Digital environments as sites for informal workplace learning in knowledge work

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Abstract

Purpose – The purpose of this study is to explore how digital technologies at work serve as environments for informal workplace learning in knowledge work.

Design/methodology/approach – Digital ethnography was used to investigate the digital environments of one public sector workplace. The data included observations, interviews and participant diaries.

Findings – The digital work environment consisted of a complex network of technologies and people connected to them. The ethnographic accounts revealed both expansive and restrictive features of the digital environment. Digital technology extended learning opportunities by providing flexible possibilities for interaction, collaboration and access to a wealth of information. On the contrary, digitally mediated presence could restrict learning if the attendance and learning remained superficial. The complexity and constant change in digital workplace environments presented challenges that could potentially restrict learning. Information overload, constant interruptions and changes were burdens that required employees' skills to manage these challenges.

Originality/value – The authors take a novel approach to view the workplace as a phygital environment in which social, physical and digital environments are combined. Because digital environments are becoming increasingly essential parts of the workplace, it is important to understand how they can support learning.

Keywords Informal learning, Digital ethnography, Workplace learning, Ethnographic

Paper type Research paper

Introduction

In the context of knowledge work, the concept of a workplace often creates the image of offices with desks, personal computers and other fitments and equipment that employees need at work. However, this deep-rooted idea of the knowledge work workplace has changed

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dramatically with the introduction of digital technologies. Digitalisation brings many changes to the workplace as an environment (Ifenthaler, 2018; Billett, 2021). For instance, the work environment of knowledge workers today is complex and consists of several digital environments and physical locations. Therefore, it can be argued that in knowledge work, workplaces are "phygital environments" (Del Vecchio *et al.*, 2023), meaning that they are combinations of *physical* and *digital* environments. In addition, *social* environments, where people interact, collaborate and relate to each other, are formed not only in physical but also in digital work environments (Tynjälä *et al.*, 2014; Vallo Hult and Byström, 2022).

As digitalisation changes work, workplaces need to be environments that support employees in coping with these new changes through workplace learning (Harteis *et al.*, 2020). Thus, workplaces are also learning environments (Billett, 2004; Skule, 2004) in which a large part of adult learning takes place, often informally, as a by-product of work (Eraut, 2011). The level of intention in informal learning varies from unconscious, implicit learning taking place without deliberate efforts to learn, to reactive learning during engagement to work activities and deliberative learning with learning objectives (Eraut, 2004). The knowledge obtained through these intentions is often considered tacit or a part of an individual's general abilities, for example, adaptation to changes. Thus, informal learning refers to learning that is usually non-intentionally acquired through everyday work and often unrecognised, unlike formal learning, which leads to certification or formal recognition (Skule, 2004). Informal workplace learning is a complex phenomenon, as it involves not only the learner, but also multiple agents, tools and resources that are embedded in dynamic and multidimensional workplace systems (Marsick *et al.*, 2017). Hence, both personal and situational features affect informal learning. According to Cerasoli *et al.* (2018), personal features include motivation and prior knowledge, whereas situational features include the context in which learning occurs, such as the work environment and available resources. Today's workplace learning context thus is a hybrid system that combines various kinds of informal learning activities (Segers *et al.*, 2022). From this point of view, the workplace as a learning environment can be understood as a complex negotiation of knowledge use, roles and processes – central, however, is the employees' participation in workplace activities and interaction (Billett, 2004).

In this paper, we study the workplace as a phygital environment, merging the social, physical and digital environments (see Figure 1), and focus particularly on digital environments as part of this phygital work environment.

Informal workplace learning has been compared to an iceberg because only a small part is observable. Therefore, Berg and Chyung (2008) have suggested that researchers should pay attention to subtle forms of workplace informal learning and use ethnographic research methodology to reveal hidden but essential features. To advance our understanding of informal learning in the digitalised workplace, we pose the following research question:

RQ1. What kind of learning environment does digital technology offer for informal workplace learning in knowledge work?

Workplace as a learning environment

Originating from, for example, Skule (2004), the workplace has been studied as a learning environment, and various features have been identified that affect workplace learning. Workplaces comprise social, cultural, technical and organisational elements, all of which impact learning (Tynjälä, 2013). Hence, the ability of a workplace to foster learning is determined by various structural, social–organisational and cultural features, such as time, resources, norms, routines, organisation of work and cultural aspects (Ellström, 2011).

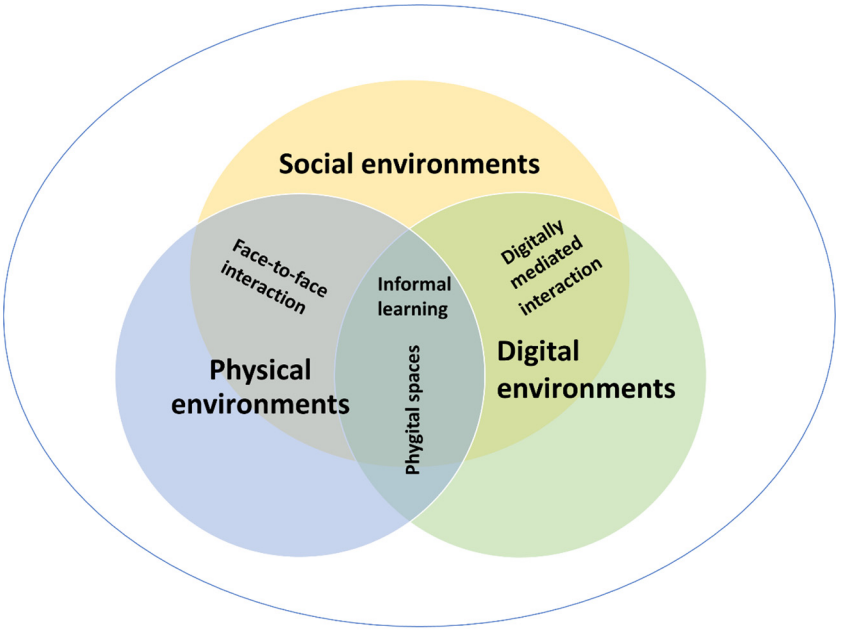

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Figure 1.
Workplace as phygital environment

According to Fuller and Unwin (2004), workplaces can be analysed in terms of their expansive and restrictive features. Workplaces that offer employees diverse forms of participation, opportunities and support for learning are expansive learning environments which support the integration of personal and organisational development. Restrictive environments constrain or fail to support participation and access to learning. Ellström (2011) argued that workplaces can be purposefully structured not only for work-related activities but also for promoting learning. Workplaces can promote informal learning, for instance, by granting autonomy for employees, encouraging interaction with others (Watkins *et al.*, 2018) and providing feedback that supports learning (Kittel *et al.*, 2021).

The concept of workplace learning, in its more conventional meaning, highlights and values the impact of the physical environment on everyday learning; physical settings can limit or facilitate social interaction through which informal learning often takes place (Kim *et al.*, 2014). However, in today's workplaces, online and offline activities and interactions blend, which blurs the boundaries between physical and digital work environments. Earlier literature has emphasised that digital technology can provide environments that support learning by integrating all the elements of professional expertise:

- theoretical or conceptual knowledge;
- practical or experiential knowledge;
- self-regulative knowledge; and
- sociocultural knowledge (Tynjälä *et al.*, 2014).

Digital environments can be seen as integral components of workplace learning environment (Gruppen *et al.*, 2019); however, digital technology is not always considered as a natural tool

for informal learning (Amenduni *et al.*, 2022). As digital environments become increasingly essential part of work, we need better understanding of these new environments and their expansive and restrictive features regarding informal workplace learning.

Previous studies on technology-enhanced professional learning have primarily concentrated on customised learning tools (Hicks, 2018; Ley, 2020; Treasure-Jones *et al.*, 2019) and programs, such as, Massive Open Online Courses (Egloffstein and Ifenthaler, 2017). However, the use of technology for informal learning in workplace context is still understudied (Littlejohn and Pammer-Schindler, 2022), despite the tremendous potential of digital technology to support informal workplace learning (Ifenthaler, 2018; Harteis *et al.*, 2020). Digital technology can enhance learning by providing access to vast information and enabling learners to navigate various contexts and environments at their own pace, but at the same time, it also requires critical skills to evaluate and use the knowledge effectively (Ang *et al.*, 2017; Watkins *et al.*, 2018). Constantly developing technology presents new opportunities to support informal workplace learning. For instance, artificial intelligence and data analytics can provide tailored information, resources and guidance for the employees (Littlejohn and Pammer-Schindler, 2022).

Yu *et al.*'s (2023) literature review summarises the double-edged effects of digitalisation on workplace learning. Digital technology can promote the integration of work practice and professional development, strengthen interaction within and outside the organisation, provide access to professional learning activities and various resources and enhance the learning experience. Shared digital work environments can cultivate common views and practices. On the contrary, digital technology can introduce negative impacts that hinder learning, such as constant change, information overload, trivial and irrelevant work, unreliable systems or poorly designed learning resources. Ineffective digital technology can restrict workplace learning (Anselmann, 2022). In knowledge work, digital technology can provide flexibility and new ways for knowledge development and management, but it also brings constraints, such as increased work demands and new skill requirements (Wallin *et al.*, 2020). Flexible and changing digital work environments require new competencies from employees as information flows and ways to collaborate and participate in work practices change (Vallo Hult and Byström, 2022). The double-edged effects of digitalisation on workplace learning are evident. There is a need for a more holistic and detailed understanding of how informal learning takes place in digitalised workplaces.

Methodology

This study applied digital ethnography (Pink *et al.*, 2016; Hine, 2015). As a methodology it provides a suitable approach to study workplace learning in complex and changing environments of work (Lemmetty *et al.*, 2022). With digital ethnography we gained insights into the environments and processes where informal workplace learning takes place and were able to study the workplace holistically, including digital as well as physical sites. Through an ethnographic approach, we could conduct in-depth, long-term investigations of digital environments from the perspective of the informants (i.e. the employees who work and learn in these environments) (Lemmetty *et al.*, 2022). With ethnographic methods, we could obtain authentic data from everyday work and by combining several parallel data collection methods capture occasions of informal workplace learning, that often otherwise is unrecognised by individuals. Ethical issues were carefully considered when entering and observing the digital environments (Schrooten, 2016). The researcher negotiated with participants to determine which digital channels and discussions she could observe, to ensure employee comfort with the presence of the researcher, and guarantee confidentiality. Before we could investigate how digital technology is used when learning informally at

work, we needed to map the various digital services, resources and tools used in the target organisation. The data collection began with this mapping and negotiating entrance to the main digital environments of the workplace.

Research setting and data

The data were collected mainly online during 2021–2022 from one unit of a public sector training organisation in Finland with 70 staff members. The workplace had offices on two locations. In addition, remote work from home was a common practice. Because of the COVID-19 restrictions, all employees worked remotely during part of the data collection period. Due to their multilocated and remote work, the employees were already accustomed users of digital technology in their everyday work even before the restrictions. Therefore, this did not significantly change the employees' normal, everyday work. The first author had the main responsibility for the data collection and analysis. The quotations from the data presented in this paper were translated from Finnish into English by the first author. A detailed description of the data is presented in Table 1.

All members of the work community were informed about the research, and participation was voluntary. Certain digital environments and discussions were excluded from the study to avoid handling the data of persons not participating in the research. The researcher announced her presence as a researcher in online forums and meetings, thus conducting ethnographic fieldwork as openly as possible (Hammersley and Atkinson, 2019).

The observation data were mainly collected online. The researcher participated in the digital environments to observe ongoing activities and discussions and recorded observations in field notes. Online forums and chats also served as documents to which the researcher could return in case there was a need to check details. The researcher spent two days at the workplace, one at each office location to make observations in the physical environments. This assisted her to gain holistic understanding of the workplace, increased the opportunities to discuss with informants and gave them the possibility to meet the researcher face-to-face. The interviews and participant diaries completed the observations and expanded knowledge about various work environments. The participants to interviews and diaries were recruited in

Type of data	*N*	Data collection period	No. of pages
Observations			
• Online meetings and gatherings: official meetings, team meetings, meetings focusing on topical issues or sharing good practices and virtual coffee breaks	23	March 2021–September 2022	Fieldnotes: 24 pages and two screenshots
• Online forums and chats: two Yammer groups, two Microsoft Teams group channels, and two Teams chats	6	March 2021–December 2022	Fieldnotes: 44 pages and three screenshots
• Days at the workplace	2	23.11.2022 and 29.11.2022	Fieldnotes: 5 pages
Interviews	15	February 2021–December 2022	176 pages of transcript
Participant diaries	7	Two weeks during March 2021–June 2022	35 pages of text and pictures

Source: The table was created by the authors

Table 1.
Research data

separate processes where the researcher contacted employees via online forums and emails and asked for volunteers to participate. Some of the individuals participated in both.

Interviews supported different phases of the ethnographic inquiry, providing information about events and environments of work and insights into work practices and the perspectives of informants (Hammersley and Atkinson, 2019). The researcher conducted 15 semi-structured discussive interviews. The interviewees were selected from all roles in the workplace: training officers, secretaries and managers. One of the interviews was a group interview, where the researcher interviewed a group of managers in the beginning of their meeting. The interviews were conducted with Microsoft Teams, which is an everyday tool and thus familiar to the participants. The interviews were recorded and transcribed. The first interviews assisted the researcher to access and map the digital field of the study. Later the interviews complemented the observations of the researcher. The researcher used digital environments and her observations as stimulus material for interviews to promote and focus the discussion. For instance, the researcher asked the interviewees to describe their view of the digital work environment, or they looked together online discussions the researcher had observed. This elicited in-depth information from the perspective of informants.

Diaries were collected from volunteer employees ($n = 7$). The participants were asked to write online diaries (Word documents) in which they reflected on their everyday learning and the use of technology for two weeks. The reflective diaries offered the possibility of studying the environments and events in which learning took place that would have otherwise been difficult to access (Pöysä *et al.*, 2003). The researcher had access to the diaries already during the writing period which enabled interaction. The researcher could, for instance, ask for more information or reflection on an online activity or event that the researcher had observed, and thus combine the perspectives of the participant to observation data.

Data analysis

The analysis was an explorative process extending throughout the research with iteratively developing understanding in the cyclical process of data collection and analysis (Coffey, 2018). The analysis approach was ethnographic qualitative content analysis which involves not only systematic analysis of the contents of the data, but also developing contextual understanding of the research setting during the field work (Hammersley and Atkinson, 2019; Lemmetty *et al.*, 2022). The analysis was abductive by nature, meaning that it started with "the local", "the specific" and then moving on to interpret the initial ideas derived from the data within a wider conceptual framework (see Coffey, 2018). The researchers thus moved back and forth between existing theory and concepts, and new insights and perspectives derived from the data.

In the beginning of the coding process the primary data (fieldnotes, transcribed interviews, participant diaries) were coded with Atlas.ti (Friese, 2014), using data-driven coding, in which codes were created from the data and further refined as the analysis progressed. The researcher coded all parts that related to digital technology, the workplace and the potential for learning. The coding frame developed included activities, interaction, practices, setting (particularly focusing to digital technologies), conditions, constraints, meanings. During the coding we identified themes and patterns from the data that described the workplace, particularly the digital environments. Then we continued to analyse further these themes and patterns along with exiting theory and concepts, to understand how the digital environments could extend or restrict informal workplace learning. In the course of the analysis process, different data sources enriched each other and with data triangulation (Hammersley and Atkinson, 2019), the researchers could validate their interpretation. Research diary was also used to keep track of and reflect the progressively developing

analysis. The ethnographic analysis provided rich descriptive accounts that increased our understanding of today's workplace as a learning environment.

Findings: workplace as a phygital learning environment

The workplace consisted of various social, physical and digital environments. Figure 2 illustrates these. Our main focus was to describe how digital technologies served as an environment for informal learning, but we also briefly depict the physical environments of the workplace as they are an essential part of the phygital workplace.

In knowledge work, digital technology is an inseparable part of work and learning, as this excerpt from an interview reveals:

> Actually, it is a bit absurd to think that there would be any other type of learning in this work environment that wouldn't be related to digital technology, because everything happens through it. (Training officer I2)

Digital technology used in the everyday work of the target organisation consisted of various tools and software. Some tools were in common use, such as Microsoft Teams and Yammer, whereas some environments, such as social media, could be chosen on an individual basis and used for more personal purposes, such as networking. Informal learning with these technologies was embedded in activities that involved interaction, peer support and conversations in which the participants developed their knowledge and skills based on their own interest and choice. In Table 2, we present context information about the main digital technologies used at the workplace. We sum up advantages and disadvantages that the

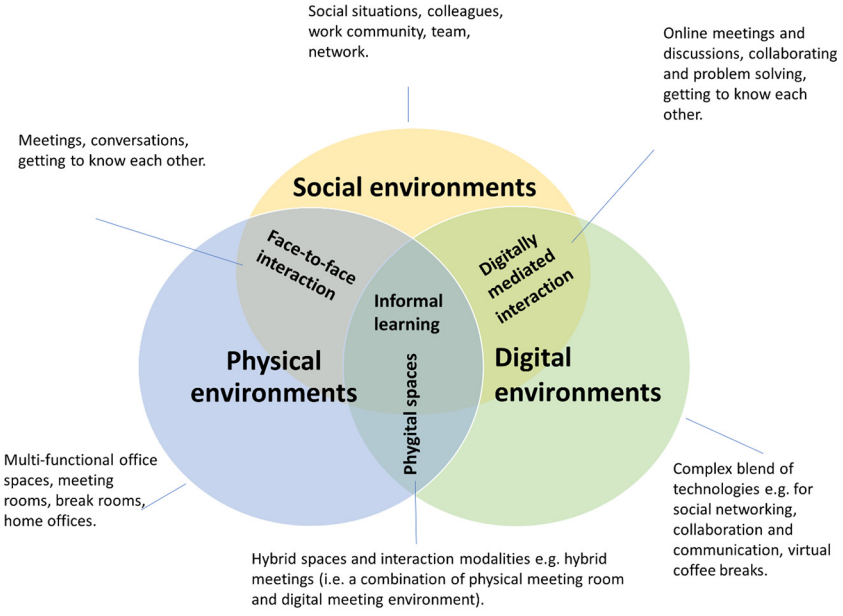

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Figure 2. Various environments in phygital workplace

Table 2.
Digital technology used in the target workplace

Digital technology	Purpose of use	Advantages (+) and disadvantages (-) gathered from the data	Extracts from the data describing the digital environments
Microsoft Yammer, environment for social networking	Internal communication: announcements, communication, knowledge sharing, connecting to other people, getting to know each other and building a community. Channels for different teams or topics	Everyone should follow certain groups. Some followed daily, some rarely. Often compared to Facebook, referring to that, the use was "light" or entertaining. + Joint discussion of the work community + Sharing and receiving knowledge + Reduces email − Difficult to find information − Several channels and messages, resulting in information overflow	"I have tried to join all the groups where there might be relevant information for my work, and I do regularly read them". (secretary I8)
Microsoft Teams, platform for collaboration and communication	Workspace for storing shared files, collaborating and communicating. Online meetings, conversation in channels and chat. Several channels and subchannels for different teams or topics. Chats used for bilateral or group discussions	+ Seen as handy because everything is there + Collaborating is easy + Chat especially was a quick everyday tool for communication + Structured through named channels and shared practices of use − Abundance of channels, messages and notifications − Difficult to follow and search for information	Teams chat: "Peer support, it is nowadays there, via chat". (secretary I15)
Moodle, learning platform	This learning environment was for the organisation's clients, but it was an essential work tool for employees, and some even mentioned it as a resource for information and learning in their work	N/A (not enough data to analyse advantages and disadvantages)	"I have also used it as a learning tool, I have checked out the subjects that will be my responsibility, and I have also used it as a means of getting acquainted with the conversations that students are having and the kinds of questions they ask. It has also worked as a way of orienting myself and learning". (training officer I5)
Email	Used mainly to communicate with external parties. Within the organisation, only used for urgent information	+ Number one on priority list, everyone reads them daily − Seen as a slow and "heavy" way to communicate	"If we want to inform everyone quickly about something, then we'll send an email to everyone". (training officer I10)

(*continued*)

Digital technology	Purpose of use	Advantages (+) and disadvantages (-) gathered from the data	Extracts from the data describing the digital environments
Other digital technology, such as Mentimeter, Flinga and Miro	Several tools used occasionally for brainstorming, collecting and presenting information	+ Easy to use; employees share tips and teach each other to use it − Restricted use of free versions and difficulties in knowing what one can do with these tools	Mentimeter: "A tool to compile and easily display the group's responses. Worked well and was user-friendly". (training officer EII)
Social media: Facebook, Instagram, LinkedIn, TikTok and Twitter	Use varied according to personal preference; some used several social media platforms to follow professionally interesting information, networking and peer support, whereas some did not use them at all for work-related issues	+ Flexibility − Work spillover to leisure time	"I follow several hashtags on LinkedIn that are purely work-related, and I network with people who relate to work" (training officer I14)

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Table 2.

participants attached to particular technologies and provide excerpts from the data to exemplify how the informants described these digital environments.

Digital technology is always used in some physical location; thus, digital and physical spaces intertwine. Technology was used in multiple physical places, such as two multifunctional office spaces, home and other locations, such as summer cottages. In remote work, home became an environment for work and learning. Sometimes informal workplace learning took place during leisure time. One interviewee explained how she used social media to learn tips about Excel or PowerPoint: "I watch those TikTok videos for work purposes, while lounging on the couch" (training officer I14). Thus, through social media, work was spilling over to leisure time and the boundary between work and leisure became blurred.

Next, we describe online meetings and discussion forums as environments for informal learning in everyday work, followed by results arising out of the analysis of digitally mediated interaction and challenges related to these digital environments.

Marinating in online meetings

Online meetings can consume a significant portion of knowledge workers' workdays. However, they can also be environments for informal workplace learning. The researcher observed both formal meetings and informal meetings to understand their role in informal workplace learning. Employees considered online meetings easy to attend and explained that it was possible to participate even in meetings that are a bit outside one's main work tasks, but in which one can learn something useful. The informants explained how they listened to things they were not yet familiar with and learned that way. Online, it was easier to be in the background and just listen without an active role. One interviewee explained:

> I listen to them [meetings] just to get knowledge about the topic and so I can understand something because I have been there [. . .] I attend many different meetings and listen in them, and it has largely been a way of learning and getting familiarised through it. (Secretary I6)

The participants even used the terms "marinating" and "osmosis" to describe their learning in online meetings. They felt that they listened and absorbed information, even if they did not understand everything or did not even need to understand everything. They could just pick the parts that were useful or interesting for them. In addition, the participants said that during the online meetings, they sometimes undertook physical activities, such as walking or doing jigsaws, and this helped them concentrate on listening. Often, the online meetings were recorded, which further expanded the opportunities to listen and receive new knowledge. One employee reflected on this learning opportunity in the diary:

> I hope to have time to listen to the recording soon, as I know there will be many new things for me. I was able to participate in the beginning of the meeting, where I already learned a couple of new things about the Excel spreadsheet. (Training officer D4)

Online meetings were multi-channel environments in which features such as chat, screensharing and reaction functions enriched communication. The chat was actively used for commenting, sharing information and asking questions during the online meetings. Chat also provided a way to continue discussions after the meeting. Screensharing was often used to enrich presentations. One participant described this: "It's so handy when you can display your own screen with it. It's a really good thing, and you can work together there and learn in a way" (secretary I15). Another participant explained, "Digitalisation adds more communication tools to it, especially those that allow you to display images" (secretary I6). In addition, reaction functions (e.g. thumbs up, hearts and clapping hands)

were used actively to enrich interaction in a meeting. A participant reflected these social aspects in the diary:

> Facial expressions and gestures can be replaced quite well with emojis when you cannot use camera or when someone is sharing some material on the screen. That's why I like Teams, for example, because you can share reactions there. (Training officer D6)

Informal meetings provided possibilities to discuss current work issues freely, share experiences and ask questions. One interviewee explained how important these kinds of meetings were and what they shared in them:

> [. . .] how someone else has found solutions and what would be good and what has not worked, then everyone does not have to repeat the same mistakes. I have found those discussions really valuable. (Secretary I7)

Thus, employees learned from others in online meetings.

Often the meetings were online, but there were also hybrid meetings that created interesting new phygital spaces. In a hybrid meeting, some people attended the meeting at the workplace where they had gathered in a meeting room, whereas others participated individually from their own computers from a distance (at home or another place). This made the environment even more versatile and created new possibilities and challenges. For instance, those participating remotely used chat for communication, sometimes resulting in parallel conversations that the on-site attendees did not see. To them, the chat seemed unnecessary and at times even disruptive, whereas for the remote participants, it was a way to interact with the work community.

Peer support through constantly open lines

Online discussion forums and chat interfaces were typical examples of digital environments in which informal workplace learning took place. Online forums documented discussions for everyone to see and read later. Yammer and Teams channels were used daily for joint discussions and information sharing. Teams chat or calls were commonly used for small group or one-to-one interactions, for example, regular communication with a co-worker. One informant explained, "The lines are indeed open nearly every day" (secretary I7). In another example, an employee described in her diary how she was trying to solve a problem and asked for help from a colleague:

> She knew that there were settings, but didn't know where to find it. We had a Teams call where we collectively looked into the matter, and eventually, through collaboration, we figured out which setting it was about. (Training officer D4)

Teams chat was used actively, and it enabled quick peer support for everyday work problems. An informant explained its benefits: "If there's a chat where there are more than one or two people, there will always be a response. There are eager people who want to help" (secretary I15). Sometimes, the chat was used as a discussion thread related to a certain topic, such as peer support during an IT system change, and the discussion in a chat thread could continue for months. The chat's informality encouraged discussion. One interviewee described the chat thus: "It serves as a somewhat semi-official channel, so it may be important in that way that participating in the discussion there is easier" (secretary I6). Chat was not only an important tool for asking for help with work problems but also a tool to keep in touch with the team.

Modern tools provided possibilities to enrich the interaction and thus also informal learning. For instance, the participants used screenshots to enrich or give details about

matters they explained to others. This example, where an informant explained everyday communication via digital technology with a new co-worker, demonstrates this:

> She asks a lot of specific advice on how to deal with this and that, so it's very concrete matters. Not long discussions, but rather, it's quick, and sometimes we even use text snippets or even images to clarify the issue. (Manager I13)

Screenshots were also used in online discussions, for instance, when sharing tips on how to do something with digital tools.

Other ways to enrich the written text were emojis, GIFs and reaction functions. These were used for expressing feelings, opinions and active listening. One interviewee stated:

> With digital technology, these emotional expressions are indeed very important. You can use emojis, give likes, clap and quickly express your stance on something with a supportive, empathetic or agreeing sentiment. (Secretary I6)

Thus, social elements were integrated to digital environments.

Benefits and drawbacks of digitally mediated interaction

Even though meeting people face-to-face in the workplace was highly valued, digital environments were essential parts of daily work and enabled collaboration in the multi-location workplace. Online forums and informal online meetings that the work community regularly had, provided environments for informal discussion. This was considered important, particularly when working remotely. Digital environments could promote getting to know each other. For instance, employees discussed on a virtual coffee break how they sometimes found out more about others:

> The point was raised that in online meetings, it's convenient to see who the speaker is, as [an employee] mentioned that he often hovers the mouse over the name to check who the speaker is and what his/her job is. (observation notes).

In an interview, one participant said, "You can definitely notice that in interaction, a certain level of familiarity also develops with these technologies through images and names". (secretary I6)

Digitally mediated interaction was experienced as inadequate in some situations. One of the informants explained:

> The interaction situation is completely different; it doesn't convey the other person's emotions, micro-expressions and facial cues at all. So I feel that it doesn't work for building connections and engaging in social situations where you want to interact with others and have casual conversations. (Secretary I7)

On the other hand, it seemed to be a natural part of multi-location work, as one employee explained her thoughts on working together via digital technology: "I have never personally experienced it as distancing, or rather, I have always felt closeness". (training officer I10)

The digitally mediated presence can encourage interaction in situations that involve power structures due to hierarchy or differences in competences. One employee told how she used Twitter:

> I find it quite enjoyable to feel encouraged to have discussions, especially with someone like [the organisation leader] or with others that I might not necessarily consider doing in person. (Training officer I10)

Teams also served as an environment where new employees could get to know other employees: "It allows for some level of initial acquaintance with colleagues, and it also

serves as a fairly low-threshold channel, especially in the early stages" (I5). A new employee explained how she followed online discussions actively in order to learn:

> There may be questions there that I wouldn't even know how to ask yet, but when I follow along, I might come across little 'aha' moments and gradually begin to grasp such things. (Training officer I5)

A mediated presence can lure to handle multiple tasks simultaneously and this multitasking can have negative aspects for learning. One interviewee reflected this: "If you're only half-engaged, trying to do something else or multitasking, you don't really get the thing" (training officer I13). A mediated presence and multitasking bring with them the risk that attendance and thus learning is superficial.

Digital technology makes visible the actions and interactions of people, such as everyday discussions, work problems and solutions, as well as the principles and values of the work community. Even though digital technology can store all this information, the participants observed that it was difficult to find this information later. Contradictory expectations were even expressed about the ability of digital technology to store and retrieve all information communicated through it, even though systematic practices to enable this type of information retrieval (e.g. metadata and hashtags) were not used. In one discussion, an employee reflected on this phenomenon and expressed his idea that sometimes communicating online is similar to discussions in the break room during a coffee break. People present at that time hear it, but most likely not everyone. Similarly, a message in an online forum is quickly drowned in the information flow, and only some read it.

Challenges of digital environments

As described earlier, in this study, the digital environment consisted of various platforms and channels. This complex and changing environment presented challenges that threatened to restrict informal workplace learning. For instance, the abundance of channels and online discussions posed difficulties for the employees. They often stated that information was scattered, making it difficult to find relevant information from the various channels, or that it was difficult to choose the right channel for a question or a comment. One employee contemplated this in the interview: "I don't have time to follow every single Teams [channel] [. . .] that is the challenge, where is the relevant information?" (training officer I10). The employees tried to manage information overload by choosing the most relevant digital channels to follow regularly. They also used the possibilities to adjust their view of the digital environment, as this excerpt shows:

> You can now organise these, so I've placed my own stuff at the top to have the ones that are more frequently used always visible, making it easier to find without scrolling through the entire view. Of course, here you can hide things; you don't need to keep everything visible, but I'll say that we do have quite a few of these Teams, groups, and channels – more than enough. (Secretary I15)

Digital technology brings constant information flow, notifications and interruptions, but, on the other hand, it also gives settings with which to control these.

Digital technology conveyed and evoked feelings, for instance, frustration in problem situations or excitement about new possibilities. Digital technology provoked negative feelings when it did not work, when a person felt they lacked the skills to use it or when a co-worker lacked the skills or used the technology differently. On the other hand, digital technology was used to deal with frustration; for instance, there was an active chat discussion during an IT system change. People used the chat not only to ask for help or solve problems but also to air their frustration, as the following example reveals: "Perhaps it

is a chat where we can also somehow release the [name of the new IT system] frustration" (secretary I6). The difficulties with digital technology created problem-solving situations in which solutions were sought and tested together through communication via digital technology.

The work community discussed and agreed on the use of digital work environments, but in many respects, agreement was still in progress. One informant, a secretary, reflected on this in a chat conversation with colleagues:

> Heh, it's as if the fundamental idea of a traditional coffee room conversation has shifted into the digital realm and swallowed up some of the information channels – no wonder we're lost in the channels ☺ [. . .] this is quite an interesting phenomenon: how and what things transform, and what forms of expression are negotiated to belong and where, at this stage, when we have moved to remote work on our own computers in these diverse digital forums. We're exploring new territory here as well, seeking shared practices ☺. (Observation notes)

Digital environments were constantly changing, posing learning requirements to which the employees responded both with attending formal training and informal learning activities. One strategy to deal with this was accepting the constant change, as this interviewee described it:

> In a way, it's something that must be tolerated, that as we constantly move forward and everything changes, the rules change, the programmes change, what we use, these platforms and everything. (Secretary I15)

The learning requirement that the constant change brought with it was also seen as positive, as this interview excerpt reveals: "It forces us to constantly learn new systems and new processes, so that on the other hand, your brain stays active". (secretary I8)

Discussion

In this study, we explored how the digital environments of one workplace served as environments for informal workplace learning. The contrasting concepts of "expansive" and "restrictive" (Fuller and Unwin, 2004) provided the means to describe the quality of this environment. We approached the workplace as a phygital environment, in which the social, physical and digital environments are merged. First, we described the digital technology used in everyday work. It consisted of a complex blend of tools and software that were primarily intended for work but also served as an environment for informal workplace learning. The physical environment also comprised several spaces: multifunctional office spaces in two locations and remote work at home and in other locations. In this phygital work environment different elements and activities merged.

Along the same lines as Yu *et al.* (2023) and Wallin *et al.* (2020), our study recognised the dual effects of digital technology. The versatile environments both expanded and, to some extent, restricted informal workplace learning. Digital technologies provided access to information and interaction with others and thus served as flexible learning environments. Online meetings and discussion forums were examples of online spaces where informal learning commonly took place. Digital technology increased the opportunities to participate in meetings, discussions and networks. Thus, it expanded opportunities for learning. Interaction was enriched with chat, screenshares and emojis which assisted to merge social and digital environments. Technology-mediated interaction expanded opportunities to collaborate and lowered the threshold of distance, both physical and hierarchical. On the other hand, the ease of attendance could restrict learning if the mediated presence and thus learning remained superficial, for instance, when handling multiple tasks at once.

The complexity and constant change in digital workplace environments presented challenges that could potentially restrict learning. Information overload, constant interruptions and changes were burdens that required employees' skills to manage these challenges. Organisational culture enabled autonomous work and learning, which supported informal workplace learning and also provided a structure in the form of shared practices and environments (Kittel *et al.*, 2021). The study participants emphasised that the work community needs agreements and rules to ensure they have shared digital environments and practices and thus can work together and handle the challenges.

Our findings supported the notion that workplace complexity can enable and encourage learning but it can also bring barriers to learning (Anselmann, 2022). The ethnographic accounts of this study revealed how digital technology further increased the complexity of a workplace, both enhancing and restricting learning opportunities. In addition, our findings demonstrated the requirements related to digital environments, such as the need to constantly learn new skills (Vallo Hult and Byström, 2022).

Limitations and future research

When considering the findings, all the limitations of a case-study approach should be kept in mind. It is impossible to completely eliminate self-selection bias. However, all employees participated in both physical and digital environments. In addition, participating employees highlighted both advantages and disadvantages related to digital technology. It is worth noting that in the target workplace, digital environments had a significant role due to the multilocated work. In contrast, in a workplace where physical environments are prioritised due to the nature of the work or organisational culture, digital environments might play a different role. Consequently, their phygital work environment could differ from the one described here. In addition, the employees of the target workplace were accustomed and skilled users of digital technology, and thus able to take advantage of the learning opportunities available in digital environments. Despite these limitations, we consider that the findings of this study provide useful knowledge to understand better the effects of digital technology to informal workplace learning. In addition, we suggest that the approach to view workplace as a phygital environment might benefit future studies and provide a rich approach to study workplace learning.

Digital ethnography allowed us to engage with and observe several digital channels and tools that the work community used. Our main focus was to study the digital environments of the workplace; therefore, our methods did not reach all of the digital environments that the individuals used, such as social media. In addition, it is worth noting that we did not compare individual differences on the ways digital technology was used for informal workplace learning, but rather aimed to capture a holistic view of the target work community. It would be an interesting aspect for future research to investigate the role of personal digital environments and individual's digital competence on workplace learning.

Conclusions

Our approach to view the workplace as a phygital environment reveals the versatility of workplace environment. As digitalisation changes work environments conceptual change is needed for workplace learning (Harteis *et al.*, 2020). With this new understanding of the workplace as a phygital environment, in which the digital environments play a crucial role beside (or sometimes even instead of) the physical ones, the workplace can be seen in a new way.

Digital environments are playing an increasingly significant role in a growing number of workplaces, and the findings of this study reveal their potential and challenges for learning.

A digital work environment is not simply a single software or digital technology, but rather a complex network consisting of various software, applications and devices, as well as the people who interact through and with them. This network also includes relationships, interactions and organisational culture. It is essential to understand how these everyday environments of work can support learning. The approach to view workplace as a phygital environment is not only useful for future research but can encourage workplaces to explore how their work environment consists of digital, physical and social elements. As our findings indicate, rich digital work environment of knowledge work can expand learning opportunities. This applies across many fields, for example, a marketing team that used brainstormed ideas in physical meetings now uses virtual whiteboards and video conferencing tools to collaborate and innovate from various locations. Similar examples can be found in various fields such as software development, teaching and more. For the future it is important to understand when and how collaboration in digital environments can promote informal workplace learning. Complexity and constant change that threaten to restrict learning, can be managed with shared work practices and ensuring the employees have skills to work and learn in digital work environments.

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