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Designing Microlearning Instruction for Professional Development Through a Competency Based Approach

Jiahui Zhang[1] · Richard E. West[1]

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Abstract
This paper explores current understanding of microlearning as an effective model for professional development. From a theoretical perspective, the authors explore the rationale for microlearning by considering literature on competency-based education (CBE) and microcredentialing. Existing research specifically focused on microlearning is then considered, including essential design elements for microlearning lessons. The discussion concludes with suggestions for both further research and practice including design and development of microlearning lessons for professional development. We argue that microlearning can be a powerful model if design is appropriate.

Keywords Microlearning · Professional development · Competency based · E-learning · Skill based

The industrial model of education, popular during much of the 19th and 20th centuries (Aslan & Reigeluth, 2013), focused on fully training professionals for a job or career and then asking them to execute relevant skills. In the current information age, a new model of professional learning is needed: a model emphasizing just-in-time instruction, focused interventions, flexible and accessible models, and learning tailored to the goals of the professional. Microlearning is an innovation developed to meet the needs of the twenty-first century professional by providing quality professional learning in formats that may more easily support continual development of careers and organizations.

Microlearning is a form of e-learning delivered in small chunks, focused on delivering skill-based and just-in-time knowledge (Paul 2016) in contrast to traditional training which may require long sessions prior to or interrupting job performance. The average adult spends 20 min per week on learning for work (Bersin 2017), interruptions which can cause work stress and role strain (Galluch et al. 2015). As 96% of people search for information online in the moment they need it (Greany 2018), microlearning is particularly appropriate for modern workplaces. The individual bite-size lessons contain only one measurable skill-based learning outcome, some form of digital-based instruction, and at least one quick assessment.

As microlearning is a fairly new methodology, discussion advocating its use for employee professional development is occurring more often on blogs, social media, and other less academic sources than in full research studies published in peer-reviewed journals. Thus only limited peer reviewed and research-based literature on this topic is available (So et al. 2018).

We conducted a raw literature screening about microlearning in EBSCO Education Full Text and Scopus databases to compare the number of academic journal articles and nonacademic articles. Searching with *microlearning* as the only keyword generated 525 results from EBSCO, but only 69 of these articles were in academic journals, less than one third of the number published in magazines. Limiting the results to peer-reviewed articles, it dropped to only 29. Adding the second keyword *workplace* took the number down to five, most of which mentioned microlearning briefly without focusing specifically on the topic. The Scopus database yielded a similar ratio of publications related to microlearning, with the number of journal articles only half the number of published conference papers.

By comparison, an EBSCO search for articles related to competency-based education yielded 1209 results from academic journals (only 502 articles from magazines). Clearly

✉ Jiahui Zhang
jiahuizhang07@gmail.com

[1] Instructional Psychology & Technology, Brigham Young University, Provo, UT, USA

related topics such as competency-based education have been explored, but much less discussion has been focused directly on microlearning.

This paper is intended to stimulate academic conversation on microlearning by examining what is currently known about its effectiveness as a teaching-learning model. Because microlearning is less understood than its related methods, we begin from a theoretical perspective by exploring it from literature sources on competency-based education and microcredentialing. We then discuss the research that does exist on microlearning specifically and discuss the essential elements for designing microlearning lessons constructed around Hug's (2005) seven dimensions model (model strengths and weaknesses included). We end the discussion with suggestions for research as well as practical suggestions for designing and developing microlearning lessons for corporate learning.

Review of Literature

Though some may question whether microlearning is a fad that may not be based on sound educational theory, our research and experience have found it theoretically sound. Because there are limited research studies on microlearning, examining the theoretical framework of competency-based education and microcredentials can help us draw many conclusions related to microlearning's potential efficacy.

Competency-Based Education

Microlearning is a form of competency-based education (CBE). The development of CBE can be traced directly to the 1960s, although its predecessor, outcome-based learning, has been practiced for over a hundred years in adult education and professional development (Nodine 2016). Different from traditional teacher-led training, in which learners must distinguish competencies, CBE begins with pre-determined competencies from which instruction is developed.

Ulmer (1981) argued that CBE should focus on an individual learner's goals rather than one-size-fits-all instruction. The discrepancy between skills taught in traditional higher education and skills valued by workforce employers has been referred to as a cultural gulf between business and academic learners (Industry and Higher Education 1999). This academia–practice gap (Huston et al. 2017) includes disparities in perceptions of generic skills (Leveson 2000), and graduates' lack of employability skills (Lowden et al. 2011). In contrast, CBE allows individual learners to customize their learning by choosing only the competencies they need to improve to qualify for the careers they desire (Sturgis, 2017). In a poll of 1207 graduates of Western Governors University, an online university offering competency-based programs, 78% reported that the skills they had learned with the CBE approach related specifically to their work—a number 10% higher than graduates from traditional universities (Marcus 2017).

An increasing number of professional companies have adopted CBE for internal professional development. According to Johnstone and Soares (2014), the National Association of Manufacturers' manufacturing skills certification system "has developed a structure of stackable credentials warranting that workers have attained the competencies required for increasingly sophisticated levels of work across many areas of manufacturing, from machine operation to engineering to management" (p. 15). This association has established a partnership with the University of Phoenix, another university offering online competency-based programs, and "the association's competency-based curriculum and credentials will form the core of a bachelor's in management at the online university" (p. 15).

Studies to date have shown the effectiveness of CBE (Hatcher et al. 2013; Mulder et al. 2010). Lepage et al. (2004) conducted a study at the University of Wisconsin–Madison on how CBE affected performance of preservice consultants and their resulting consumer satisfaction. Participants included 24 graduate students from the school of psychology and a group of consultees who were teachers and parents of preschool-aged children. The graduate students had participated in a four-year competency-based program with six phases: pre-training assessments, competency-based training, post-training assessment (1), consultation capstone, post-training assessment (2), and post-training assessment (3, follow up). The major components of the CBE phase included readings, observations, audio-taped role plays, and supervision. Participants had many opportunities to apply what they had learned to real life simulated scenarios. The study found a significant increase in post-assessment scores, high consultee satisfaction rates, and more likelihood that behaviors of intervened child clients would change.

Digital Open Microcredentials

CBE is an umbrella designation embracing needs-based and goal-driven teaching and learning approaches including open digital microcredentials (what many call open badges). While some prefer to use the term *microcredential* to represent a larger body of learning than *open badge*, the two terms are frequently used interchangeably in the literature. Figure 1 shows the relationship we posit for CBE, microlearning, and open microcredentials. The use of open microcredentials to indicate educational progress was adapted from youth scouting programs. By completing specific task(s), a boy or a girl scout earns a badge. In training settings, open badges (microcredentials) are created and issued to validate an individual's acquisition of a skill. Compared to traditional

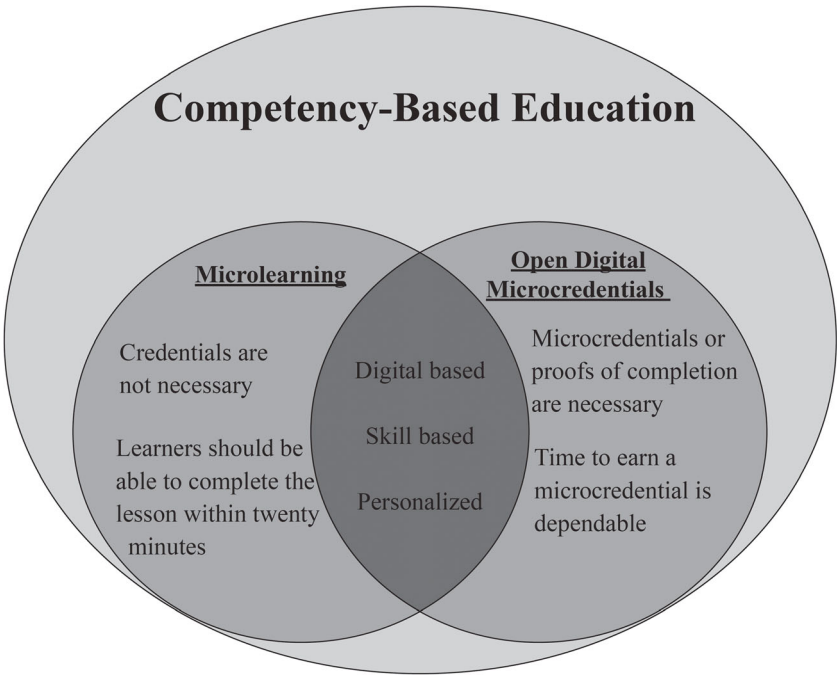

Fig. 1 The relationship among CBE, microlearning, and open digital microcredentials

transcripts and credentials, for which trustworthiness of grades and course or program completion dates are questionable, each open microcredential is a metadata cloud of proofs (Belshaw 2016).

> [They include] information about the badge issuer (institution name, date of issue, rubric and requirements for the badge) and badge earner (name, evidence of learning, and feedback from the issuer), providing a more transparent picture of what has been learned and the observable evidence of that learning" (Farmer & West, 2016, p. 45).

Learners have the right to choose which microcredentials they want to earn based on their diverse learning needs and goals and thus create unique learning paths. For example, Trainee A and Trainee B from the same marketing department of a company may view their selling strategies differently. Trainee A thinks knowing what she is selling is the priority, whereas Trainee B is more concerned with developing his interpersonal skills. Although both of them work in the same department, they can customize diverse learning paths by selecting different microcredentials to work on to become more competent sellers according to their own definitions of success.

The concept of learners' choice in developing their learning pathway is embedded in current microcredentialing systems. In 2019 Badgr, one of the leading open badge/microcredential providers, launched an open pathways add-on allowing an employer (or teacher) to create a pathway consisting of open microcredentials from various institutions and learning providers. Anyone, including an employer, can create a predetermined pathway with choices for "passing off" each step of the path. In addition, learners can construct their own pathways to represent their own goals, previous learning, and future intended learning. These learning pathways can be shared and duplicated as open objects to be components of an open education infrastructure.

Gamrat et al. (2014) conducted a qualitative study on personalized learning in teacher professional development through open microcredentials. They found that teachers chose different content and assessment levels based on their needs and schedule, ranging from simple activities that required less time to microcredentials that were more rigorous. The results also indicated that all study participants rated personalized learning and open microcredentials favorably. This finding supports previous research designating four considerations for creating effective digital-based personalized learning: learner choices, instructional design, learning environment, and assessments (Green et al. 2005).

Many companies are exploring open microcredentials as a form of professional microlearning. IBM's expansive open microcredentials initiative (see https://www-03.ibm.com/services/learning/) has issued over a million open microcredentials to their employees, as well as to others participating in their online training. IBM has reported that this program has resulted in greater employee engagement, more professional development participation, and higher social media brand impressions (as employees share their microcredentials; see Leaser 2015). Under a recent agreement with Northeastern University, many of these microcredentials can now be converted to university credit towards a master's degree (Leaser 2018).

Microlearning

The literature on CBE and open microcredentials demonstrates overlap with microlearning, as there are more similarities than differences among them (see Fig. 1). CBE shares the theoretical and practical frameworks of microlearning, while open microcredentials can provide means for its practical representation and acceptance. Other aspects linking the three include the online mode of delivery, the focus on obtaining skills, and the emphasis on personalized learning directed by the learner (Figure 2).

First, the microlearning options are digitally based. The titles and abstracts of all 64 results related to microlearning (or variations such as microcontent) in Scopus database indicated digitalized instruction delivery. Digital-based learning is created to fit information retrieving styles of today's adults (Donahue 2016; Paul 2016; Pedro 2009; Winger 2018). According to Pedro (2009), millennials' cognitive preferences for information are different from those of older generations, as they prefer to (a) access information digitally, (b) use visual representations, (c) multitask, and (d) receive short bursts of information. He confirmed that as millennials are entering the job market, traditional forms of training need to be shifted to digital formats.

Second, CBE, microlearning, and open microcredentials are all skill based. Paul (2016) emphasized the importance of microlearning for reinforcing previously learned skills. Instead of traditional instruction in critical thinking, for instance, learners can take microlessons or earn microcredentials for specific skill sets, such as analyzing problems, researching causality, and identifying biases. The company Hand & Stone used mobile microlearning to train their employees on knowing and understanding their products, thus increasing employees' upselling competence. This $20 per month investment yielded $2400 per month in extra sales (Dutton 2018). The skills taught in microlessons are concrete, measurable, and relevant to the defined competencies.

Third, CBE, microlearning, and open microcredentials all emphasize personalized learning. Most existing literature about microlearning focuses on personalization (Bruck et al. 2012; Kovachev et al. 2011; Wen and Zhang 2015). For a study on tagging for microlearning, Kovachev et al. (2011) developed a web add-on that included translating, converting text electronically, tagging learning content, scraping content from web pages, and synchronizing to the application on mobile devices. The findings of the study showed results similar to the personalized teacher professional development of Gamrat et al. (2014), presented as an example to support the effectiveness of open microcredentials.

Despite the similarities, a distinction between microlearning and open microcredentials may exist in the amount of learning represented in a single unit. Gamrat et al. (2014) argued that earning a microcredential should involve more significant effort than completing an activity and earning a "stamp." Similarly, (Farmer & West, 2016) argued that microcredentials carry more weight if they represent significant mastery of a skill. However, microlearning values just-in-time learning, which enables individuals to learn a skill

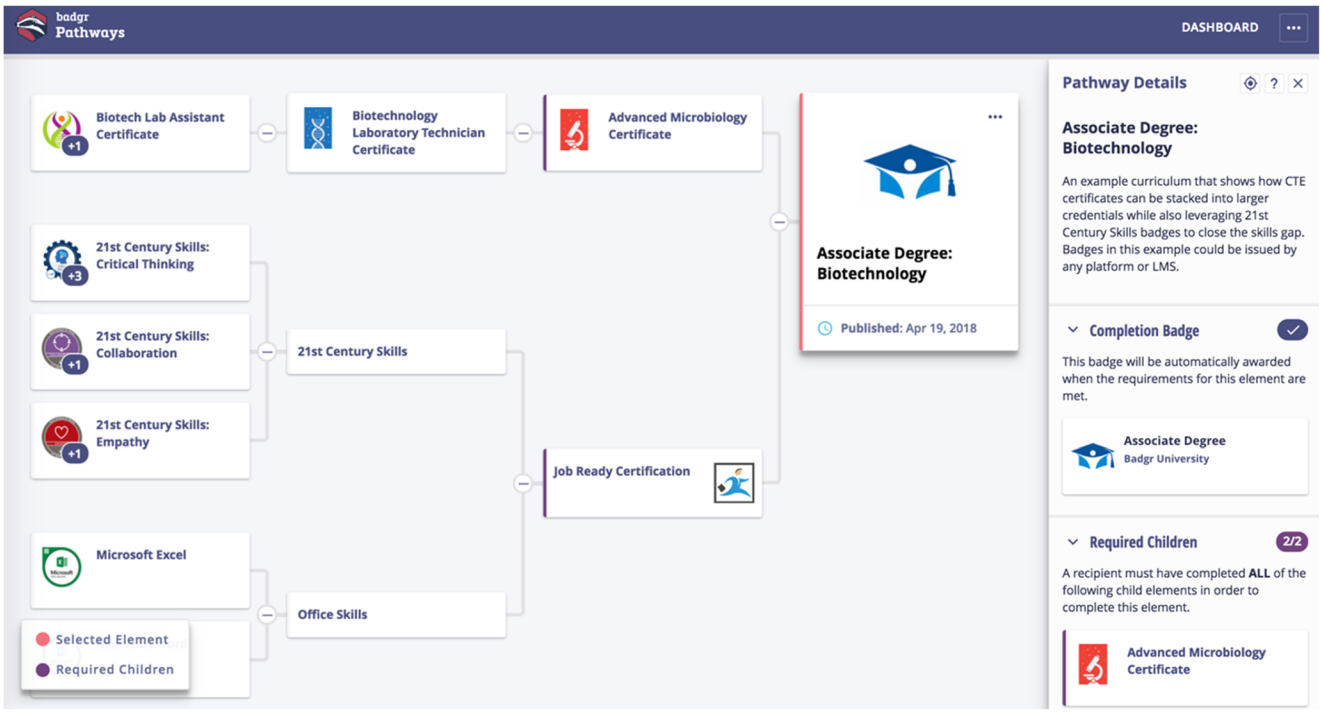

Fig. 2 Pathways allow microcredential issuers, or earners, to organize microcredentials into personalized paths where earners select their preferred option for each requirement on the path. Shown is Badgr pathways, from https://support.badgr.io/pages/viewpage.action?pageId=84967427

quickly on demand (Kapp and Defelice 2018), perhaps in only a few minutes (Winger 2018). Also the focal point of microlearning development is capturing small bursts of attention due to decreased adult attention span during this digital age. Thus as microlearning and microcredentials continue to evolve, credentials representing mastery of smaller competencies may be needed for completion of distinct microlearning modules along a learning pathway. The open pathways structure can allow these smaller stamps, checkpoints, and eventually badges to then aggregate to automatically form issued microcredentials.

Strategies for Microlearning Module and Lesson Design

As noted, while *bite size* is the buzzword of microlearning, the actual length typical of a microlearning lesson remains controversial. Some scholars have claimed the lesson should be around 5 min (Kapp and Defelice 2018; Paul 2016), but some have argued 15 to 20 min is more adequate (Alqurashi 2017). Some voices claim microlearning is not just about time: Individual lessons should take as long as needed to deliver *one* measurable learning concept (Dave 2018; Dillon 2018). We suggest that learners should be able to complete a microlearning lesson within 20 min; however, it is critical for the lesson to include activation of prior knowledge, delivery of information, and some form of short assessment. Dividing a traditional training sequence, which might have taken hours, weeks, or even longer, into many small pieces is not a skill inherent for every instructional designer. One must be able to extract *must-know* information or skills from a pile of *ok-to-eliminate* possibilities (Alqurashi 2017).

This is not an easy process. If we transcribe part of our daily conversation, we will realize that we unconsciously add information that has nothing to do with the main idea we are expressing. We add extra information in order to make the story more complete. But the content of microlearning needs to be so concise that it "cannot be divided into smaller pieces without the loss of meaning" (Buchem and Hamelmann 2010, p. 5). Not unlike minimally viable product design, microlearning design must be based on the smallest description of a competence that can be sufficient.

Module Design: Grouping Pieces, Representing Progress

To produce such a concise version, experts can design microlearning didactically (Buchem and Hamelmann 2010; Hug 2010). Hug (2010) introduced four models for microlearning module design, distinguished by how they sort content into larger groups: aggregation, conglomerate, emergence, and medium/form distinction. Similar skills can be bundled together in the aggregation model, but the conglomerate model is like a big pot containing diverse skills. An emergence model allows learners to self-organize the skills they have determined to include. For medium/form distinction learning, each skill or group of skills becomes a medium for acquiring a more complicated competency.

Hug's four didactic models have implied that the learning modules need to be visual for learners. Finding a way to accumulate *microlearning* into eventual *macrolearning* visually is critical (Baumgartner 2013; Winger 2018). Capella University has done this well with a learner competency dashboard that visually displays the progress of the learner towards achieving competencies (Fig. 3). Because learners acquire skills at different paces, they must be able to easily access records of which competencies they have acquired, which competencies they still need, and how well they are progressing towards their learning goals—which visualizations such as this dashboard can provide. For traditional learning modules, instructors set learning objectives, and each of the objectives may require more than one concrete skill to complete. In contrast, each microlearning lesson focuses only on one skill, so learners must be able to map their competencies as individual puzzle pieces forming an expansive image. Having a way to sort these lessons and map these competencies can help novice learners avoid feeling overwhelmed by the large number of bite-sized lessons (Baumgartner 2013).

Lesson Design: Providing Essentials

Similar to Merrill's first principles of instruction (2002), we argue that microlearning should have a complete flow of instructional events organized around a central problem: in this case a problem situated in the learners' work environment. Margol (2017) suggested the importance of conducting a needs analysis prior to designing microlearning lessons to identify employers' desired business outcomes, expected competencies, and anticipated competency gaps. Microlearning lessons should be situated in the context of the learners' working environment (Buchem and Hamelmann 2010), allowing them to apply the skills they have learned to their job immediately. To teach practical skills, microlearning lessons provide just-in-time learning with just enough information for participants to learn a skill as they need it (Kovachev et al. 2011; Wen and Zhang 2015). Paul (2016) also claimed that the knowledge delivered through microlearning should be easy for learner to reference. As well as being conveniently brief, they must be digitally based so that learners can access them on demand.

Hug (2005) suggested seven dimensions for designing microlearning lessons: time, content, curriculum, form, process, mediality, and learning type. To study the effectiveness of the seven dimensions, Job and Ogalo (2012) conducted a qualitative study in Britain, collecting 85 questionnaires

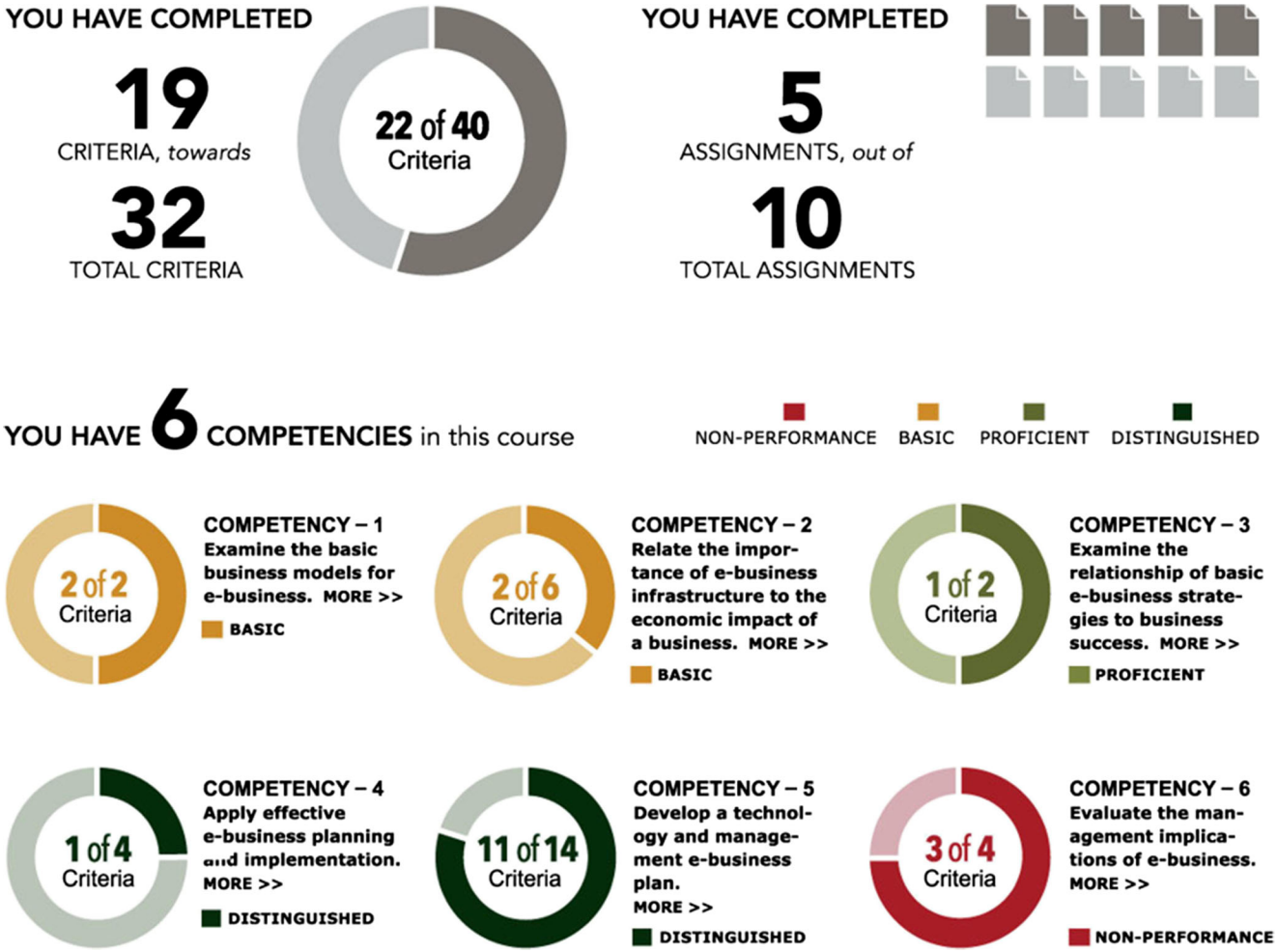

Fig. 3 Competency maps provide feedback to earners based on their progress towards mastering defined competencies. Show is a competency map by Capella University for e-commerce business course competencies. Reprinted from A.W.Bates (2015), *Teaching in a Digital Age*, retrieved from Senese (2018)

regarding perceptions of microlearning in workplace training. Almost 80% of the respondents expressed positive attitudes toward microlearning. They selected process, curriculum, and form (in that order) as the three most important dimensions of the seven; the difference between process and curriculum was almost 10%, but the difference between curriculum and form was only about 2%. Hug defined the process as different forms of learner interactions. The study confirmed that learner interactions, such as learner to learner, learner to expert, and learner to content, are inseparable from microcontent in a microlearning lesson (Alqurashi 2017; Baumgartner 2013).

Hug's model lacks a feedback dimension, which is essential to digital-based learning. Berge (2002) considered learning goals, learning activities, and feedback/evaluation the most critical components of e-learning. He used the analogy of a set of gears, which will not function properly if one part is missing. Due to the brevity of lesson content and assessments, students have particular need of feedback to help them identify their capability to perform the skill. Feedback can be provided immediately for quiz questions or via coworkers and managers if learners asked to apply the skill in a workplace setting. Alqurashi (2017) contributed another counterargument for the seven dimensions, claiming that Hug's model did not consider technology use. Alqurashi's model sorted all seven dimensions into one design aspect, which she referred as *content aspect*, and with pedagogy aspect and technology aspect in addition.

Discussion

Reviewing the literature on competency-based education and digital open microcredentials in relation to the limited literature on microlearning suggests fundamental principles for designing microlearning experiences. Merely dividing a traditional training lesson into smaller chunks is not sufficient to promise effective microlearning. Instructional designers need

to consider the following aspects when developing lessons for this innovative way of learning.

Central Problem or Skill

Individual lessons should be centered on one problem or skill. Including more problems or skills interferes with the objective of allowing individuals to learn a new skill or knowledge cluster within a short amount of time. The problem or skill should be contextualized in real situations connected to learners' jobs and careers so that they can immediately apply the learning.

Activation and Assessment

Although opinions vary on the length for a microlearning lesson, we posit that it can be as short as possible if it includes activation of prior knowledge and assessment of learning—both of which are crucial for effective learning (Merrill 2002). Microlessons can be delivered through simple formats. For example, the lesson can begin with a problem that will be familiar in the learner's employment, which will activate intrinsic motivation for learning the skill. The assessment at the end of each lesson may include a short quiz and/or activity that asks learners to apply the skill to a current workplace task that can result in feedback from peers or supervisors. The designer should avoid open-ended questions for which feedback will not be available.

Categorization and Reference

Because microlearning is short and skill based, learners are more likely to quickly reference a skill they learned quickly, rather than one from a long formal training lesson accompanied by details and complex relationships. Categorizing microlearning lessons and linking them to a content table or a search box will save time for learners wanting to retrieve information on demand. Designers should be sure this microlearning utilizes openly licensed materials that can be referenced freely and long term, even if the employee transitions to a new school or employment.

Personalized Learning

Lessons that learners can take at any time from any place at their own pace are not unique to microlearning. However, microlearning can improve personalization. When individual learners complete a traditional lesson, they must follow a certain sequence in order to achieve the learning objectives. Microlearning allows learners to choose only things they want to learn. Instructional designers need to consider ways that enable learners to take lessons in which aspects do not require all other aspects or a set order of a sequence.

Visual Tracking

A dashboard shows each individual's microlearning achievements, competencies, and/or needed competencies will help the learners better understand their abilities and their progress. Combining microlearning lessons into macrolearning programs helps learners plan their own learning pathways and avoid being overwhelmed by the large number of bite-size lessons.

Brevity

The essence of microlearning is that lessons are short and can be completed quickly. Brevity and concision are the most challenging features for instructional designers. Finding ways to exclude unnecessary information and focus only on important knowledge requires practice. As the process requires breaking a traditional lesson into small chunks, a designer might begin by determining the number of microlearning lessons that are needed to achieve the original learning objectives. It is critical that instructional designers revise each chunk several times to eliminate information that is not necessary for solving the central problem or performing the central skill.

Conclusion

This paper analyzes literature regarding theoretical and practical foundations as well as effectiveness of microlearning. Due to the limited amount of research-based literature on microlearning, we approached it as a branch of competency-based education in order to find more evidence to support the claim that purposeful learner-centered education/training is powerful if designed properly. Some insights on principles for designing microlearning lessons were also included.

Microlearning is designed to help learners acquire a skill or solve a problem within a short time period . It should be digitally based, skill based, and personalized. Instruction should be in contexts enabling learners to immediately apply the skills in their job. Designers of microlearning instruction must determine ways to sort skills into more complicated competencies so that learning pathways leading to microcredentials can be established Some form of visual tracking is critical for enabling learners to visualize the skills they have acquired and need to acquire to be competent. Individual microlearning lessons center around a single skill or problem, providing a simple activation of prior knowledge, microcontent for delivering information, and a short assessment providing immediate feedback. These aspects must be unified and purposeful to boost learning efficiency.

Since microlearning is in its early development, a broad range of studies can make significant contributions to this

field. Future research can focus on generating quantitative and qualitative evidence to examine the effectiveness of microleaning for professional development in various industries. Articles we have reviewed about microlearning revealed a gap in discussing its limitations. As all of these articles claim that microlearning is effective for skill-based training, studying its potential in delivering less tangible knowledge will add valuable discussion to the field. Additional studies might emphasize how grouping microlearning lessons affects learner perceptions of and ability for forming complex competencies. Researchers could analyze and compare models for designing microlearning lessons and learning pathways. Because existing articles on microlearning lack discussion of assessment, studies on how different types of assessment can impact microlearning experience and knowledge retention would be valuable.

Compliance with Ethical Standards

Conflict of Interest This study does not have any conflicts of interest to disclose.

Human and Animal Rights It does not involve human participants or animals.

Informed Consent No informed consent was required.

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