BECOME COMPETENT IN 15 MINUTES? - THE SUITABILITY OF MICRO LEARNING FOR COMPETENCE DEVELOPMENT

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BECOME COMPETENT IN 15 MINUTES? - THE SUITABILITY OF MICRO LEARNING FOR COMPETENCE DEVELOPMENT

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Abstract

Short learning formats such as micro learning are well suited to meeting the growing learning needs created by increasing digitalization. With the help of learning content that is limited in terms of time and content, learners can retrieve information in a demand-oriented and situation-specific manner and acquire knowledge to enable them to adapt to changed circumstances at short notice. However, due to its limited length and content, micro learning is not suitable for developing all types of competences. In this research paper, we present the results of a structured literature review and the empirical results of an interview study. We conducted interviews with 33 experts who are in charge of the design of learning content at enterprises and instructional designers concerning the competences that can be developed using micro learning in enterprises. We identified six different competences that are suitable for development through micro learning: action competence, professional competence, linguistic competence, self-learning competence, social competence, and digital competence. For IS Education, the findings demonstrate the potential learning outcomes using micro learning.

Keywords: micro learning, technology-enhanced learning, competence, action competence, digital competence, workplace learning, knowledge management, organizational learning
1 Introduction

Increasing digitalization leads to challenges as well as potential for organizational learning and knowledge management in enterprises. Digitalization changes job profiles and job structures, regardless of whether the enterprises are in the industrial or service sector (Frey and Osborne, 2013). Working life is becoming more fast-paced. For example, product life cycles change at ever-shorter intervals. Two major consequences of that are increasing knowledge and technology-intensive activities in organizations (Busse et al., 2019). In the same way, the requirements for professional skills and competences are becoming enhanced in all forms of work (Hämäläinen et al., 2018; Nokelainen et al., 2018; Kim et al., 2011). Therefore, the learning needs for employees are increasing (e.g., training for new products, production, or service processes) and knowledge needs to be adapted more frequently and in shorter learning durations (Busse et al., 2019). Consequently, it is crucial to integrate learning in the workplace where learning needs emerge. That is why the workplace has increasingly established itself as a legitimate learning environment over the last few decades, not only for learning new competences, skills, and knowledge but also to enable employees to participate more effectively in ever-changing work environments (Le Clus, 2011).

As mentioned above, digitalization offers potential as well. The use of new technologies in vocational education and training (VET) in the workplace is one possible way to enhance learning and respond to the emerging needs of working life (Hämäläinen and Cattaneo, 2015). Technology-enhanced workplace learning offers solutions for integrating learning processes smoothly into work processes and — at an advanced stage — to consciously reflect the work situation (e.g., in learning objects) (Schmidt and Braun, 2006). Technology-enhanced learning (TEL) concepts such as micro or mobile learning, are among the possibilities for addressing the learning needs of employees. They promise to offer more flexible education and training opportunities (Alkhatib and Rensing, 2016). The results of current trend studies reveal the relevance of micro learning for organizational learning. Ninety one percent (n=65) of the enterprises surveyed in the DACH region (Germany, Austria, and Switzerland) attach increasing importance to micro learning as a central learning concept (mmb Institut, 2018). With the help of small and short learning units (micro content), employees’ needs for individual and situation-specific support can be satisfied (Job and Ogalo, 2012). Thus, employees receive information just in time, for example in their workplace or on-site at the customer premises (Nokelainen et al., 2018).

However, “technology alone does very little to aid learning” (Hämäläinen and Cattaneo, 2015). According to the conceptual model of technology-mediated learning by Gupta and Bostrom (2009), three major factors influence learning outcomes such as skills or competences: learning context, learning method structures, and learning process. This goes along with contributions by scholars such as Jahnke et al. (2019), who argue that micro learning is not suitable for all types of topics and, therefore, not suitable for promoting all kinds of competences (Jahnke et al., 2019). So far, there is still a lack of research on using micro learning for developing competences. In particular, the question of which competences can be developed using micro learning has not yet been answered by research. However, for competence-based micro learning, it is the very first step in clarifying which competences can be developed and kept current in a micro learning environment (Emerson and Berge, 2018). Knowing the possibilities and limitations of micro learning for competence development is crucial for embedding micro learning into organizational knowledge management. Thus, the main goal of this paper is to explain which competences can be developed with micro learning and thus to evaluate the suitability of micro learning for developing competences in enterprises. We approach the subject from two perspectives. In the first step, we conduct a structured literature review to examine the published research on this subject. Thereby, we answer the following research question:

RQ1: Which competences can be developed with micro learning according to the literature?

To complement this theoretical perspective with practical insights, we acquire knowledge from experts in the fields of VET and instructional design. Both expert groups possess practical knowledge about the use of micro learning and its potential in developing competences. We present the results from a qualitative interview study and answer the next research question:

RQ2: Which competences can be developed with micro learning according to practitioners?
To answer both research questions, we have organized the remainder of this paper as follows: In the next section, we describe the theoretical foundation. In Section 3, we present our research design and, thereby, the approaches to the literature review and the qualitative interview study. Next, we combine the results of both perspectives and discuss our findings. Finally, we summarize our findings in the conclusion.

2 Theoretical Foundation

In this section, we describe the theoretical background of our study. In Section 2.1, we provide an overview of the concept of competence and explain why competence management is important for knowledge management in enterprises. We also discuss different frameworks for systematizing competences and which framework we will use to classify our results in sections 4 and 5. Moreover, we demonstrate the potential of technology-enhanced learning to develop competences. In Section 2.2, we introduce micro learning as technology-enhanced learning and explain the potential of workplace learning with short and small learning units.

2.1 Competence Development Using Technology-Enhanced Learning

Corporate knowledge is often distributed in the minds of individual employees. For a consistent level of knowledge, organizational knowledge management has become increasingly important in recent years (Marwick, 2001). The aim of organizational knowledge management is to share the knowledge of individual employees with the entire workforce in order to benefit from higher knowledge in daily business, which can improve, for example, customer satisfaction and financial results (North and Hornung, 2003). One important research topic in the knowledge management domain is competence management, which can provide essential and competitive knowledge in organizations, knowledge that is sometimes hidden (Draganidis and Mentzas, 2006). That is why competence-based approaches have become increasingly important for companies and the training of employees and the development of vocational training for competence development by identifying the knowledge/competence gaps within groups of employees (Sampson and Fytros, 2008). The aim of such approaches is to impart the necessary competences to employees (Kupper and van Wulfen Pulthe, 2001) in a formal or informal way (Aspin and Chapman, 2000; Field, 2001). At this point, technology-enhanced learning has become essential in establishing the infrastructure and possibility for lifelong learning and continuous competence development (Sampson and Fytros, 2008).

In 1973, the concept of competence was first introduced into human resources literature (McClelland, 1973). Competences are now relevant in human resource management, VET, and performance management (Otto et al., 2007; Hoge et al., 2005). Despite the importance of competences, there is no common definition because of the variety of different interpretations of the term competence (Winterton et al., 2006; Le Deist and Winterton, 2005). Even the terms competence and competency are not uniformly used in their meanings: Sometimes the terms are used as synonymous, sometimes the term competencies is used as a plural form of competence (Winterton et al., 2006; Le Deist and Winterton, 2005). Obviously, competencies can be understood as a subset of important competences in a specific field (Sampson and Fytros, 2008).

The original meaning of competences comes from psychology and includes abilities of individuals that help to cope with specific demands and tasks of their environment (Sampson and Fytros, 2008). The first definition of competences in human resource management was published by McClelland, who interpreted a competency as “a personal trait or set of habits that leads to more effective or superior job performance” (McClelland, 1973). Another definition in the field is the one established by Bartram, who defines competences as “sets of behaviors that are instrumental in the delivery of desired results or outcomes” (Bartram et al., 2002). The definition of competences in the context of VET includes the possibility of performing tasks or handling situations through a competence. For example, competences are defined by Voorhees as “a combination of skills, abilities, and knowledge needed to perform a specific task” (Voorhees, 2001). For this study, we define competences as a set of behaviors, skills, abilities, and knowledge to perform specific tasks and handle situations (Bartram et al., 2002; Voorhees, 2001).
Regarding the statements above, competences consist of three different dimensions (Sampson and Fytros, 2008): First, competences contain an individual’s characteristics such as knowledge, skills, abilities, and behaviors. The second dimension is the proficiency level, which is used to group competences in levels with regard to the individual’s performance. The third dimension refers to the context in which a specific competence has to be applied, for example, a task or a situation.

In the literature, different competence models/frameworks can be found that focus on specific areas of application, for example, competences relevant for the workplace (Bartram, 2005) or competences that are relevant regarding digitalization (Distel et al., 2019). A prominent German job-related competence approach is the so-called action competence approach. In this approach, action competence consists of professional competence, personal competence, and social competence (Le Deist and Winterton, 2005; Straka, 2004). Professional competence describes the ability to solve problems and to act adequately in action situations based on specific knowledge, while personal competence includes personal characteristics (e.g., self-confidence and responsibility) and refers to the willingness and ability of an individual to develop opportunities and their own talents, to think and to judge, and to make plans (Le Deist and Winterton, 2005). Social competence describes the ability to communicate, interact with others, and maintain relationships (van Hasselt and Hersen, 1992; Le Deist and Winterton, 2005). Furthermore, a balance of professional, personal, and social competence is a prerequisite for method competence (a goal-oriented approach to solve problems), linguistic competence (to understand and design communicative situations), and (self-)learning competence (the ability to initiate self-regulated learning or to learn with others) (Le Deist and Winterton, 2005). The aim of this approach is to develop action competence in occupational contexts during the entirety of an individual’s professional life, and it is used to classify our results in sections 4 and 5.

As technology provides excellent opportunities to improve education (Donaldson and Knupfer, 2002) and competence development, technology-enhanced learning approaches such as micro learning are suited because of potential in several areas: TEL enables the learner to acquire new knowledge flexibly and on their own when necessary (Steffens, 2006), helps to continuously develop competences during the work process (Schmidt and Braun, 2006), and addresses lifelong learning without increasing employee absences because of seminars. With the opportunity to design learning units in various and less cognitively demanding ways, technology-enhanced learning can enhance the efficiency and effectiveness of gaining knowledge and memorizing it (Dror, 2008). For that, the conceptual model of technology-mediated learning shows that in combination with the learning context (e.g., learning goals) and the learning process (e.g., individual attitude, appropriation), the learning method structures (e.g., learning techniques, information technology) have an impact on the learning outcomes (e.g., competences) and should be considered in the development of learning programs (Gupta and Bostrom, 2009).

### 2.2 Micro Learning as Technology-Enhanced Learning

Today, individuals are taking ever more advantage of the ubiquity of the Internet and mobile devices in the workplace (Degirmenci et al., 2019; Niehaves et al., 2012). For workplace training and learning, micro learning on mobile devices has drawn increasing attention in recent years. Workplace learning often happens just in time, when, and where the employees need it (Rensing, 2016). Therefore, mobile technologies and devices are a central driver for this kind of learning since they allow time- and location-independent learning (Lave and Wenger, 2011). Furthermore, short and small learning units (i.e., micro content) are required to support just-in-time learning on the move (Gu et al., 2011). Especially because of time limitations at the workplace, micro learning has the advantage of flexibly conveying knowledge in the moment of need (Jahnke et al., 2019). Using the technical capabilities of mobile devices (e.g., built-in sensors to locate the learner and adapt the learning content to the surrounding context) to distribute micro content, situated learning on the job can be enabled without information overload (Decker et al., 2017). Additionally, even rather new technologies such as virtual or augmented reality are learning forms that use short and small learning content (e.g., Santos et al., 2016; Horst and Dörner, 2019). Concerning the learning effects of micro learning, several studies demonstrate its potential to positively
influence the learning process (e.g., improve knowledge, learners’ motivation, engagement, performance, retention, and support continuous learning) (e.g., Jahnke et al., 2019; Bruck et al., 2012). Nevertheless, there is a lack of knowledge about what micro learning can and cannot do, especially regarding competence development (Clark et al., 2018; Baek and Touati, 2017). To address this question in the following sections, we first describe the main characteristics of this learning format. According to Job and Ogalo (2012), micro learning is technology-enhanced learning (e.g., on mobile devices) with small and fragmented micro content that can be learned in short periods of time (up to 15 minutes). Therefore, micro learning is suited to time-independent learning with context and demand-related micro content (Rensing, 2016). Micro learning is appropriate for embedding learning activities in different contexts and can be used in a stand-alone way or integrated into an e-/blended learning concept (Decker et al., 2017). Since there are various applications and use case scenarios for micro learning (e.g., declarative learning, process-oriented learning, situated learning), micro learning cannot be assigned to a specific learning theory, such as behaviorism or cognitivism (Hug, 2005). Instead, micro learning must be flexibly adapted to the respective learning situation in psychological and didactic aspects. To do this, it is essential as the first step to define the learning goals. In the following sections, we will elaborate on which learning goals can be developed in the sense of competences with micro learning.

3 Research Design

To address our research goal by elaborating on which competences can be developed with micro learning, we conducted a literature review in the first step (Section 4) and an interview study in the second step (Section 5). We describe the methodic approaches of both studies in the following subsections separately. The theoretical framework that we used to derive deductive competence categories is the job-oriented approach of action competence (Le Deist and Winterton, 2005; Straka, 2004; see also Section 2.1). Using structured content analysis (Mayring, 2014), we coded the relevant statements in the literature as well as in the interviews according to the competence categories. As we conducted the literature review beforehand, the results of the literature review helped us to refine our applied coding scheme. Therefore, we reached a better foundation for interpreting the statements of the experts in the interviews as they probably have a more practically oriented understanding of competences. The research design and interplay of both studies are summarized in Figure 1.

![Figure 1. Research Design](image)

3.1 Methodic Approach of the Literature Review

To answer RQ1, we conducted a structured literature review according to vom Brocke et al. (2015) and Webster and Watson (2002). To identify the current state-of-the-art of developing competences with micro learning, we defined the review scope in a first step: We focused our search on research outcomes and have included the databases we searched in Figure 2.

![Figure 2. Research Framework of the literature review](image)

We used various combinations of keywords (see Figure 2) to search for accessible search results in all selected databases. We included papers that match our research and obtained 262 papers with a mix of
scientific research publications and published practice articles. As we finished our collection of literature at the end of June 2019, we included papers published until the beginning of 2019. To filter the identified papers, we checked the titles and abstracts of the search results first and excluded duplicates. Afterward, we reviewed the full text of the remaining papers in detail. We included papers in our analysis that show which competences can be developed and supported using micro learning and excluded papers that do not fit our research aim. For example, we excluded papers that describe frameworks or learning platforms for micro learning and its general potentials without focusing on which concrete competences can be developed using micro learning. Finally, we came up with a total of 59 papers that are relevant for answering our first research question (see Figure 2).

3.2 Methodic Approach of the Qualitative Interview Study

To answer RQ2 and thus include the expertise of practitioners, we conducted a qualitative and explorative interview study according to Myers (2013) based on three steps. In the first step, we identified potential experts through direct contact from fairs or projects and searches in practice-relevant journals. We contacted experts who are either (1) in charge of the design of learning content for training in their enterprises (training experts: TExp) or (2) professionals in the field of instructional design and technology-enhanced learning design (instructional design experts: IDExp) and develop micro learning units for enterprises as service providers. Considering the specifications of micro learning, it is a requirement of the selection process that the experts have experience in the didactic design of micro content. These two perspectives help us to understand both the practice in enterprises and the expertise of professionals in the field of micro learning.

To ensure heterogeneity and to achieve a comprehensive cross-section for the research area, we involved TExp independent of the industry sector. In total, 33 (20 TExp from 17 enterprises; 13 IDExp) accepted our interview invitation. Fourteen of the 20 TExp (1-9; 13-14; 16-17; 20) were managers of training or e-learning departments, whereas six TExp (10-12; 15; 18-19) were employees. The following industries are represented in our sample of TExp: customer services, telecommunications, engineering, banking, chemistry, aerospace, consulting, furniture, and food. In the sample of IDExp, four IDExp (24; 28; 30; 33) are CEOs of their e-learning agency. Nine IDExp (21-23; 25-27; 29; 31-32) work as employees.

In the second step, we conducted interviews with the 33 experts via phone or face-to-face. The interviews lasted between 17 and 75 minutes ($\bar{x} = 37$ min; $\bar{x} = 37$ min). We used a semi-structured interview guideline to leave the interviewees enough room to express their own ideas. Among other research interests about the use of micro learning for VET (e.g., application areas, instructional design, and challenges), one section of questions addressed the suitability of micro learning for developing competences. We used the following leading question as the introductory question: Which competences can be developed with micro learning? As the last interviews did not reveal any new insights, we decided not to conduct further interviews (Glaser and Strauss, 2006). We recorded the interviews on audio tape and transcribed them afterward.

In the third step, we analyzed the empirical data with the help of a structured content analysis approach (Mayring, 2014). In this step, we anonymized the transcribed recordings and coded relevant statements by using the software MAXQDA. Two independent researchers conducted the coding through continuous analysis of the transcripts, followed by a mapping of the codes to the core topics. Afterward, we translated the relevant statements into English while preserving the meaning.

4 The Literature Perspective on Micro Learning

In the following section, we describe the results of our literature review to answer RQ1. In the literature, we identified five types of competences from the typology of action competence (Straka, 2004) that can be developed using micro learning units (see Table 1).

Due to the requirements of society and enterprises, the acquisition of knowledge is becoming more and more important (Boyatzis, 2009). Micro learning responds to those requirements and “to the growing need of lifelong learning for members of society” (Turner and Kalman, 2014). As shown in Table 1, the
literature review demonstrates with 43 mentions that micro learning is well suited to promoting professional competence (see Table 1). Because of the “small units” (Friedler, 2018) and the “short snippets of information” (Yousuf et al., 2019) that are “focused on a single learning objective/topic/concept/idea” (Jahnke et al., 2019), micro learning simplifies the acquisition of factual knowledge and can increase the professional development of the learner (Friedler, 2018; Ramage, 2014). Especially in conjunction with a mobile device professional knowledge can be acquired “anytime and anywhere” (Zheng, 2015). It is possible that learners acquire missing information and factual knowledge (e.g., by watching a short video) on their own because they can access the learning units on demand whenever they determine a knowledge gap (Zheng, 2015; Kadhem, 2017).

<table>
<thead>
<tr>
<th>Definition</th>
<th>Number of mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional competence</strong>: Ability to have specialized knowledge and to deepen it to benefit from it in different areas of application (McGaghie, 1991).</td>
<td>43</td>
</tr>
<tr>
<td><strong>Action competence</strong>: Ability to use and transfer learned factual knowledge in practical tasks appropriately (Le Deist and Winterton, 2005).</td>
<td>19</td>
</tr>
<tr>
<td><strong>Linguistic competence</strong>: Ability that helps individuals to use language in a targeted manner and to interpret different kinds of communication correctly (Savignon, 2018; Coseriu, 1985).</td>
<td>17</td>
</tr>
<tr>
<td><strong>Self-learning competence</strong>: Ability to organize and initiate self-regulated learning to achieve self-determined goals (Pintrich, 2000).</td>
<td>13</td>
</tr>
<tr>
<td><strong>Social competence</strong>: Ability to interact and communicate with others and to maintain positive interpersonal relationships (van Hasselt and Hersen, 1992; Selman, 1981).</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1. Suited competences to be developed with micro learning

The learning success of micro learning results from being integrated into the current work or activity, the immediate utilization (Little, 2014), and the practical transfer of the learned content (Friedler, 2018) by using the new information or knowledge for a current task (Cai, 2015). Corresponding tasks in a learning unit initiate first reflections and help employees to cope with practical challenges (Cai, 2015; Little, 2014; Simons et al., 2014). That is why it is possible to convey “factual knowledge into skills needed for the job” (Jahnke et al., 2019) by applying the learned content directly and immediately. In our literature review we identified 19 mentions stating that micro learning is suited for imparting action competence (see Table 1). Because of the small, work-integrated learning units, micro learning offers the opportunity to provide skills training and to transfer factual knowledge into practice (Fox, 2016) so that micro learning can lead to changes of actions (Cai, 2015). In the context of action competence, the literature mentions problem-solving competences as well. Micro learning can assist “learners when they are solving a problem” (Bruck et al., 2012) with problem-oriented learning units. However, the literature also states that imparting problem-solving competences is a challenge with regard to the design of the learning units (Jahnke et al., 2019) because the content has to be “designed for learners to be engaged in practical problem-solving activities rather than just listening to presentations or videos” (Jahnke et al., 2019).

As shown in Table 1, we identified 17 statements that micro learning is suited for promoting linguistic competence in terms of learning a foreign language. Micro learning is especially suited for learning and imparting vocabulary (Cai, 2015). With micro learning, it is possible to offer vocabulary that fits to surrounding objects, locations, and texts (Cai, 2015). Micro learning can also offer the opportunity to display “parts of a web article being read into a foreign language” (Cai, 2015) and improve the listening comprehension of the learner. There is the option to use different multimedia formats, such as audios or videos, in the learning units in order to make them “more attractive” (Zheng, 2015) and “stimulate the interest of student[s] in contemporary learning” (Zheng, 2015).
Using micro learning, it is possible to arrange learning units with didactic, methodical, physical and media aspects (Jahnke et al., 2019; Yousf et al., 2019). In order to create learning processes, learners have to decide independently and in a self-motivated way what to learn (Cai et al., 2017). Thus, micro learning is suited to developing self-learning competence. We identified 13 mentions stating this. Several studies show that the learner’s engagement and motivation to learn increases through micro learning (Jahnke et al., 2019). To reach this aim learning units “should guide learners in a flow, starting with aha-moments with examples and then shifting to how to transfer the knowledge” (Jahnke et al., 2019). Because micro learning typically offers content and exercises passively, learners have to decide on their own if and what they want to learn (Cai et al., 2017). That is why users need a “high initial motivation to learn” (Cai et al., 2017) and have to be autonomous and self-determined to use the little learning units actively.

Another competence we identified in our literature review is social competence. We identified five mentions stating that micro learning is suited to developing social competence. As learners are often proud of having acquired knowledge on their own, with intrinsic motivation and a good deal of discipline they enjoy “sharing their discovered knowledge and skill with others” (Ramage, 2014). The sharing of information and knowledge among learners can result in a “learning community” (Nikou and Economides, 2018) in which everybody shares their knowledge which leads to the positive effect of so-called “social micro-learning” (Nikou and Economides, 2018). Due to this high interaction (Nikou and Economides, 2018; Bitzer et al., 2012) and frequent exchanges of information and knowledge, it is possible that learners can learn with and from other learners and improve their social competence, particularly with regard to communication competence and team competence, along the way.

In summary, the results of the literature review show that micro learning is suited to developing the five identified competences. As presented, some of these competences can be promoted directly with micro learning (e.g., professional competence), whereas other competences can be imparted indirectly (social competence) or are a prerequisite for using micro learning (self-learning competence).

5 The Empirical Perspective on Micro Learning

To answer RQ2, we identified six types of competences. They are largely similar to the results of the literature review (see Figure 3).

![Figure 3. Mentions of suited competences to be developed with micro learning (difference by both expert groups)](image)

However, in contrast to the literature review, the experts (training experts: TEexp; instructional design experts: IDEexp) also mentioned that micro learning has the potential to develop digital competences. As digital competence is not an explicit part of the approach of action competence (Straka, 2004) that we used for coding our results, we derived digital competence as an additional competence category inductively. As in Table 1, we define the term digital competence to clarify how we coded this competence category in the interviews. However, there is no common understanding of this facet of competence in research. For instance, Ilomäki et al. (2016) analyzed 76 educational research articles in which the concept of digital competence was investigated. Summarizing their findings, the authors explain that digital competence consists of four elements, which we used as the definition for coding the transcripts:
Definition of digital competence by Ilomäki et al., 2016

1. Technical skills and practices in using digital technologies, which is a central basis for digital competence.
2. Abilities to use and apply digital technologies in a meaningful way and as an appropriate tool for working, studying and for various activities in everyday life in general.
3. Abilities to understand the phenomena of digital technologies.
4. Motivation to participate and engage in the digital culture.

Moreover, we were able to identify differences in the evaluations between both expert groups surveyed. The results of the explorative study are highlighted in Figure 3 and described below.

Similar to the results of the literature review, professional competence is the most frequently mentioned competence. Fifteen experts (45% TExp, 46% IDExp) stated that factual knowledge could be made available independently of time and place with the help of mobile devices. According to the experts, it is suitable for learning basics, such as laws or rules in a specific context. However, IDExp22 expressly mentioned that it is difficult to convey specialist knowledge with micro learning. She explained that it is difficult to use micro learning for complex scenarios such as explaining a completely new machine in the production area. In her opinion, micro learning cannot cover everything in this context. Still, it can offer beneficial value when it is embedded in an overall learning concept.

Table 3. Exemplary quotations on professional competence

<table>
<thead>
<tr>
<th>Profession competence</th>
<th>N=15</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;The e-learning formats are super and very helpful for fact learning and also great for learners because they can always have it with them, always in their pocket.&quot; (TExp12)</td>
<td></td>
</tr>
<tr>
<td>&quot;I believe that what it can achieve is to convey basic rules in a short way.&quot; (TExp13)</td>
<td></td>
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</table>

Just five contributions in the literature mention the development of social competence with micro learning. By way of contrast, it is the second most frequently mentioned competence. Fifteen experts (45% TExp, 46% IDExp) stated that factual knowledge could be made available independently of time and place with the help of mobile devices. The literature only focuses on facets of social competence, such as team and communication skills. According to the contributions, social competence can only be imparted as a side effect (e.g., because learners are proud of their learning success and, therefore, share their knowledge with others). However, in the empirical study, the experts state that micro learning has the potential to develop social competence directly (see Table 4). Exemplary use cases include conflict or discussion training that fosters communication skills. In this regard, the experts point out that the learning context is decisive. If the context is appropriate, micro learning can develop social competence. The meaningful embedding of communication tools or group quizzes can thereby help to promote social competence in the team. However, four experts (15% TExp, 8% IDExp) have a different view. They find it difficult to develop social competence via micro learning. The experts did not rule it out in principle but consider other learning formats to be better suited. According to TExp12, face-to-face training is much more suited to promoting social competence than would be possible in any e-learning format.

Table 4. Exemplary quotations on social competence

<table>
<thead>
<tr>
<th>Social competence</th>
<th>N=9</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;And the second is the topic of communication. We do this partly through group quizzes, where people work together on one goal.” (TExp19)</td>
<td></td>
</tr>
<tr>
<td>&quot;Teamwork competence, which is also a competence that can be promoted under certain circumstances if you use many communication tools in the training, [i.e.] in the micro learning units.” (IDExp21)</td>
<td></td>
</tr>
<tr>
<td>&quot;Also in the soft skills domain, the analysis of a sequence when you have learned certain skills, conflict training, for example, I can also imagine a micro learning with an application situation. So basically everything, if the context is right.” (IDExp27)</td>
<td></td>
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</tbody>
</table>
In contrast to the results in Section 4, seven experts (15% TExp, 31% IDExp) identified a completely new dimension that can be promoted using micro learning: **digital competence** (see Table 5). “Since experiences generate competences, digital competence can also be promoted” (TExp15). Most experts assume that digital competence can be fostered as a side effect if, for example, many different media types are used. On the other hand, IDExp22 emphasized that micro learning can also directly promote digital competence, but other e-learning formats may be used for this purpose as well. According to TExp15, a certain digital competence is also necessary for learning successfully with digital formats such as micro learning.

<table>
<thead>
<tr>
<th>Digital competence</th>
<th>N=7</th>
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<tbody>
<tr>
<td>“And by the way, apart from the knowledge you have acquired, you can also teach IT skills or media skills.” (IDExp23)</td>
<td></td>
</tr>
<tr>
<td>“So when we talk about media competences and when I have a lot of media in use in this micro learning environment, then I can promote the media competences of the person participating.” (IDExp21)</td>
<td></td>
</tr>
<tr>
<td>“What we see as a side effect of this electronic learning process is learning how to use PCs, we have seen that it works quite well.” (TExp8)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 5. Exemplary quotations on digital competence*

The experts (e.g., TExp5, IDExp27, and IDExp28) also support the statement from the literature review that action competence develops from professional competence when the acquired knowledge is applied in problem situations. The experts attach great importance to action competence since it is the basis for situated learning (i.e., an essential characteristic of micro learning). According to IDExp27, action competence can be promoted if a learner has to transfer the applied knowledge into another context (e.g., if the learner has to choose between different opportunities after a short introduction video). However, the experts also noted that they tend to do that in smaller contexts and manageable situations for micro learning units. Table 6 lists exemplary quotations on action competence.

<table>
<thead>
<tr>
<th>Action competence</th>
<th>N=7</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The second aspect is the knowledge of action, i.e. competences that affect action, which can also be presented very well by using videos or other short micro learning elements to show how this works.” (IDExp28)</td>
<td></td>
</tr>
<tr>
<td>“Action competence in any case, because a lot of what triggers situated learning is basically that I lack the necessary competence for an action. And I see that as the biggest point now.” (TExp15)</td>
<td></td>
</tr>
<tr>
<td>“Applying, i.e., application competence, action competence, could also be supported. For example, by transferring the learned knowledge in another context.” (IDExp27)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6. Exemplary quotations on action competence*

In contrast to the literature, the expert groups assessed the suitability of micro learning to develop **linguistic competence** somewhat differently. While no training expert mentioned a suitability for promoting linguistic competence (see Figure 3), four instructional design experts consider micro learning to be suited for developing it (see Table 7). For instance, IDExp22 proposed a suitable application context. In the enterprise environment, micro learning can support employees in preparation for an international customer appointment in which, for example, English or French is the conversational language.

<table>
<thead>
<tr>
<th>Linguistic competence</th>
<th>N=4</th>
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<tbody>
<tr>
<td>“I believe that language skills can also be promoted quite well with micro learning. If I’m in an enterprise and I say, okay, soon we’ll have a big customer and everyone needs to get fitter in English or French, then it's important.” (IDExp22)</td>
<td></td>
</tr>
<tr>
<td>“Then I can well imagine this in the area of language learning, which is also what happens in the enterprise area.” (IDExp27)</td>
<td></td>
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</table>

*Table 7. Exemplary quotations on linguistic competence*
Similar to linguistic competence, self-learning competence is exclusively addressed by instructional design experts—not by the training experts. As already elaborated in the literature review, micro learning is a self-determined learning format. Therefore, the assumption that self-determined learning formats can promote self-learning competence is obvious. Nevertheless, only two instructional design experts considered self-learning competence in the interviews (see Table 8). According to both experts, micro learning in combination with mobile learning applications could be a fruitful approach to developing self-learning competence. Exemplary content could focus on work organization skills such as time management.

<table>
<thead>
<tr>
<th>Quotes</th>
<th>Self-learning competence</th>
<th>N=2</th>
</tr>
</thead>
<tbody>
<tr>
<td>“With the short content that promotes the culture of self-learning, you could really make a catalog. I am also a self-learner and use that. Nowadays, many apps have this memory function. That is why I would say that a self-learning culture would be nice. For example, I could imagine content for time management, [work-]organization and [work-]structuring.” (IDExp33)</td>
<td>“Self-learning competence, i.e., that I can acquire knowledge by myself.” (IDExp29)</td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Exemplary quotations on self-learning competence

To summarize the results of the empirical study, we were able to support the results from the literature review. Furthermore, we were able to identify one additional dimension of competence: digital competence. In Section 6, we discuss our findings from the literature review and the empirical study.

6 Discussion

In this section, we will first discuss the central findings of our study. We will discuss both similarities and differences between both research studies. Then, we will demonstrate the contribution of our study to the research stream on IS Education as well as the implications for practitioners.

What competences can be developed with micro learning?

Both studies most frequently mention the suitability of micro learning for developing professional competence. The small learning units of micro learning are particularly well suited for addressing and quickly solving employees’ knowledge deficits at the moment of need (e.g., to learn factual knowledge such as basic rules). However, the results of the empirical study have some limitations. Due to the capacity of small learning units, micro learning reaches its limits when it comes to imparting in-depth specialist knowledge. If this condition is respected, micro learning is particularly well suited for efficient (factual) knowledge building in small but continuous steps.

In the working context, it is particularly important to transfer applied knowledge into new situations to cope with practical challenges. Therefore, learners must convert their factual knowledge into skills that they need in order to be competent for action in the job. Thus, action competence develops from professional competence when the acquired knowledge is applied in problem situations. Both the literature and the experts consider micro learning to be suited to promoting action competence. However, according to the experts, small and manageable learning situations should be created for this purpose.

The findings from both studies on social competence are not uniform and should be addressed by future research. The literature rarely considers the development of social competence and only mentions it as a side effect of learning. In contrast to that, the instructional design experts in the study stated that social competence can be promoted directly. Possible learning scenarios can be discussions or conflict training. Conversely, four experts in the study do not believe that micro learning is appropriate for promoting social competence. More precisely, they consider other learning formats such as face-to-face training much more suited.

Moreover, the results of the literature review, as well as the results of the interview study, show that micro learning is suited to promoting linguistic competence. Above all, both perspectives mainly consider scenarios of vocabulary learning. However, only the instructional designers mention linguistic competences. One reason for this may be that the training experts have focused their consideration more
on application scenarios that are particularly important in the enterprise context, whereas the experts in instructional design have a broader perspective on what micro learning is suited to do. Nevertheless, the scenarios mentioned above (e.g., preparation for an international customer visit with the help of small learning content) are even relevant in the organizational learning context.

The competence to create self-organized learning processes was mentioned least in the study and was only mentioned by the instructional design experts. The experts stated that micro learning could be a fruitful approach (e.g., for training units on topics such as work organization or time management). Moreover, the literature contributions show on the one hand that micro learning can promote self-learning competence by increasing learners’ engagement and motivation to learn. On the other hand, self-learning competence is an important prerequisite for self-determined learning formats such as micro learning. However, the fact that no training expert mentioned self-learning competence raises the legitimate question of to what extent it makes sense in the enterprise context to provide workplace-integrated learning content to promote self-learning competence. Therefore, future research should investigate if self-learning competence is a prerequisite rather than an outcome of using micro learning.

We also identified a difference between the literature and the interview study, namely, the suitability of micro learning for teaching digital competence. The findings in the literature do not yet contain any findings on this subject. Conversely, seven experts in the interview study rated micro learning as suited to promoting digital competences. For instance, if micro learning units use a variety of media, digital competences as facets of digital competences can be promoted. In addition, according to the experts, digital competences can be promoted as a side effect. They argued that the use of micro learning applications can already promote digital competences. Eventually and similar to self-learning competence, a certain digital competence is necessary for successful learning with micro learning at all. Comparing our findings to the definition of digital competence by Ilomäki et al. (2016), our findings are mostly related to the first and second elements of the definition (see Table 2).

Finally, the results of the literature review and the empirical study did not explicitly indicate that micro learning can be used to develop personal competence or method competence. However, as both competence dimensions are relating to the other dimensions of action competence (Le Deist and Winterton, 2005), there might be a hidden correlation. Therefore, future research should address this issue to clarify if both competence dimensions are possible learning outcomes of micro learning.

In summary, the results of our multi-perspective analysis show that micro learning is suited to promoting certain competences but that it depends on the actual (learning) context. The characteristics of micro learning are small and short learning units. These limits must be taken into account. It becomes clear that micro learning should not be used as a stand-alone learning format to develop the competences of employees. As a limitation in the interpretation of the results, it should be noted that both in the literature and in the empirical results, the competences suitable for developing with micro learning are only mentioned without explaining how to use micro learning to develop them.

**What are the implications of our results for research and practice?**

On the one hand, our study results provide an overview of the relevant literature for competence-based micro learning. On the other hand, we consider the experience of practitioners using micro learning for competence development. Thus, we provide a comprehensive summary of the possibilities and limitations of micro learning for developing competences.

Therefore, our findings have implications for both research and practice. In the context of technology-enhanced workplace learning, the identified competences are possible learning goals and learning outcomes of micro learning. Another finding that goes along with the conceptual model of technology-mediated learning (Gupta and Bostrom, 2009) is the meaning of the learning context. Especially in the interview study, both expert groups mention that the appropriate learning context is decisive. However, further research is necessary to analyze the details of the learning method structures and the learning process according to Gupta and Bostrom (2009). Furthermore, practitioners can use our findings as well. From the perspective of workplace learning, our results do not only highlight the potential outcomes of micro learning. The six identified competence types also provide information about certain learning scenarios and application areas of micro learning (e.g., language learning, incorporation of employees,
context-dependent learning on demand). Furthermore, practitioners should consider that micro learning is not a stand-alone learning format. Instead, it is more useful to implement micro learning next to other learning formats such as classroom training. Our results also support the meaning of workplace learning in enterprises. To meet the increasing learning needs caused by digitalization, learning in the moment of need is particularly crucial. A combination of formal and informal learning is necessary to foster the learning transfer and “connects theory to practice in a realistic and efficient way” (Billett, 2001). Furthermore, our results show the potential of micro learning for knowledge management in organizations. Micro learning represents one possibility for developing the necessary competences of the employees to stay competitive in an ever-changing environment. To do this, knowledge management needs to integrate the workplace perspective as it encompasses a wide range of learning environments (Eraut, 2004; Watkins and Marsick, 1992). Especially for the educational research on IS, the findings show the potential learning outcomes using micro learning. Moreover, the results are transferable to the field of education at schools and universities. Teachers can use our findings to integrate micro learning in learning environments, for example, to offer sessions for preparing and following-up on lectures. Therefore, micro learning can be a possibility for updating the curriculum by integrating new ideas and technologies. Moreover, our work provides the motivation to revise the approach of action competence. Digital competence is a new and crucial dimension in the competence profiles of employees that is necessary to address technological advancements and changing workplace requirements (Ilomäki et al., 2016). Therefore, we assume that digital competence is another dimension of action competence.

To return to the title of this paper, micro learning can help a learner to become competent in 15 minutes in a limited context (e.g., to internalize the most important information of a new product). Nevertheless, micro learning is not the “theory of everything” as one expert highlights: “Micro learning would be less suited to teach the theory of relativity. This is a subject that would not be suited.” (TExp3)

7 Conclusion and Outlook

The overall research goal of this study was to elaborate on which competences can be developed with micro learning. The aim was to support the developers of micro learning applications by showing the potential learning outcomes of competence-based micro learning. To achieve this aim, we asked two research questions and answered them by conducting a structured literature review as well as an empirical study. As presented, we identified five competences mentioned in the literature and the interview study. Professional competence was named most frequently. Additionally, digital competence was identified but was only mentioned in the interviews. Both in the literature and in the results of the empirical study, the competences are only mentioned without any discussion of how to use micro learning to develop them. The limitations of this paper lie in the selection and interpretation of the analyzed articles, which were dependent on the judgment of the individual researchers. Using a systematic and structured literature analysis, we tried to minimize the individual and subjective influence of each researcher. Moreover, there are limitations concerning the interview study. The experts were only asked which competences can be promoted with micro learning without being asked which competences cannot be promoted using micro learning or how to develop the competences with micro learning. In addition, the results were not quantified. Nevertheless, our results contribute to the educational research in the IS research stream, as micro learning is an important design feature of many modern educational information systems (as in mobile learning, augmented or virtual reality or even conversational agents). Our findings demonstrate the potential learning outcomes using micro learning. Furthermore, we give a theoretically and practically sounded summary of the possibilities and limitations of micro learning for developing competences. Thus, our findings provide valuable insights for knowledge management in organizations regarding competence development.
References


