), which are typically around 2-6 minutes in duration. This functions as *snackable content*, which are concise nuggets that have been optimized for mobile learning (Jahnke et al., 2019). In this chapter, the term *mobile learning* is used to refer to any type of learning that relies upon, or is disseminated through a mobile device. This definition is not connected to any pre-existing pedagogical assumptions or underlying theories of learning, instead, it is associated with objects that are explicitly technological in nature.

Today's generation of learners no longer carries heavy backpacks with textbooks to and from class, and nor is its learning primarily reliant on long, face-to-face classes. Instead, learners carry mobile devices with them at almost all times. They interact, connect, and engage with classmates and teachers, and process and absorb information in vastly different ways (Kohnke, 2020; Torgerson & Lannone, 2019). As a result, microlearning has become an emergent practice not only in education, but also in corporate and workplace training (Clark et al., 2018). It has engaged and motivated employees (Callisen, 2016; Glahn, 2017) and helped them to fit learning into their demanding schedules by providing quick answers and solutions (Shank, 2018). The number of studies into competency training in the workplace and the impact of microlearning on learners continues to increase (Emerson & Berge, 2018; Nikou & Economides, 2018a, 2018b). In this chapter, *learners* denotes students in education or workplace employees and teachers who are working in an educational institute or as workplace trainers.

Having the ability to access relevant, engaging microcontent on their mobile devices can afford learners brief learning experiences while simultaneously allowing them to dig into particular areas of content in more depth. This method of learning caters specifically to the needs of the current generation of learners. It is, moreover, a more motivating type of learning experience than some traditional learning methods (Reinhardt & Elwood, 2019). Microlearning is not a new concept (Hug et al., 2005), though the increased number of mobile applications (or apps) has only scratched the surface of technology's full pedagogical potential (Goggins et al., 2013). Teachers in formal education environments and learning professionals in corporate settings will benefit from exploring the possibilities of microlearning to motivate and engage today's learners, thereby maximizing the number and quality of their learning experiences. This chapter, provides suggestions for practical strategies, tools, and best practices in multimedia design. In doing so, it aims to help educators and learning professionals create and deliver microlearning mechanisms that are optimized for mobile learning.

Microlearning Philosophy

The adoption of microlearning techniques requires careful planning and the reimagining of conventional teaching approaches into alternative ones, specifically embracing and devising learning formats that consist of short, essential messages or bursts of information. The key tenet of microlearning is to create high-impact, highly engaging modules of learning that are accessible, and digestible, in a short timeframe (Kapp & Defelice, 2019). These bursts of learning are not short, self-contained events. Instead, microlearning deconstructs concepts or topics into meaningful chunks and focuses on single ideas to allow for a better learning pace that is tailored to, and by, the individual, thereby reducing the risk of cognitive overload (Demmans Epp & Phirangee, 2019). Microlearning introduces individualized learning paths by prioritizing the delivery of short, high-impact messages (Zoltan, 2017).

Several specific terms have been employed in the context of teaching and microlearning, and scholarship about these terms, to articulate the specific structures of such learning devices and strategies in more depth. The term *micro-level* represents the organization of an individual session, whereas the overall course structure is known as the *meso-level*, and the curriculum is described as the *macro-level* (Buchem & Hamelmann, 2010). In engaging with microlearning approaches, individuals can take control of their learning. This, in turn, facilitates the effective transmission and retention of information (Sun et al., 2015). Moreover, microlearning nurtures perpetual, life-long learning by bridging formal and informal learning experiences. The process of doing so involves the utilization of mobile technologies to create learning objects before integrating them into brief events. As with all pedagogical approaches, it is necessary to think carefully about whether particular learning objectives are suitable for, and transferable to, microlearning environments.

To introduce mobile microlearning and microteaching to learners successfully, it is crucial to consider which available apps are the best ones (e.g., the most visually impressive, the fastest running, requiring the least storage space) for mobile devices. The concept of microlearning has become synonymous with bursts of high-impact learning that take place in media-rich environments, like those of video and e-learning, and in a diverse mix of modalities, such as through infographics and podcasts. These modalities provide learners with new forms of stimuli that increase levels of both engagement and learning retention. To create and deliver effective microlearning experiences, one thing is paramount: meaningful design. The next section presents four key strategies to optimize approaches to mobile microlearning.

Practical Strategies

The primary aim of microlearning is to teach a straightforward, engaging, and well-structured lesson, which allows learners to understand key concepts efficiently and effectively (Zhang & Ren, 2011). Mobile microlearning addresses learning topics with goals of being understandable, being easy to absorb, and having a correct answer available (Jahnke et al., 2019). Today mobile devices (e.g., cellphones, tablets) are increasingly used in the workplace, which allows users to just as easily communicate with someone as find out how to complete a task. Mobile learning brings learning anytime and anywhere to learners without necessitating them to step away from their work environment. These microlearning objects "can be made available on demand to facilitate just-in-time learning" (Sun et al., 2018, p.123), such as offering at-a-glance information to teach or refresh prior learning (e.g., how to put on and remove a face mask). Mobile microlearning enables learners to learn on the go without information overload.

To achieve this when segmenting away from traditional workplace and classroom-based learning to bite-sized learning via mobile applications, it is important to: incorporate videos and other visual components; use minimal text; use responsive page designs; and ensure there are at least some consistent, recurrent elements. The key is to keep all the elements simple and to incorporate only what is essential. Remember: *less is more*. Microlessons require high-quality content to be effective in the same way as any other pedagogical material would (Zhang & Ren, 2011). Visual aids, interactivity, and simplicity can all contribute to effective learning practices. Likewise, setting small and specific learning objectives engages learners (Bratt, 2020). Consider taking the textbook or training manual and breaking it down into small, manageable chunks of short learning events that can be delivered via mobile devices. This could include a 3-minute podcast or presentation using slide that provides an overview of the topic, followed by a 2-minute flash-card event with learners' drills for factual information. Later, learners could have access to a video or infographic that helps them to remember what to do or shows them a process of completing a task. When segmenting content for mobile microlearning, focus on a single learning goal in manageable chunks for each goal.

When planning to use microlearning, educators and learning professionals should consider these questions:

- What is the learning aim for learners?
- How will microlearning help learners to achieve this aim?
- What form should the microlearning take?

The answers to these questions will help educators and learning professionals determine how to structure the mobile learning content. Added to this, the four key considerations below (learners' needs, medium, interactivity, and simplicity) can guide educators, learning professionals, and instructional designers and developers in creating successful mechanisms of microlearning for mobile use.

Learner Needs

Microlearning is about meeting learners' needs and delivering personalized, flexible learning in short, bite-sized learning chunks (Jahnke et al., 2019). When considering how to formulate a potential mobile microlearning event, it is first necessary to think about learners' needs and how to create possible mobile solutions that meet those needs. This should be the *red thread*

upon which to focus: How is it possible to optimize the use of learners' time while effectively fulfilling their learning needs? This depends on on the responses to three questions:

- What does the learner need to know or learn?
- Will the learner find this resource useful?
- How will it affect the learner's learning?

Forms of microlearning are often facilitated by mobile devices with relatively small screens. The first step in preparing a microlearning event is to decide upon its objective. Is the event going to form part of the preparation for the next class/training? Does it reinforce the input of learners in class discussions? Does it constitute standalone training? It is important to ensure that learners' needs have been carefully considered when designing the event, as well as how they might apply it. Doing so will ensure that both learning professionals and learners find significant value in the materials, and it will increase the likelihood of learners achieving the specific learning outcome. Finally, it is important for educators and learning professionals to consider how microlearning will affect their capacity the facilitators of knowledge and skills. For example, it is important to ask important questions, such as: Will it provide valuable instruction and enrich learning without taking up additional time or impeding pedagogical practice? And, is it necessary to reinvent established pedagogical practices completely or can existing teaching materials and strategies be used?

Medium

There are many potentially useful forms of media for microlearning events. Video is often the preferred medium when designing microlearning events, as it can combine slides, audio, graphics, and video. However, many other media are available, such as podcasts, infographics, e-learning lessons or modules, blogs, social media, simulations, slideshows, and pdfs, which appeal to different types of learners. It is important to keep the educational message simple and engaging while still providing high-quality content, no matter which medium has been selected. When considering which medium would be most suitable for delivering the event, it is important to ask:

- What medium or format would be most relevant and specific to the topic?
- What should learners do before, during, and after the event?

Do not be afraid to include multiple learning elements (e.g., visuals, audio, quizzes, slideshows, pdfs, and links). However, it is recommended that only one medium be used for each microlearning event component. Events work best when they are short and focused and consequently, do not confuse learners. It is also recommended that every event explain the fundamental premise or concept clearly, summarize all the key points, and include details of resources through which learners may gain further information.

Interactivity

Interactivity and engagement are two vital components of any learning event to ensure that learners are participating actively. As microlearning events are brief, learners must be focused upon and interested in the event throughout. It is effective to embed a variety of features in the chosen medium to appeal to different learning style preferences. When developing an event, consider the type of features that will reduce levels of passivity and increase input from, and activity on behalf of, learners. For example, consider if the event should...?:

- Provide single choice questions? Alternatively, use multiple-choice questions?
- Use branching on learning decisions?
- Offer dropdown lists?
- Employ fill in the blank events?
- Use click and reveal exercises?

Given the multitude of different types of features available for mobile learning with which one can create rich, efficient, and effective optimized events, it is important to keep the focused learning outcome in mind at all times and to be clear about how the features help to achieve the outcome. It is, for example, a good idea to incorporate some review events as interactive features (e.g., digital flashcards) in microlearning mechanisms (Kapp & Defelice, 2019). For instance, learners could receive a checklist to complete to verify whether they have grasped the fundamental concept or premise, or they could be asked to write a short reflection on social media or websites such as *Padlet* or *lino* (Kohnke, 2019a).

Simplicity

Because the central tenet of microlearning is to deliver short and snappy lessons, simplicity is key (Jahnke et al., 2019). The message should be clear, targeted, and focused, presenting each concept or subject one step at a time to be manageable (Lindner, 2007). Information needs to be easy to digest and to hold the audience's attention, delivering immediate results. To achieve simplicity, consider the following questions:

- Who is the intended audience?
- What is the best way to present information without dumbing it down?

Simplicity does not mean that the microlearning event not require learners to master complex knowledge of skills. Instead, as learners delve into additional microlearning events, the content could be designed to become increasingly difficult, while the fundamental premise of the session remains simple. The events should be designed for a single purpose, have a sole learning objective, and be part of a larger course aim. Therefore, when deconstructing key concepts or larger topics, it might be necessary and, indeed, good practice, to develop a series of microlearning events. For example, mini e-learning modules with short burst of learning consisting of video tutorials, followed by infographics and social media, can be created and implemented.

It is important to keep in mind the four key considerations described above when designing and optimizing practical microlearning events for mobile learning. It is vital to remember that the process is not about *slicing and dicing* regular learning materials. Instead, it is about connecting with, and motivating, learners, ensuring that they are engaging in meaningful, active learning while simultaneously tapping into available mobile resources to maximize the learning experience (Hwang & Chen, 2017). In addition, the intended practical strategies should be considered carefully, as well as ensure that the primary purpose or objective has been deteremined and is understood. Microlearning is not a one-size-fits-all strategy, and it will not work for every kind of learning or all kinds of content. With the right strategy and planning, however, mobile microlearning events can positively enhance teaching practice. Additionally, microlearning caters particularly well to the learning capabilities and skills of the current generation of learners (Aitchanov et al., 2018; Dai et al., 2018). In the next section, the impact of specific tools and apps that can enrich, enhance, and optimize microlearning experiences for mobile use will be identified and explored.

Tools and Apps

In our fast-paced culture, mobile learning is both flexible and customizable. It creates immediate learning opportunities. Apps provide multisensory opportunities such as audio, text, visuals, and actions to complement and aid understanding of learning content. However, as there are millions of apps available, the challenge is deciding where to start. A good point of reference is to consider the following questions:

- How do I find high quality apps?
- Which apps are good aids for learning about this subject?
- Which learning apps do learners already use and like?

Deciding which app is the most suitable for delivering the key message is paramount for creating effective and engaging microlearning. The chosen app must be able to deliver the key message in a simple, effective way while simultaneously deepening the learning process. As a general rule, the tool or app should be easy to set up and to use inasmuch as task motivation is crucial for learning (Nikou & Economides, 2018a, 2018b). Apps can technically be divided into two groups: (1) those that offer automated practice and learning and, (2) those that enable users to create things themselves. The more artifacts learners can create (e.g.:, through word clouds or checklists), the more likely the app will prove engaging for learners, and therefore, the more likely it is to increase levels of task motivation among learners.

In the next section, several tools, apps, and software that are easy to use and that require little technical knowledge are discussed. As there are so many tools and apps available for designing and optimizing microlearning events for mobile learning, this is not an exhaustive list but, rather, a general point of reference.

Podcasts

A podcast is an effective microlearning tool and a good starting platform from which to introduce microlearning using mobile devices. A podcast is, in essence, a micro-lecture on a given topic. Generally, podcasts rely on audio, are easy to create, and are effective in increasing levels of engagement with listeners, who are their audience (Drew, 2017). Podcasts can be created on any computer platform or mobile device using a host of commercial, free, or open source programs such *Audacity* for Windows, *GarageBand* on MacOS, *Voice Memo* for iOS or *Anchor* for Android. To optimize the production of podcasts, one can create a free account on *Soundcloud.com* (available on the web, iOS, Android or, alternatively, through *Simplecast* or *Captivate*). On Soundcloud, it is possible to host almost all podcasts, and learners can subscribe through the really simple syndication (RSS) function to receive automatic notifications whenever new podcasts become available.

Presentation Software

Presentation software like Microsoft *PowerPoint*, *Keynote*, and *Google Slides* is available on most computers and they can easily be used to create microlearning objects. For example, software like *Microsoft PowerPoint* comes with a built-in screen capture feature, which can capture videos from *YouTube* or *TED*, making it easy to attach the video's URL to the PPT(X) file. Moreover, PowerPoint can integrate animations, triggers, and feedback to present microlearning events as stories. Similarly, *Google Slides* can be used to create microlearning content to capture the attention of learners. Collaboration is a major reason to

use *Google Slides*, as both application and presentation are saved in Google Drive, learners, educators, and learning profesisonals) can easily share and simultaneously edit and co-create learning content. For users of Apple products, Keynote is a good user-friendly alternative, and it comes with themes, animations, and effects. Additionally, with *PowerPoint*, *Google Slides*, and *Keynote*, it is easy to create checks, quizzes, surveys, and assessments, which can help to reinforce learners' knowledge. To produce more professional microlearning events, it is possible to add *iSpring*, an e-learning authoring tool that is available on Windows operating systems and that functions as a PowerPoint add-on. The software allows educators and developers to create and enhance their PowerPoint presentations by incorporating content such as videos, branched quizzes, simulations, and interactions. These PowerPoint presentations can also be packaged into mobile-friendly lessons and integrated into learning management systems. *iSpring* is an excellent tool for educators and developers who have used the PowerPoint program for a long time.

Infographics

Infographics are visually appealing and they can break complex data down into simple visual formats as quick reference materials. Infographics can be useful for reviewing larger courses that learners have just undertaken or for providing a quick snapshot of new information (e.g., step-by-step instructions, timeline to illustrate how something has changed over time). To make infographics memorable, they should be made intuitively comprehensible. Thus, design considerations include carefully choosing visual elements, such as charts, graphs, and colors, and they should include minimal supporting text to convey key messages (Kohnke & Chan, 2019). Leaners will be able to gather information from images and texts that are easy to understand and comprehensible at a glance. *Canva* and *Piktochart* are two easy-to-use web tools for creating dynamic infographics. Infographics can be exported in JPEG or PNG picture format, making them easy to share.

Videos

Videos can be used in the context of microlearning either as a form of standalone learning or as part of a series of teasers, that is to say, quick introductions to key learning elements. According to Köster (2018), most learners find videos more interactive and compelling than podcasts, PowerPoint presentations, or infographics, as they stimulate deeper levels of recall and retention, thereby leading to more positive learning experiences. Videos are especially suitable for offering high-impact, just-in-time forms of learning, for example, to demonstrate how to carry out a detailed procedure (e.g., change a tire, put on safety gear, improve customer service skills). The key criteria in optimizing videos for learning are that they are engaging and immersive and that they offer the required support for learners at the moment of need. As with other microlearning events, it is necessary to match each video to a specific learning outcome. Videos make it easy for learners to pause and to watch the content multiple times to help them to grasp the topic. When designing videos, bear in mind that, as aforementioned, *less is more*. It is important to keep it focused and let the visual stimuli tell the story. To complete the microlearning event, additional resources can be included with which learners may access extra information, as well as quizzes to reinforce learning. There are many video creation and editing tools available. IMotion HD for Apple IOS or Magisto Video Editor and Maker for Android are free and easy to use. Microsoft and Apple also offer video editing tools in their suite of software tools.

Flashcards

Interactive flashcards, which can be accessed on mobile devices, are easy to create, and use, and constitute an effective and relatively simple option for delivering microlearning for initial learning or review of key concepts and terms. Flashcards can allow learners to learn progressively, faster, and as active users (Nakata, 2019). They are easy to create using free online flashcard sites like *Flashcard.online*, *StudyBlue,* and *FlashDecks*. *Brainscape.com* is an excellent source for previously created flashcards across multiple disciplines and grade levels. Interactive flashcards can incorporate animations, sounds, and images. For example, a keyword, phrase, number, or image may be on one side of the flashcard, while, on the other side, there is explanatory text or animation. This mechanism helps learners to make visual connections with facts or the steps of a process, allowing them to quiz themselves on the topic in question, for example, if learners need to learn a large amount of factual information about new products or features.

Collaborative Spaces

Today's learners use various social media channels throughout the day. As such, social media can present opportunities to create active learning communities through which instructors and facilitators may connect with learners, anytime, anywhere. It is possible to create closed *Facebook* groups in which learners can access and discuss course-related events and share a variety of media, including podcasts, videos, PowerPoints, and infographics. Similarly, microblogs like *Twitter* can be useful to summarize or reflect on events succinctly, due to character limitations on individual posts, called *tweets*. Another popular platform is *Instagram*, to which learners can upload word clouds to illustrate visual concepts. Social media allow learners to support each other and to feel more involved with educational communities (Trowbridge et al., 2017). Learners can also collaborate in real time to brainstorm ideas by using collaborative social sites like *Mindmeister*, *Bubble*, or *Cacoo*. Moreover, poll and survey tools such as *Kahoot!*, *Poll Everywhere*, *Mentimeter*, or *GoSoapBox* can increase levels of learner participation (Kohnke, 2019b; Moorhouse & Kohnke, 2020).

Before or after a microlearning event, educators and learning professionals can pose questions using a number of question formats, including open-ended questions, word clouds, true-or-false statements, and multiple-choice questions. Such pre- and post-practice exercises delivered via social collaborative apps can help to close the feedback loop and provide opportunities for learners to learn from and with their peers. As with all forms of social media, collaborative learning can provide learners with valuable opportunities to practice communicating knowledge (Göschelberger, 2016a, 2016b). Collaborative forms of microlearning deepen levels of learning and understanding as well as enabling learners to feel as though they are part of a community.

In summary, microlearning encourages the process of studying in short bursts, and it can be introduced through numerous platforms as illustrated above. When designing visually appealing and content-precise events, especially for mobile use, it is important to strive to keep learning events short and focused, encourage contributions to deepen learning choose a delivery platform that is available anytime and anywhere and create learning communities so that learners have opportunities to create, curate, deliver, and engage in learning events. The efficacy of microlearning events lies in the interactivity and simplicity of their design (Baumgartner, 2013).

Best Practices

Microlearning has the potential to revitalize training and education and to give learners what they need by using short, bite-sized chunks of learning content that can be delivered directly to learners' mobile devices. Learners can conveniently access and complete events during their daily commutes or during their breaks or free time. As microlearning takes place in small bites, learners can revisit any given content multiple times, and the retention rate is higher than that of learners who undertake traditional methods of learning (Kang, 2016; Shail, 2019).

While microlearning objects can stand alone as isolated learning events, they can also be part of a larger learning experience. If designed appropriately, microlearning can provide increased flexibility and lead to higher levels of engagement and productivity among learners (Nikou & Economides, 2018a, 2018b). Faced with an overwhelming volume of information in today's fast-paced, increasingly connected, and mobile society, educators and instructional designers must rise to the challenge of educating today's learners by integrating microlearning events into traditional and emerging online pedagogical practices. As one embarks on designing and optimizing microlearning events for mobile learning, the following seven tips can help:

1. Make it focused - Keep each event focused with one learning objective.
2. Make it simple - Keep the text and layout simple.
3. Make it graphic - Keep it visual to illustrate the topic.
4. Make it interactive - Keep it interactive, increasing levels of engagement and memory recall.
5. Make it short - Keep it around 2-6 minutes in length to maximize the concentration span and to increase levels of learner engagement.
6. Make it social - Keep it social by incorporating social media, discussion forums, and polls.
7. Make it mobile adaptive - Keep the design simple, clear, and adaptable.

Summary: Why Mobile Microlearning Works

This chapter offers practical strategies, tools, and best practices in multimedia and instructional design to help educators to create and deliver microlearning that is optimized for mobile learning. The process of incorporating microlearning into traditional courses and professional development programs can initially seem daunting. However, by using the information in this chapter as a starting point and a guide, targeted microlessons that can take advantage of ubiquitous forms of technology can be created and delivered. By optimizing microlearning materials for mobile learning, learners can be afforded the flexibility to fit learning into their busy schedules, anytime, anywhere.

The short, engaging, and interactive delivery of content that characterizes microlearning meets the information-retrieving style and needs of today's generation (Donahue, 2016; Winger, 2018). Instead of reading long sections of text in traditional textbooks or manuals to grasp a particular concept, learners can: (a) watch a short informative video, (b) access an interactive infographic that visually deconstructs complex ideas, (c) use interactive flashcards to make visual associations with facts or concepts, (d) work through branched simulations on slideshow presentations, (e) listen to authentic interviews or lesson summaries on podcasts, and (f) take collaborative quizzes or access additional learning resources, all within only 2-6

minutes. If microlearning events are optimized for mobile devices, learners can multitask, receiving short bursts of information while accessing information through digital platforms.

There are several benefits to adopting microlearning events on mobile devices, including the provision of just-in-time access to content or resources, the consolidation of key information, and the incorporation of many different modalities such as infographics, videos, podcasts, images, and word clouds (Souza & Amaral, 2014). By distilling key learning messages—conveying them in simple and clear ways through mobile devices using responsive designs and easy-to-remember visuals, microlearning enables learners to receive specific information through an interactive format, one that is highly motivational and rewarding. Hopefully, by incorporating some of the tips and suggestions that have been outlined in this chapter, levels of learner engagement and active learning through the use of mobile microlearning events can be optimized. The incorporation of optimized microlearning materials for mobile learning is an exciting avenue to explore. It has great potential to lead to even more engaging and effective methods of learning in the future.

Discussion Questions

1. How can you align your learning outcomes with methods of microlearning? Is your content suitable for mobile learning?

2. What are the challenges you may face in optimizing microlearning materials for mobile learning in your particular teaching context? How could it best be delivered? How could it suit your audience/learners?

3. In what ways could optimized microlearning events for mobile learning be used to create personalized events for learners?

References

Aitchanov, B., Zhaparov, M., & Ibragimov, M. (2018). The research and development of the information system on mobile devices for micro-learning in educational institutes. In *2018 14th international conference on electronics computer and computation (ICECCO)* (pp. 1–4). IEEE.

Baumgartner, P. (2013). Educational dimensions of microlearning – towards a taxonomy for microlearning. In P. Bruck & M. Sedlaczek (Eds.), *Designing microlearning experiences – Building op knowledge in organisations and companies,* Innsbruck University Press. https://pdfs.semanticscholar.org/836b/52598a2f1aca8a068c1a392a53e0b4ea55f5.pdf

Bratt, S. (2020). *Essential strategies for developing mobile-based micro-learning*. Edmedia + Innovate Learning Proceeding. Association for the Advancement of Computing in Education (AACE).

Buchem, I., & Hamelmann, H. (2010). Microlearning: A strategy for ongoing professional development. *eLearning Papers, 21*(7), 1–15.

Callisen, L. (2016). *Why micro learning is the future of training in the workplace*. https://elearningindustry.com/micro-learning-future-of-training-workplace

Clark, H., Jassal, P. K., van Noy, M., & Paek, P. L. (2018). A new work-and-learn framework. In D. Ifenthaler (Ed.), *Digital workplace learning* (pp. 23–41). Springer.

Coakley, D., Garvey, R., & O'Neill, Í. (2017). Micro-learning—Adopting digital pedagogies to facilitate technology-enhanced teaching and learning for CPD. In G. The & S. Choy (Eds.), *Empowering 21st century learners through holistic and enterprising learning* (pp. 237-242). Springer.

Dai, H., Tao, Y., & Shi, T. W. (2018). Research on mobile learning and micro course in the big data environment. In *Proceedings of the 2nd international conference on e-education, e-business and e-technology* (pp. 48–51). ACM.

Demmans Epp, C., & Phirangee, K. (2019). Exploring mobile tool integration: Design activities carefully or students may not learn. *Contemporary Educational Psychology, 59*. https://doi.org/10.1016/j.cedpsych.2019.101791

Donahue, M. (2016). Microlearning and the incredible shrinking attention span. *Hotel Management, 231*(7), 27.

Drew, C. (2017). Edutaining audio: An exploration of education podcast design possibilities. *Educational Medial International, 54*(1), 48–62. https://doi.org/10.1080/09523987.2017.1324360

Emerson, L., & Berge, Z. (2018). Microlearning: Knowledge management applications and competency-based training in the workplace. *Knowledge Management & E-Learning: An International Journal, 10*(2), 125–132.

Glahn, C. (2017). *Micro learning in the workplace and how to avoid getting fooled by micro instructionists*. https://lo-f.at/glahn/2017/06/micro-learn ing-in-the-workplace-and-how-to-avoid-getting-fooled-by-micro-instructionists.html

Goggins, S. P., Jahnke, I., & Wulf, V. (2013). *Computer-supported collaborative learning at the workplace*. Springer.

Göschelberger, B. (2016a). A platform for social microlearning. In K. Verbert, M. Sharples, & T. Klobučar (Eds.), *Adaptive and adaptable learning*. EC-TEL 2016. Lecture Notes in Computer Science, Vol. 9891 (pp. 513-516). Springer.

Göschelberger, B. (2016b). Social microlearning motivates learners to pursue higher-level cognitive objectives. In G. Vincenti, A. Bucciero, M. Helfert, & M. Glowatz (Eds.), *E-learning, E-education, and online training*. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, Vol. 180 (pp. 201-208). Springer, Cham.

Hug, T., Lindner, M., & Bruck, P. (2005). *Microlearning: Emerging concepts, practices and technologies after e-learning*. Innsbruck University Press.

Hwang, G.-J., & Chen, C.-H. (2017). Influences of an inquiry-based ubiquitous gaming design on students' learning achievements, motivation, behavioral patterns, and tendency towards critical thinking and problem solving. *British Journal of Educational Technology, 48*, 950–971. https://doi.org/10.1111/bjet.12464

Jahnke, I., Lee, Y.-M., Pham, M., He, H., & Austin, L. (2019). Unpacking the inherent design principles of mobile microlearning. *Technology, Knowledge and Learning, 24*(2), 1–35.

Kang, S. H. (2016). Spaced repetition promotes efficient and effective learning: Policy implications for instruction. *PIBBS, 3*, 12–19. https://doi.org/10.1177/2372732215624708

Kapp, K. M., & Defelice, R. A. (2019). *Microlearning: Short and sweet*. Association for Talent Development.

Kohnke, L. (2019a). Use sticky-notes and make the content stick. *Teacher Trainer, 33*(1), 6–7.

Kohnke, L. (2019b). Tech review: GoSoapBox – Encourage participation and interaction in the language classroom. *RELC Journal,* https://doi.org/10.1177/0033688219872570

Kohnke, L. (2020). Exploring learner perception, experience and motivation of using a mobile app in L2 vocabulary acquisition. *International Journal of Computer-Assisted Language Learning and Teaching, 10*(1), 15–26. https://doi.org/10.4018/IJCALLT.2020010102

Kohnke, L., & Chan, B. (2019). Exploiting infographics. *Modern English Teacher, 28*(1), 67–68.

Köster, J. (2018). *Video in the age of digital learning*. Springer.

Kukulska-Hulme, A., & Traxler, J. (2005). *Mobile learning in developing countries*. Commonwealth of Learning, Vancouver, Canada. http://oro.open.ac.uk/49128/

Lindner, M. (2007). What is microlearning? (Introductory note). In *3rd International Microlearning 2007 Conference*. Innsbruck University Press.

Moorhouse, B., & Kohnke, L. (2020). Using Mentimeter to elicit student responses in the EAP/ESP classroom. *RELC Journal, 51*(1), 198–204. https://doi.org/10.1177/0033688219890350

Nakata, T. (2019). Learning words with flash cards and word cards. In S. Webb (Ed.), *The Routledge handbook of vocabulary studies* (pp. 304–319). Routledge.

Nikou, S., & Economides, A. (2018a). Mobile-based assessment: A literature review of publications in major referred journals from 2009 to 2018. *Computers & Education, 125*, 101–119. https://doi.org/10.1016/j.compedu.2018.06.006

Nikou, S., & Economides, A. (2018b). Mobile-based micro-learning and assessment: Impact on learning performance and motivation of high school students. *Journal of Computer Assisted Learning, 34*(3), 269–278. https://doi.org/10.1111/jcal.12240

Reinhardt, K. S., & Elwood, S. (2019). Promising practices in online training and support: Microlearning and personal learning environments to promote a growth mindset in learners. In J. Keengwe (Ed.), *Handbook of research on virtual training and mentoring of online instructors* (pp. 298–310). IGI Global.

Shail, M.S. (2019) Using micro-learning on mobile applications to increase knowledge retention and work performance: A review of literature. *Cureus, 11*(8): e5307. https://doi.org/10.7759/cureus.5307

Shank, P. (2018). *Microlearning, macrolearning. What does research tell us?* https://elearningindustry.com/microlearning-macrolearning-research-tell-us

Souza, M. I., & Amaral, S. F. (2014). Educational microcontent for mobile learning virtual environments. *Creative Education, 5*, 672–681.

Sun, G., Cui, T., Yong, J, Shen, J., & Chen, S. (2015). Drawing micro learning into MOOC: using fragmented pieces of time to enable eBective entire course learning experiences. In *International Conference on Computer Supported Cooperative Work in Design* (pp. 308–313). IEEE CPS.

Torgerson, C., & Lannone, S. (2019). *Designing microlearning*. American Society for Training & Development.

Trowbridge, S., Waterbury, C., & Sudbury, L. (2017). *Learning in bursts: Microlearning with social media*. https://er.educause.edu/articles/2017/4/learning-in-burstsmicrolearning-with-social-media

Winger, A. (2018). Supersized tips for implementing microlearning in macro ways. *Distance Learning, 15*(4), 51–55.

Zhang, X., & Ren, L. (2011). Design for application of micro learning to informal training in enterprise. In *2nd international conference on artificial intelligence, management science and electronic commerce* (pp. 2024–2027). https://doi.org/10.1109/AIMSEC.2011.6011235

Zoltan, R. (2017). Exploitation of micro-learning for generating personalized learning paths. DS 87-9. In *Proceedings of the 21st international conference on engineering design* (ICED 17), Vol 19: Design Education, pp. 129–138. Design Society.