The Theory of Learning in Micro

Context & Explanation

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Design Knowledge chunking continual process microlearning

The Theory of Learning in Micro is a proposed theory on how people micro-learn. This theory is based on the hypothesis that learning is a continual process better supported with smaller, more focused learning resources and activities. Based on two main beliefs, knowledge and design, The Theory of Learning in Micro was crafted as a foundation for how people learn in micro, providing a set of beliefs and assumptions for the microlearning design and development community.

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Introduction

Learning is a complex process only observable or assessable after the intervention (Driscoll, 2014). This complex process is explained through learning theories derived from beliefs and assumptions of "how one comes to 'know'" (Driscoll, 2014, p. 5). These learning theories then undergo an iterative testing and refining process (Kerssens-van Drongelen, 2001). This paper describes the first iteration of a new learning theory focused on microlearning. The paper also argues for a theoretical stance to shape the design, development, and use of learning in micro.

Learning

The act of knowing comes from three learning processes: (a) natural, which occurs through experience and discovery, (b) instructed, which occurs based on a stimulus, and (c) cultural, which occurs through the community as something everyone needs to learn (Gee, 2004). Natural learning is typically connected to Piaget and Inhelder (1969) genetic psychology based on developmental milestones and is not connected with learning but with maturation (Driscoll, 2014). Instructed and cultural learning are planned learning but may or may not reside in formal education settings. Instructed learning is learning specific information while cultural learning is community-oriented, where certain information and practices are taught to everyone in that community (Gee, 2004). The learning environment (formal, informal, non-formal), modality (face-to-face, hybrid, online), resources (texts, devices, internet), and other items can differ in instructed and cultural settings (Gee, 2004; Hamilton et al., 2021; Schwier, 2012). Regardless of the environment, modality, and available resources, instructed learning, the learning focus of this paper, is typically considered in formal settings in a macro lens.

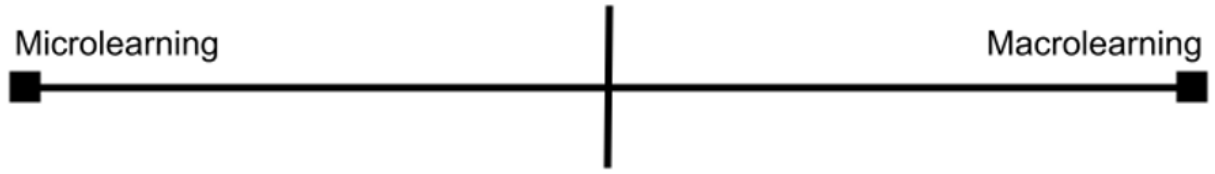
Macrolearning

Macrolearning is content presented in large quantities with formative and summative assessments, typically in face-to-face settings (Buchem & Hamelmann, 2010; Shenaman, 2021). Macrolearning typically ends when a certificate (e.g., HVAC certification) or degree (e.g., high school diploma, bachelor's degree) is awarded and takes a longer time to complete (Buchem & Hamelmann, 2010; Schwier, 2012; Zhang & West, 2020). If macrolearning sits on one side of a

learning spectrum, then microlearning would sit on the other with the necessary content chunked in shorter time periods (see Figure 1).

Figure 1

Microlearning to Macrolearning Spectrum



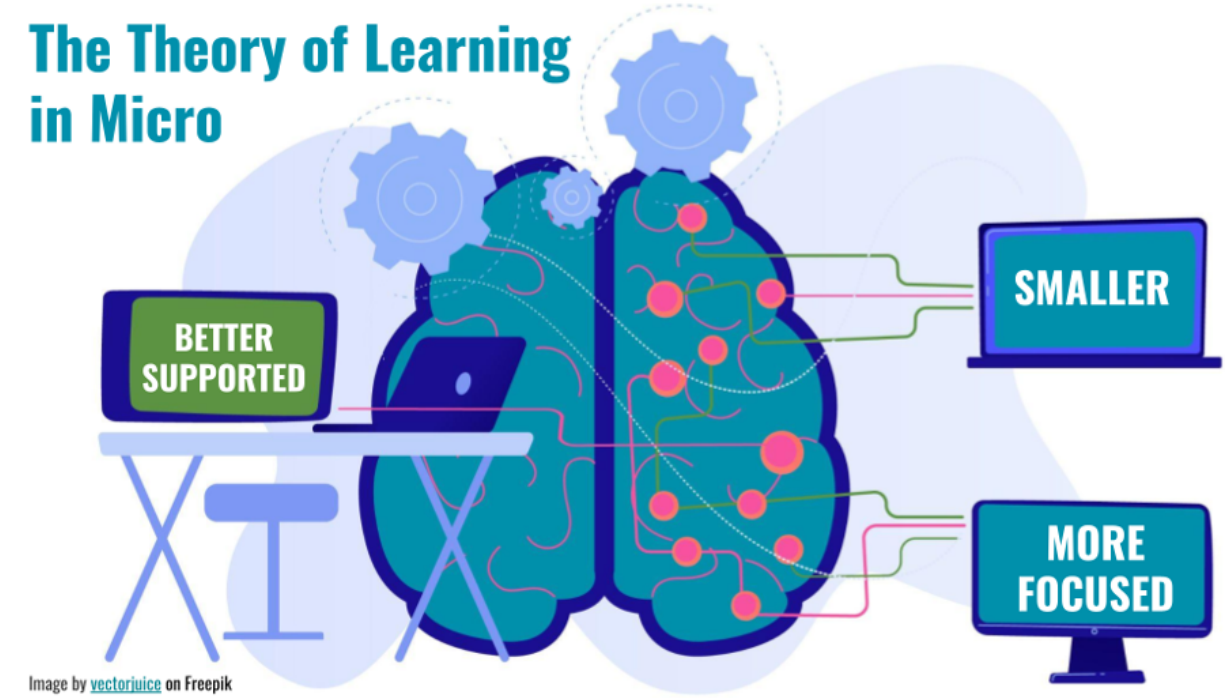
Microlearning

Microlearning is an emerging eLearning approach referring to bite-sized information presented in various short formats (Major & Calandrino, 2018; Tipton, 2020). The length of time for microlearning varies in the literature and is typically completed in no more than 15–20 minutes (Aldosemani, 2019; Manning et al., 2021; So et al., 2020) with some variations of longer amounts of time (see de Vries & Brall, 2008; Zhang & West, 2020). Buchem and Hamelmann (2010) differentiated between microlearning and micro-objects. They argued that content could be micro and the main focus of learning, absent from activities, while microlearning includes both content and activities. Resources, or micro-objects, that are less-than-one-minute have emerged in microlearning literature, especially with the rise of short video platforms such as TikTok and Instagram; however, Hamilton et al. (2021) called these less-than-one-minute learning segments an extreme form of microlearning, coined nano-learning. In the literature, nano-learning is less ubiquitous than microlearning, so we call any learning that is less than 20 minutes, including learning that is less than one minute long, microlearning.

We contend that learning in micro is different from macrolearning, and the process of "how one comes to know" (Driscoll, 2014, p. 5) is different with microlearning. The *theory of learning in micro* is based on the hypothesis that learning is a continual process better supported with smaller, more focused learning resources and activities (see Figure 2), but learning is still being designed in a macro-approach, regardless of established research (Madden & Govender, 2020; Tipton, 2020). To differentiate the theory of learning in micro from micro-objects (Aldosemani, 2019; Buchem & Hamelmann, 2010), we are proposing a theory focusing on how people learn in micro.

Figure 2

The Theory of Learning in Micro



Note. Adapted from "Brain with Digital Circuit and Programmer with Laptop. Machine Learning, Artificial Intelligence, Digital Brain and Artificial Thinking Process," by vectorjuice, n.d., *Freepik*.

Theory Description

The *theory of learning in micro* is based on two assumptions: (a) how content and procedural knowledge are gained in microlearning, and (b) how design impacts the gain of that knowledge. Within these two assumptions, the theory of learning in micro emerged, showcasing a gap in the literature on how people learn in micro.

Knowledge

The knowledge gained through microlearning includes two primary categories: acquisition and application of knowledge.

Acquisition

Knowledge acquisition of knowledge is the gaining of new information based on previous knowledge and schema (Adcock, 2013; Anderson, 1984; Sweller, 1988). Within knowledge acquisition with microlearning, two instances occur when compared to macrolearning: (a) microlearning better supports content knowledge acquisition than macrolearning (Manning et al., 2021; Polasek & Javorcik, 2019), and (b) in spaces where breadth of knowledge is more prioritized than depth, microlearning will better support this breadth of knowledge than macrolearning (Dingler et al., 2017).

Content Knowledge Acquisition

For content knowledge acquisition, smaller or shorter amounts of content support the cognitive load and working memory (Lee et al., 2013; Miller, 1956). Cognitive load is the amount of information someone can take in based on extraneous stimuli, prior knowledge, and intrinsic interest while moving learning from working memory to long-term memory (Lee, 2013; Paas et al., 2010; Sweller, 1988). Chunking, a term commonly associated with microlearning (Birch & Lewis, 2020; Buchem & Hamelmann, 2010; Hanshaw & Hanson, 2018), is typically used when discussing cognitive load and refers to creating smaller or shorter amounts of information and learning (Lee et al., 2013; Miller, 1956). These smaller chunks of learning support knowledge acquisition by removing the extraneous content and activities, focusing

learners on the most important aspects (York, 2013), and grouping like content together to help learners scaffold the content and integrate it into their existing schema (Adcock, 2013; Lee et al., 2013).

Breadth of Knowledge

The breadth of knowledge refers to the amount of knowledge, typically indicating a lot, without necessarily having a deep understanding of the knowledge (Webb, 2012). Furman (2017) calls breadth of knowledge the "mile wide, inch deep" (p. 32) scenario, where one knows a lot of information but has surface-level knowledge of those items. When the breadth of knowledge is needed, such as in introductory courses or Google searches for quick information, microlearning is optimal due to its short length, ability to chunk with other like content, and easier connection to prior knowledge (Buchem & Hamelmann, 2010; Dingler et al., 2017).

Application

Application of knowledge is the practice of implementing learning (Molenda, 2013). Within application of knowledge, three instances occur with microlearning: (a) microlearning provides opportunities for learning for authentic application and content knowledge (Emerson & Berge, 2018), (b) in spaces where depth of knowledge and skills are needed, microlearning better supports specific skills and knowledge than macrolearning (Polasek & Javorcik, 2019), and (c) microlearning supports learners' learning and application of new knowledge quickly (So et al., 2020).

Authentic Application

Authentic application of knowledge involves demonstrating skills in real-life situations or settings (Zheng & Sang, 2013). Microlearning can support authentic application and just-in-time tasks similarly to job aids but moves beyond immediate assistance to upskilling and reskilling, especially in workplace settings (Hogle, 2021). Upskilling is when someone refines their current skills, and reskilling is when someone learns something new (Degreed + Harvard Business Publishing, 2019; Hogle, 2021). In both upskilling and reskilling, authentic application is needed through focused and purposeful resources (Degreed + Harvard Business Publishing, 2019). Microlearning can be used for these focused and purposeful resources, ensuring application in an authentic manner is included.

Depth of Knowledge and Skills

Depth of knowledge refers to the connections and extent of knowledge on a topic (Webb, 2012). Microlearning supports specific skill acquisition in both just-in-time and mastery senses (King, 2021). In application, mastery of skills is regularly connected to competency. Microlearning has been connected to competency-based learning, which focuses on applying learned knowledge, skills, and/or attitudes to showcase proficiency in a topic (Emerson & Berge, 2018; Zhang & West, 2020). Although competency and depth of knowledge are regularly coupled with time (Webb, 2012), microlearning research suggests that skills can be learned for immediate and continued application and transfer in shorter chunks of learning (Hamilton et al., 2021; Hogle, 2021; King, 2021).

Learn and Apply Quickly

Microlearning supports just-in-time learning and new knowledge when needed quickly (King, 2021; So et al., 2020). Learners want to find information quickly and have their specific learning needs met (Hamilton et al., 2021; Hogle, 2021; So et al., 2020). This personalization of learning and access to various topics is being designed in microlearning platforms that enable subscription or pulled approaches that are learner-centered (see Hamilton et al., 2021; Hogle, 2021; Zhang & West, 2020). Microlearning can support learners in their application of learning by providing short resources that, when designed well, can be effective and allow learners to apply their knowledge in a short-time format (Tufan, 2021).

Design

We also follow the assumption that design impacts the gain of knowledge. We provide recommendations that support designing learning in micro in two categories: microlearning design and the learning environment.

Microlearning Design

The design of microlearning moves beyond chunking and reducing content to the specific design considerations to support learning in micro (Tufan, 2021). Within microlearning design, two instances occur: (a) microlearning designed with cognition elements and researched multimedia principles will better support knowledge acquisition (Tufan, 2021), and (b) microlearning designed with reflective practices and hands-on opportunities will better support knowledge application (Emerson & Berge, 2018).

Design with Research-Based Guidelines

Building new knowledge on previous schemas will be better supported if microlearning is designed with cognition elements such as cognitive load theory (Sweller et al., 1998) and researched multimedia principles such as Mayer's (2017) cognitive theory of multimedia learning (Tufan, 2021). As previously argued, knowledge acquisition is better supported with shorter learning that is more focused, removing the learner's extraneous load (Sweller et al., 1998). Coupling this with researched multimedia principles supports the design of learning that increases essential and germane load while reducing the extraneous load (Clark & Mayer, 2016; Mavilidi & Zhong, 2019; Sweller et al., 2019). By designing microlearning with cognition and researched multimedia principles in mind, learning can be more effective and impactful (Tufan, 2021).

Include Reflective Practices and Hands-on Opportunities

The inclusion of hands-on frameworks in microlearning design, such as active learning (Brame, 2016), and reflective frameworks like self-regulated learning (Zimmerman, 2002), supports knowledge application with and without competency-based models (Emerson & Berge, 2018). Active learning, which includes hands-on activities and reflective practices, allows the learner to practice by doing (Brame, 2016). Active learning is very important in skill-based or competency-based learning as it supports depth of knowledge for skill-based practices (Polasek & Javorcik, 2019) that support learners' desire to learn quickly (So et al., 2020). Goal setting, self-observation, and self-reflection, which can be used with active learning as reflective practices, support motivation and self-awareness of new learning and connect learning back to personal environments (Ley, 2013; Zimmerman, 2002). Microlearning, when designed with reflective and hands-on practices, can support learners in acquiring and applying new learning.

Learning Environment

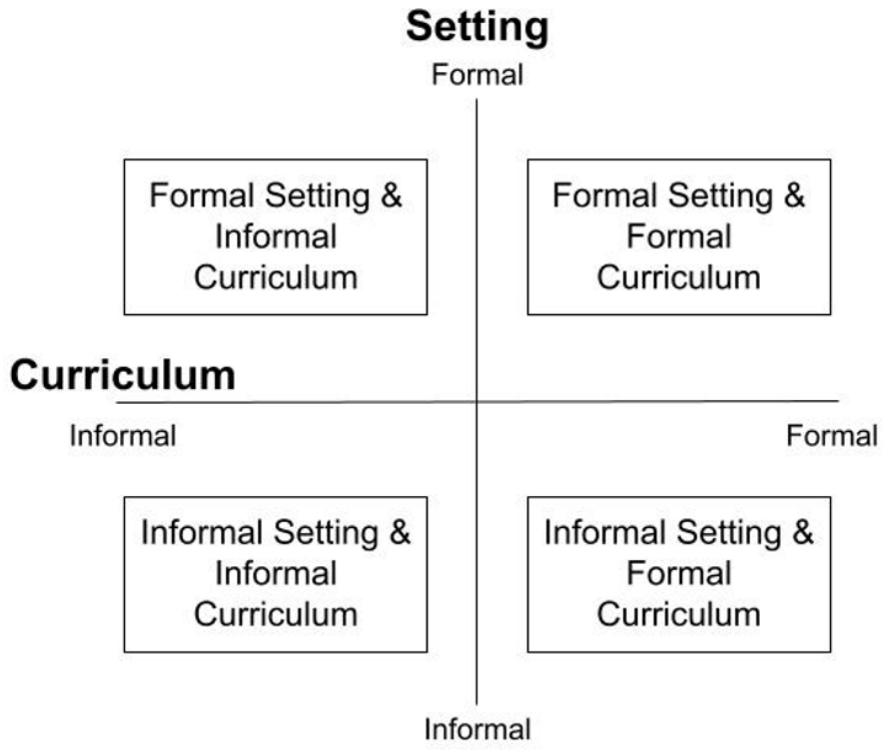
The learning environment includes how the learning is made and delivered (Schwier, 2012); when creating learning, it is considered the most important factor (Marsick & Volpe, 1999; Rosemary & Feldman, 2009). Within the learning environment, two instances occur: (a) microlearning should be specifically designed for formal or informal learning and (b) microlearning designed for informal learning environments will better support knowledge application than knowledge acquisition (Buchem & Hamelmann, 2010).

Designed for Specific Environments

Learning is on a continuum. In formal learning, the setting and curriculum are structured, typically directed by a teacher or facilitator. In informal learning, the setting and curriculum are learner-directed (see Figure 3; Sefton-Green, 2004). Informal learning models differ from formal learning models as they include specific design considerations for the self-directed, social learner searching for or learning in a non-intentional way (see Gu et al., 2014; Manuti et al., 2015; Martinez & Whiting, 2020). The use of microlearning designed for formal environments will be less effective in knowledge acquisition and/or application in informal environments (Emerson & Berge, 2018). When designing microlearning, the specific environment in which the learning will take place should be considered because formal, non-formal, and informal learning has different considerations during design.

Figure 3

Continuum of Informal and Formal Learning



Note: Adapted from "Designing Informal Learning Environments," by S. A. Martinez and J. N. Whiting, in J. K. McDonald and R. E. West (Eds.), *Design for learning: Principles, processes, and praxis* (p. 2), 2020, EdTech Books. https://edtechbooks.org/id/designing_informal. CC BY-NC.

Informal Learning Environments

Microlearning and informal learning have been connected in the literature (see Boileau, 2018; de Vries & Brall, 2008; Martinez & Whiting, 2020), but few studies have considered informal microlearning design (see Bal et al., 2023; Buchem & Hamelmann, 2010). In informal learning environments, networking and collaboration within communities occur; thus, microlearning is ideal for quick sharing of information and skills (Buchem & Hamelmann, 2010). Informal microlearning resources include videos, infographics, and internet searches (Kasenberg, n.d.; King, 2021), with the most popular being videos (Czyz, 2017). Within these resources, there is a large focus on upskilling and reskilling, especially in workplace settings (Hogle, 2021). The focus on skills in informal learning literature and the connections of informal learning and microlearning suggest that informal microlearning will better support the application of knowledge based on the direct, short content provided through the popular video format.

AECT Connection

The theory of learning in micro is in direct alignment with the Association for Educational Communications & Technology's (AECT) mission of "promoting scholarship and best practices in the creation, use, and management of technologies for effective teaching and learning" (AECT, n.d., para. 4). As a leader in educational technology research and best practices, AECT is in a position to help shape the future of research on microlearning by encouraging members to engage in scholarly work in this area, and ultimately, by paving the way for Learning Design and Technology researchers to connect the existing practice with theory. Through our initial theory, we hope to exemplify the values of

leadership and collaboration as we work together to establish a foundation for how people learn in micro. Further, advancing knowledge and design related to microlearning demonstrates a commitment to producing high-quality artifacts, a component of the AECT value of professional standards.

Why Use this Theory

Microlearning has been around since 2002, but even with 20 years of use, it is still considered an emerging instructional design trend (Hug, 2007; Madden & Govender, 2020). Although microlearning is used in various contexts and environments, the definition and design elements vary. A few microlearning frameworks and models exist in the literature (see Alqurashi, 2017; Dolasinski & Reynolds, 2020; Hug, 2007; Kasenberg, n.d.). These frameworks and models support practitioners' use of microlearning. However, additional research is needed to provide context and explanation and robust theoretical perspectives that can be tested and challenged. In summary, our proposed *theory of learning in micro* aims to provide a set of beliefs and assumptions to the microlearning community to be used by Learning Design and Technology researchers as further frameworks and models are developed.

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Mohammad Shams Ud Duha is pursuing his Ph.D. in Learning Design and Technology at Purdue University, USA. He is also the recipient of the prestigious Andrews Fellowship at Purdue. His research interests are online learning environment, social media in education, and microlearning. His research has appeared in multiple leading journals, including Online Learning, Journal of Computing in Higher Education, and TechTrends. He has worked as an Instructional Designer for Purdue Repository for Online Teaching and Learning (PoRTAL) and the Paraimpact Project at Purdue University. He is currently serving as the President of the Graduate Student Assembly of the Association for Educational Communications and Technology (AECT), an international association of scholars and professionals concerning instructional technology. Prior to his joining Purdue, he taught English at Brac University in Bangladesh. He was also awarded a Fulbright Scholarship to teach at Indiana University, Bloomington, USA during the 2015-16 academic year. Shams is also a writer and chess player. He has written three books, has scripted nine plays and drama serials for Bangladeshi television, and achieved an international rating in chess.

Okan Arslan

Texas Tech University

Okan Arslan is a Ph.D. candidate at Texas Tech University in the instructional Technology program with a minor in Information Sciences and Quantitative Studies. His research focus is on Instructional Design and Technology, Healthcare Education, Simulations in Healthcare Education, Learner Analytics, Educational Data Mining, and Technology Integration.

Jessica Collier

Sam Houston State University

Jessica Collier is a doctoral candidate in the Instructional Systems Design and Technology program at Sam Houston State University. She holds an M.Ed. in Instructional Technology and has more than 10 years of experience developing equitable, accessible, inclusive learning experiences for diverse audiences in the higher education, adult education, and business sectors.

Paula Marcelle

Indiana University, Bloomington

Paula Marcelle is an emerging scholar and practitioner. She is an instructional designer and adjunct faculty teaching courses in the design of instructional materials, and foundational science. Her research interests include self-regulated learning, micro-credentials, educational policy, STEM education, and equity in secondary education. She has multiple research projects in various stages of development in the research process and in different kinds of analyses (qualitative, quantitative and mixed methods).

Annetta Dolowitz

Over 20 years as a trainer and educator with learners in the public and education sectors. Passionate about working with people, collaborating on developing employee training and solutions to problems, building relationships with others that; foster self-sufficiency, guiding and supporting the implementation process, and promoting team development.

Jamie Bernhardt

Jamie Bernhardt is a PhD Student in Learning Technologies at Georgia State University, where he also earned a BA in Philosophy and a MS in Instructional Design & Technology. Jamie previously worked in Instructional Design roles with Abbvie Inc., the Emory Autism Center, Atlanta Speech School, and the School of Social Work at Georgia State University. Jamie's primary research interests center around designing multimedia learning environments for diversity, meaning making, and understanding and improving one's abilities and health. Jamie has published research about a summer program evaluation meant to engage adults on the autism spectrum into practicing independent living skills while setting and achieving their own health and wellness goals in an on-campus residential experience. He also completed research about evaluating the quality of YouTube videos for fidelity to use of best practices from the field of health literacy (e.g. for plain language, quality, understandability, and actionability). Jamie's dissertation will study the design and use of games and interactive multimedia experiences to enhance learning about one's own cognitive abilities.

Meg Swanson

Brigham Young University

Meg received her bachelor's degree form Brigham Young University - Idaho and is currently a graduate student studying Instructional Psychology and Technology at Brigham Young University. She has a particular interest in design and assessment, looking into computational thinking and microcredentials.

Monalisa Dash

Brajrajnagar College