

Work-integrated learning in managers' cooperative work practices

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Abstract

Purpose – This paper aims to focus on academic library managers' learning practices in the context of cooperative work supported by computational artefacts. Academic library managers' everyday work is mainly cooperative. Their cooperation is supported predominantly by computational artefacts. Learning how to use the computational artefacts efficiently and effectively involves understanding the changes in everyday work that affect managers and, therefore, it requires deep understanding of their cooperative work practices.

Design/methodology/approach – Focused ethnography was conducted through participant observations, interviews and document analysis. Ten managers from a university library in Sweden participated in the research. A thematic method was used to analyse the empirical material. Computer supported cooperative work (CSCW) and work-integrated learning was used as the conceptual lens.

Findings – Five learning practices were identified: collaboration, communication, coordination, decision-making processes and computational artefacts' use. The findings show that learning is embedded in managers' cooperative work practices, which do not necessarily include sufficient training time. Furthermore, learning was intertwined with cooperating and was situational. Managers learned by reflecting together on their own experiences and through joint cooperation and information sharing while using the computational artefacts.

Originality/value – The main contribution lies in providing insights into how academic library managers learn and cooperate in their everyday work, emphasizing the role of computational artefacts, the importance of the work context and the collective nature of learning. It also highlights the need for continual workplace learning in contemporary knowledge work environments. Thus, the research generates contributions to the informatics field by extending the understanding of managers' work-integrated learning in their everyday cooperative work practices supported by computational artefacts' use. It also contributes to the intersection of CSCW and work-integrated learning.

Keywords Work-integrated learning, Cooperative work practices, Computational artefacts, Situated learning, Academic library managers

Paper type Research paper

Introduction

This research explores the significance of cooperation for work-integrated learning in the context of academic library managers' everyday work practices. For learning, the

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acquisition of knowledge is related to the situation that is part of the activity, context and culture in which the knowledge is developed and used (Weinert, Billert, de Gafenco, Janson, & Leimeister, 2023); that is, learning is situational. In the context of this research, this type of learning can be the consequence of changes in everyday work caused by digitalization and the use of new computational artefacts.

Academic library managers' everyday work is mainly cooperative, and it is typically supported by computational artefacts' use. It includes activities such as setting the library strategy, coordinating the efforts of employees and achieving the library organization's objectives through the application of available resources (Dempsey & Brafman, 2018). It also includes activities of managing distributed work tasks or projects supporting activities and overseeing the work arrangements (Chatzipanagiotou, 2019; 2021).

Likewise, in an academic library, there is a group comprised of multiple managers, who must cooperate to manage the library organization regardless of their own perspectives or conflicting goals and associated behaviours. Cooperative work is described as activities of multiple actors that work together for a specific cause and are interdependent in their execution (Schmidt & Bannon, 1992). The library managers' cooperation [1] typically relies on computational artefacts' use to enable and support managers' interactions. These computational artefacts pervade the work activity and change it, so that the support becomes inseparable from the structure of the work itself (Schmidt, 1991).

While academic library managers' cooperative work practices supported by computational artefacts' use are important, less attention has been paid to the learning perspective in such contexts. Previous research by Orr (1995) and Thoresen et al. (1996) discussed learning at work, but not in a library context. Vallo Hult, Johansson, Islind, & Snis (2022) argued for a deeper understanding of digital learning practices. Likewise, there is a need for a deeper understanding of the learning dynamics in cooperative work supported by computational tools. Vallo Hult et al. (2022) continue that, despite being a focus in informatics research, workplace learning often leans on conventional theories without explicitly articulating the learning aspects. In addition, in previous computer-supported cooperative work (CSCW) and literature, cooperation and computational artefacts are studied heavily, but the work-integrated learning perspective has been less in focus (Stahl, Koschmann, & Suthers, 2006). Continuing, the actual way that academic library managers' work is carried out and what it means to be an academic library manager is still an under-explored academic topic within CSCW. Current studies about library managers focus mainly on their skills (Eftimova, 2019) and their organization of library services (Engeström, Rantavuori, & Kerosuo, 2013). However, to our knowledge, learning that is embedded in library managers' cooperative practices and supported by computational artefacts' use is not extensively addressed. Furthermore, there is not much research on embracing theoretical underpinnings from other fields to enhance our understanding of learning at work (Vallo Hult et al., 2022). Based on the above, the intersection of CSCW, working and learning could open up new paths in research. Therefore, we argue that it is of interest to emphasize the learning part that shows cooperating actors' learning situated in their workplace.

The perspective of work-integrated learning originates from research and practice on learning at the workplace. Historically, workplaces have not always been considered areas for learning, but sites where work takes place. From the 1960s and on, research has shown interest in workplaces as settings where learning occurs (Nikolova, Van Ruysseveldt, De Witte, & Syroit, 2014; Vallo Hult et al., 2022). Learning at work can be related to the concept of practice, where practice refers to what people do when they work collaboratively (Chatzipanagiotou, 2021; Schmidt, 2018). To describe instances of learning is to describe a

behaviour by which actors engage in learning as they organize, make sense, discuss or justify contingent activities, including navigating novel situations and overcoming obstacles. This way, learning at work can be associated with learning in practice. Learning is a social process, situated in work practices, where actors learn together when cooperatively engaging in their daily work. In the seminal paper *Layers of silence, arenas of voice: the ecology of visible and invisible work*, Star & Strauss (1999) focused on visible and invisible work when they ask “[...] what exactly *is* work, and to whom it might (or should) be visible or invisible” (1999, p. 10). Likewise, workplace learning is considered to be both visible and invisible because it often involves informal learning instead of more formal learning. In this paper, the aim is to explore and present empirically informed insights into how learning (work-integrated learning) is embedded in academic library managers’ cooperative work practices supported by computational artefacts’ use. To achieve the aim of the research, the following research question is formulated: *How do academic library managers learn when cooperating among themselves and with other actors to perform their everyday work?* For this, a focused-ethnographic study was conducted among middle managers of an academic library in Sweden. The data [2] were re-visited and analysed this time from the perspective of work-integrated learning. The study generated conceptually interesting findings for the informatics field regarding the intersection of CSCW and work-integrated learning research.

The rest of the paper is structured as follows. Following this introduction, second section provides a brief literature review and the conceptual lenses used in the research, starting with CSCW concepts and extending to learning and situated learning theory, establishing connections between these concepts and theories. Third section describes the methodological choices of the research. Fourth section presents the findings and fifth section engages in a discussion. The paper concludes in sixth section, summarizing the key research findings.

Literature review and conceptual lenses

The development of computational artefacts has been interwoven with the development of cooperative work in the sense that the challenges facing cooperative work have determined in various ways the use and development of computational artefacts. *Computational artefacts* are considered tools that support the coordinative activities of cooperative work practices and regulate how the activities of collaborating actors are to be interrelated (Ackerman, Dachtera, Pipek, & Wulf, 2013; Christensen, 2006; Kuutti, 2013; Randall, Harper, & Rouncefield, 2007; Schmidt & Bansler, 2016). Suchman (2007) argued that the computational artefact is not just a tool in the workplace; rather it follows the dynamics of work practices, and she emphasizes the importance of the social context of computational artefacts’ use and the work practices that make cooperative work possible. In doing so, computational artefacts must be understood in the context in which they are situated and in relation with the specific people that are using them and their practices (Schmidt, 2011; Schmidt & Bansler, 2016; Suchman, 1997; 2007).

Cooperative work includes interdependent activities of multiple collaborating actors for a specific cause (Schmidt & Bannon, 1992). It has certain characteristics, such as cooperating actors’ groups, which are often large and not permanent; they may be embedded within larger groups; and their interactions change dynamically depending on the situation (Schmidt & Bannon, 1992). Cooperative work is distributed physically, in time and space, and logically, in the sense that cooperative actors are semi-autonomous in their work. In this research, cooperative work refers to multiple academic library managers who work together to manage their library organization. *Practice* refers to what library managers do when they

collaboratively work using computational artefacts. Thus, by referring to *work practices*, we are referring to work activities and we are recognizing the unity of action in work – both conception and execution (Schmidt, 2018). In other words, when studying a work practice, we are considering how actors determine the nature of situations, how actors choose effective and efficient techniques, how they deal with routine problems, how they determine deviations from the established rules and so on.

In this paper, we adopt the term “computational artefacts” to explore the work practices of academic library managers that integrate digital technologies into their everyday work. One of the most common ways of conceptualizing computational artefacts is to consider the context of their use. Suchman (1997) introduced the concept of *situated action* to describe actions in the context of particular circumstances and the complex relationship between work practices and the work setting in which actions emerge. So, in this research, computational artefacts are studied in the context in which they are situated (the academic library), in relation to the specific people who are using them and their practices (the work practices of academic library managers) and in relation to people’s actions (academic library managers’ actions in their work practices).

Following this argumentation, managers’ learning how to use efficiently [3] and effectively [4] the computational artefacts can be approached and explained with *situated learning theory*. *Situated learning* emerged in the late 1980s as an alternative to the traditional cognitive theory of learning. Based on traditional cognitive theory, learning is considered the transfer and accumulation of knowledge and information (Nicolini, Scarbrough, & Gracheva, 2016). However, situated learning theory supports that learning is a continuous social process that emerges from a socially constructed practice and the interpretation of personal experiences associated with it (Gherardi, Nicolini, & Odella, 1998; Lave & Wenger, 1991). Knowledge is considered a social construct that is facilitated by cooperative actors’ interaction, evaluation and collaboration. Likewise, Mörtberg & Elovaara (2010) observed in their research that learning is done as part of the everyday work of cooperating actors without necessarily including extra time for training and learning. Within CSCW, this approach can be seen in the idea that cognition is an aspect of social practices as developed by and engaged in by a group of cooperating actors (Stahl, 2013).

According to Tynjälä (2013), there is a need for new forms of learning that enable people to engage in social networked learning rather than individual learning. In CSCW, learning is considered to take place in everyday work where cooperation is important. Thus, cooperating managers are constantly confronted with challenges. Besides having to adapt to new computational artefacts, they are required to engage in learning how to use them and, therefore, learning new practices, while at the same time leaving behind old ways of organizing and working. Hence, work-integrated learning is an equally important aspect from a management perspective. *Work-integrated learning* is a concept that encapsulates various approaches to understanding learning, where learning is seen as knowledge and experiences situated, integrated and linked in the workplace (Billett, 2009; Vallo Hult et al., 2022). Research on work-integrated learning brings learning and working together and examines the relationships between them (Harteis, Rausch, & Seifried, 2014). These approaches are linked in workplaces to support change in work processes and practices and learning in practitioners’ work. Learning is at the core of work activities. It is not seen as requiring time away from being engaged at work. Practically, this means that the co-production of professional knowledge is achieved through learning in joint collaboration at the workplace.

Continuing, the core concepts of CSCW are applied to illustrate identified features of learning in the workplace, such as *articulation work*. Articulation work, following on from

Strauss (1985), is an aspect of work practices related to the accomplishment of work. Cooperative work is distributed in the sense that actors are semi-autonomous in their work in terms of special situations and local contingencies. Because of the interdependence of work, the distributed nature of the arrangements must be managed. Articulation work is not always visible and is not considered “real work”. However, it emerges as a set of activities that are required to manage the distributed nature of cooperative work (Schmidt, 2002; Schmidt & Bannon, 1992; Strauss, 1988). Another core concept of CSCW, which has several interpretations, is *awareness*. The common element, however, in these interpretations, which we also adopt, is that cooperating actors, while doing their individual part of work, consider the context of their joint effort, and they align and integrate their work activities with those of their colleagues in a smooth and seamless way (Schmidt, 2002). Awareness is conceived as an integrated aspect of practice and implies action and human interaction. Such awareness can be facilitated by computational artefacts for collaboration. *Appropriation*, also a core concept in CSCW, refers to cooperating actors adopting appropriate measures in order to support the adaptation of certain artefacts to a certain practice (Müller, Hornung, Hamm, & Wulf, 2015). The above concepts helped us understand the role and importance of the context and, at the same time, turned our attention to practice as forms of managers’ engagement with the context/the setting. By turning our attention to practice, we focused on the central role of meanings that managers assign to their actions; it is managers’ engaged actions around computational artefacts’ use and information that make these computational artefacts meaningful for them and facilitate managers’ learning how to use them.

Thus, the aforementioned concepts allowed us to explore the intersection of CSCW and work-integrated learning, which are used as a reference point to discuss the findings of the collected empirical material to address the aim of the research. The presented concepts are used to explore managers’ work as “everyday cooperative work practice” (Schmidt, 2018; Schmidt & Bannon, 1992). Based on the perspectives of work-integrated learning (Billett, 2009) and situated learning theory (Gherardi et al., 1998; Lave & Wenger, 1991; Mörtberg & Elovaara, 2010; Vallo Hult & Byström, 2021), they are used to explain managers’ learning how to use efficiently and effectively the computational artefacts that are integrated and situated in their workplace. This is where CSCW can contribute to work-integrated situated learning. Putting attention to cooperative practice in workplaces provides answers on how academic library managers work and, therefore, learn together at the workplace and how this can be supported by computational artefacts’ use.

Methodology and methods

The methodological stance, based on an ethnographic approach, is presented. The methods for data collection and data analysis are discussed in detail.

Empirical setting

The empirical setting is a university library in Sweden, which serves approximately 33,000 students and 2,100 employees, including five faculties. The university has operated on two campuses since 2010, in different towns, each with a library facility. The library has approximately 60 employees, plus some temporary part-time staff. When the fieldwork was conducted, the University Library was organized into three main sections (Media Management, Research Support and Learning Support), including four functions (Metadata, Media, Meeting Space and Teaching and Learning). It was also enhanced by three more units: the Finance Unit, Infrastructure Unit and Communication Unit, which report directly to the Library Director.

The management team consists of the Library Director, the three section managers and the Finance, Infrastructure and Communication managers. During annual strategic planning meetings focused on organizational development and budget building, the management team expands to also include the function leaders. The members of the aforementioned expanded management team of both campuses, not including the Library Director, participated in this research study. That is, ten academic library middle managers of the university library constitute the participants in this research (represented in the findings as Library Managers 1–10).

Regarding the library's computational artefacts, the managers have organized most of the work under the university's Web portal (termed MS), which provides links to the university's website and to most of its systems (such as Outlook), services (such as Link and Skype), emerging technologies and the university library's website. The university's Web portal supports creating groups, open or closed, temporary or permanent. In addition, there is a shared directory (termed BS) on the university's main server (S://), which belongs to the University Library and where managers store and archive completed library documents. There is also another collaboration tool that the managers use for project management and information organization (called TR). The University Library also uses the Integrated Library System (ILS), its own service management system where library staff members report and fix problems related to the ILS, its own finance system and the University's repository. In addition, the academic library managers in the library are also offered devices such as personal computers, laptops, tablets, mobile phones, common printing machines, common web audio/video conferencing tools and digital projectors.

Methodology

Ethnography as a research methodology has a long tradition in informatics and CSCW for understanding work practices, including the use of computational artefacts (or digital technologies) (Suchman, 2007; Suchman & Wynn, 1984). It enables the researcher to study what people are doing in their daily work, thus identifying patterns of thought and practice and examining the relationship between them because what people do is not always the same as what they say they do (Crang & Cook, 2007). Despite variations in ethnographic methodologies, some commonly accepted main principles of ethnography and focused ethnography are natural settings, holistic view, descriptive understanding and participants' point of view (Blomberg, Giacomi, Mosher, & Swenton-Wall, 2017). That is, we examined managers' activities in their everyday setting within the larger context of the university organization in relation to the social context as a whole. Our focus was on describing the actual actions and behaviours of the participants, not what they ought to do or what they say they do; we attempted to understand the "world" from their point of view. Focused ethnography, while distinct from conventional ethnography, shares the same core principles (Blomberg et al., 2017). However, it differs by having a shorter duration and a contemporary focus on specific problems, subjects and contexts (Knoblauch, 2005; Pink & Morgan, 2013).

Moreover, focused ethnography is frequently applied when the researcher possesses prior familiarity with the subject matter and applies pre-existing knowledge to investigate an uncharted facet (Randall et al., 2007). That is, the first researcher's formal academic background, including her professional experience as an academic librarian, enabled us to carry out the ethnographic study more efficiently, achieving saturation within a shorter time.

Data collection

The focused ethnographic approach entailed the following methods for the collection of data: documents review, participant observations, informal face-to-face interviews and formal face-to-face semi-structured interviews. The empirical material was collected through direct contact with the research participants within the empirical context, where the identity and role of the researcher was fully known to everyone in the research setting.

Through reviewing organizational documents, the data collected aimed at helping us to acquire knowledge about the specific academic library. This provided useful backdrop to the organization before entering the research setting and before conducting observations and interviews. By combining the knowledge obtained from these documents with the data acquired from observations and interviews, a deeper understanding of the specific research setting and the people under study was created.

Ethnographic researchers rely on observation to uncover participants' daily routines and understand their actions, going beyond verbal reports (Crang & Cook, 2007). Over three months, the first researcher shadowed academic library managers, observing and experiencing their everyday work practices firsthand.

Through interviews and observations, the aspiration was a comprehensive understanding of the participants' work environment, behaviours and mindset. Both informal conversations during and after observations and formal interviews, guided by a prepared set of semi-structured questions, were conducted with the ten library managers. All formal interviews were audio recorded with participants' consent and notes were taken during the interviews, which were conducted in English.

The data collected from interviews, combined with those of the participant observations and documents, allowed us to progressively understand the meanings that the academic library managers assigned to their everyday work activities and to their social setting. These insights in turn informed explication of their cooperative work and computational artefacts usage that illustrated their work-integrated learning.

Data analysis

We used thematic analysis as our analytical device, a coding process involving steps such as data familiarization, generating descriptive codes, categorization, theme identification, examination, definition and presentation of final findings (Lichtman, 2010; Madden, 2013). The process involves moving from coding to categorizing and then identifying themes in the data.

In our analysis, the notes from the document review, the observation notes and the interview transcriptions were printed and organized into folders. Interviews were transcribed verbatim before printing. The printed material underwent multiple readings to gain a deeper understanding of participants' perspectives on cooperative work practices, interactions and the use of computational artifacts. The aim was to identify similarities and generate initial codes by carefully reading the transcribed empirical material and identifying specific terms related to the research question. Attention was given to text indicating work activities, tasks, projects and related actors' perceptions, computational artefacts and learning approaches. These terms formed initial codes for the research question. Extracted codes were reviewed for repetition or redundancy and organized into broader categories aligned with the research aim and question. The initial category list, linked to library managers' work practices and the impact of computational artifacts on work-integrated learning, evolved through iterations of re-readings. The final step involved reviewing and organizing categories into themes, concluding the analysis with theme definitions.

Findings

Five *learning practices* emerged from the data analysis:

- (1) Collaboration
- (2) Communication
- (3) Coordination
- (4) Decision-making processes
- (5) Computational artefacts' use

Five learning practices emerged through the analysis and interpretation of the data. Managers engage in cooperative work-integrated learning through collaboration, communication and coordination. Decision-making, which also emerged as an important aspect of managers' work, involves learning within the workplace. From the above, the interdependent and interrelated nature of managers' everyday work became evident. The managers confirmed that computational artefacts' use is interwoven with their work and through that they also learn. Below, each theme is explained and supported by the participants' quotations, reflections and our observations.

Theme 1: Collaboration as a learning practice

The academic library managers were identified to be active actors whose work evolves around collaboration, coordination and communication including learning. Collaboration is a purposeful relationship in which all managers choose to cooperate to accomplish a shared outcome. This shared outcome can be a specific project, task or a broader organizational goal. Observations showed that collaboration encompasses both asynchronous and synchronous communication methods supported by computational artefacts' use that enable managers to work together and interact. Hence, library managers' collaboration is supported and enabled by computational artefacts to accomplish their work practices' goal.

Managers' collaboration practices were observed as a system of interdependent and interrelated purposeful activities, where managers act as central coordinators of these work tasks and activities, and, at the same time, they are aware and aligned with each other's work. Library Manager 2 said:

The management group we have, we are working in a new way now [. . .]. Someone (meaning a manager from the management team) puts a document on BS and then we use that document to take notes from. [. . .]. So, [. . .] we write down the main points of the meeting and, then we share it, not only in our management team, but we share it with all the employees. The meeting minutes document is sent out each Monday, after we have the meeting, and it is sent as a shared link on MS. Then, it is filed [. . .] archived in S:/. So, it's in full text in MS and in S:/. . .]. We also work together and communicate through e-mail of course [. . .] and then, the social media group [. . .].

When managers were asked to provide examples of how they work and learn together, they provided a colourful account of how they carry out their collaboration activities and how they use computational artefacts in different ways to achieve common collaboration goals. Library Manager 6 added:

I mainly work with our web portal when I want to give information to my colleagues (meaning the other managers). Sometimes I do it orally in meetings and sometimes I do it on the intranet or via e-mails depending on the outcome.

Regarding the support offered by computational artefacts used in managers' collaboration, Library Manager 4 said: "We are always working through systems (meaning information systems) and we are always working with improving the systems to better support us [...]".

In most managers' examples, they commonly integrated computational artefacts into collaboration, aligning with communication, coordination and information sharing activities. Managers' learning was observed to be done as part of their collaborative actions and interactions in their everyday work.

Theme 2: Communication as a learning practice

Managers' collaboration practices were observed to be interconnected with practices of communication and coordination. Their everyday communication was also related to their work with sharing and managing information including the use of computational artefacts to support these activities. E-mail, file sharing, shared view, computers and video conferencing were identified as artefacts that supported their synchronous or asynchronous communication interactions at the same or at different locations.

Managers ascribe an important role to information in relation to their communication as illustrated by Library Manager 2 and 5: "Information is all" and "Information we give and get and share with others [...] is what we need to know and what others need to know [...] Information is everything we work with". Managers' knowledge is created through information sharing and, therefore, through their communication.

However, the use of computational artefacts is sometimes challenging because the artefacts may not be robust enough to facilitate managers' communication. These challenges may lead to workarounds or unintended practices as vividly described by Library Manager 3:

I think technology should be helping us more to manage information and our corporate knowledge. We need a system which is going to capture important communications in an easy way without expecting people to print them, file them, document them into a corporate system. [...] So, if there was this clever system that really, I think, force you to capture as you went, so it was going to be usable by other people, so it was categorized and findable [...].

Still, managers were observed learning to overcome the communication challenges of their everyday work.

Theme 3: Coordination as a learning practice

Library managers' coordination work was observed to include leading the work of their team members to achieve the objectives and goals. Thus, coordination was tied to and part of managers' cooperative work and learning. The observations and interviews showed that the coordination practices include also breaking down and managing the work through a series of distinct steps. Managers forecast required activities, plan them, collaborate and communicate to accomplish them, plan lines of authority, make decisions and schedule the required tasks for the accomplishment of the goal. An example of how managers perform the breakdown and coordination was given by Library Manager 10:

I prepare an agenda and one of us is taking notes [...] like an alphabetical list of who will keep the notes. I send it (meaning the agenda) via Outlook [...] I say "this is my suggestion of agenda. [...] Are there anything that you want us to discuss?" I want it to be a collaborative agenda [...] We keep them (meaning the meeting minutes) in BS. And, if we work with documents like now [...] we have BS. [...] All of us have the documents there, the notes and the documents. And then, we keep it as an archive in S:/

At the same time, they try to foresee unanticipated contingencies. After completion, they make sure that all related files are archived, and lessons learned are documented mainly with the support of computational artefacts' use.

Evident in this are the elements of distributed coordination. The work tasks were found to be performed as parts of larger patterns of activity, the plans and procedures through which such work is supported, and the practices through which an awareness of the work being done is shared with others involved in its accomplishment. Managers' perspectives, ideas and behaviours, in this way, slowly meshed, and managers' learning was found to emerge.

In addition, maintaining thorough documentation enables managers to assess goal fulfilment, track completed tasks, identify pending work and communicate work status. Managers were also observed to oversee activities to spot potential issues promptly and take corrective actions for goal completion. Managers' learning was observed to be done as part of their coordinative tasks, activities and interactions in their everyday work.

Theme 4: Decision-making processes as a learning practice

Decision-making was also found to be an integral part of managers' cooperative work and learning. Managers' decision-making was observed to be based on the available information, their previous knowledge and their interaction with the organization and their perspectives, values and beliefs. Information and meetings are managers' main mechanism of managing, through which they discuss, plan and practice the practical activity of decision-making. Library Manager 4 said:

We have to go through this in meetings in every section [...] and see what we can come up with. So, if we have good arguments for this [...] and if they can see that it's worth [...], we have to discuss that.

Library Manager 2 added: "[...] secondly, discussion between all employees in order all perspectives to be heard". More specifically, the managers conduct targeted meetings, organizing them by involved individuals or relevant sections. During these meetings, managers share comprehensive information to facilitate understanding and meaningful discussions, which leads to decision-making. The role of computational artefacts was found to be supportive and mediating in this process, and managers' learning was found to be embedded in their decision-making interactions and practices.

Theme 5: Computational artefacts' use

Computational artefacts' use was found to be intertwined with the academic library managers' everyday cooperative work practices. Managers confirmed that the plethora of computational artefacts, although it offers them options in their cooperative work, sometimes has negative results as they feel confused and overwhelmed and agreed that they must improve their use. The computational artefacts that were selected and imposed on them by the university organization were not well integrated in the work practices and this challenged their cooperation. On the contrary, managers further explained that it has to do with each person's perspective, knowledge, training and willingness to learn.

Library Manager 6 said:

[...] we have tried different platforms. [...] we use a lot of different platforms to collaborate. [...] and sometimes it's really easy for them (meaning the other managers) to understand the platforms and why we need to use them. And, sometimes they just think 'oh no, not one more platform' [...].

The staff's familiarity with computational artefacts and their use was found to differ. This difference could restrict the managers' decision of which tool to use for their collaboration, communication and coordination practices. Library Manager 9 explained:

Not all employees are familiar with technology, such as Link or Skype, and this sometimes is a problem because, for example, I can only get in contact fast through Link. Or we can use the library chat. But not everyone has downloaded it.

To reduce the use of different independent computational artefacts to avoid confusion among the staff, Library Manager 1 said:

I like learning about technology and using databases. So, I don't struggle with that. But, I know that some of my colleagues perhaps think it's a challenge [...]. So, we are trying not to have so many options [...].

In addition, the introduction of new computational artefacts was found to require managers' acquisition of new knowledge and skills. However, there is no special time reserved for training and learning how to use the new computational artefacts. Learning was observed to be embedded in the existing work practice as managers learn on the way and from each other. However, managers suggest training to learn how to use the computational artefacts in their everyday cooperative work practices in the best possible way; and policies concerning their use, along with a framework that clearly states the structure of information life cycle and which computational artefact should be used for which specific purpose.

Discussion

The research findings showed that academic library managers' learning was framed through their everyday work cooperation and, therefore, the discussion starts with that. The findings showed that the library managers were a group of interdependent individuals that cooperated to manage their library organization with the support of computational artefacts' use. While the use of computational artefacts supported academic library managers' cooperative work activities and learning, they caused also challenges which affected managers' learning. The identified cooperative work practices and the challenges that managers experience, permit discussing the paper's research question, *How do academic library managers learn when cooperating among themselves and with other actors to perform their everyday work?*

Academic library managers' activities to support learning as well as their cooperation is carried out through collaboration, communication, coordination and decision-making processes. Moreover, these learning practices intertwine with each other, emphasizing the interconnectedness of collaboration, communication and coordination in the decision-making processes facilitated by computational artefacts. The cooperating managers used a multitude of computational artefacts to interact, facilitate, mediate, regulate, support and coordinate their interdependent activities. That is, the managers appropriated (Müller et al., 2015) the use of computational artefacts to coordinate and articulate (Schmidt, 2002; Strauss, 1985, 1988) the distributed activities of their collaborative work arrangements. Likewise, the managers mediated and supported their collaborative interactions, facilitated organizational communication and coordinated workplace activities in spite of distance with available computational artefacts. They thereby augmented their capacity for articulating their distributed activities and, thus, being aware (Tenenbergh, Roth, & Socha, 2016) of each other's work. Their interactive and cooperative work formed complex interrelations of collaboration, communication, coordination and decision-making processes. Learning to use efficiently and effectively the computational artefacts requires in this context deep understanding of managers' cooperative work practices (Christensen & Harper, 2016;

Orr, 1995; Schmidt, 2014; Thoresen, et al., 1996), understanding of the changes (Vallo Hult & Byström, 2021) and challenges caused by computational artefacts' use in these cooperative work practices that affect managers.

Furthermore, computational artefacts were not found to be just tools in academic library managers' workplace (Ackerman et al., 2013; Christensen, 2006; Kuutti, 2013; Schmidt & Bansler, 2016; Suchman, 1997; 2007). They were also found to support the cooperative activities of managers' work practices and regulate how these activities were interrelated (see e.g. Schmidt, 2011; Randall et al., 2007), while, at the same time, illustrating the dynamics of managers' work practices (Suchman, 2007). In this way, managers were observed to become active actors in the emergence of their ways of working and learning with the support of computational artefacts' use.

The incorporation of work-integrated learning added depth to the understanding of how managers adapt to new computational artefacts. Work-integrated learning emphasized the seamless integration of learning and working, challenging the notion that learning requires dedicated time away from work. This resonates with the observed practices of academic library managers who learn to use computational artefacts as an inherent aspect of their daily cooperative work.

The challenges associated with the use of computational artefacts, including the potential for confusion and overwhelm, highlighted the need for a nuanced approach to technology integration. The varying levels of familiarity among managers and staff with different computational tools underscored the importance of considering the user's perspective, knowledge and training in implementing these technologies effectively.

More specifically, the research findings showed that collaboration was a purposeful relationship in which managers work together, with the support of computational artefacts' use that enable their cooperation and interactions, to accomplish a shared outcome. Managers' communication practices included information, which is managed with the support of using computational artefacts, to interact, conduct, integrate, articulate, coordinate, align and appropriate their cooperative work arrangements. These activities illustrate the articulation work managers perform to achieve the library goals and objectives. Thus, this work is related to situations where the managers lead and coordinate the team to carry out their daily work. The work included in these activities is mostly visible, but it also includes elements of invisibility such as the experiences and knowledge the managers and the team use in their daily activities (Star & Strauss, 1999). Furthermore, learning takes place in everyday work, e.g. in articulation work and it is also embedded in the acquisition and use of knowledge and experiences (Orr, 1995; Thoresen, et al., 1996; Weinert et al., 2023). In decision-making practices, managers identified, made sense and chose alternatives based on the available information, their previous knowledge, perspectives, values and beliefs and their interaction with the organization. Again, information was shared with the facilitation of computational artefacts' use for managers to understand situations. The artefacts were used to satisfy managers' work requirements, however, other times alleviated their work, whereas some other times created challenges as there were deficiencies observed. The aforementioned practices – that is, collaboration, communication, coordination and decision-making processes – supported managers' learning.

Learning was found to be added to the existing practices and cooperating actors learned together. Managers' workplace learning was complex, multidimensional, contextual and dynamic. The main assumption is that knowledge is collective, not individualistic (Gherardi et al., 1998; Lave & Wenger, 1991; Stahl, 2013). The argument is that human action is the result of interaction between individuals and between individuals and their environment/context (Lave & Wenger, 1991; Gherardi et al., 1998). Because interaction is considered a way of learning, the learners and their environment become inseparable. Therefore, the

context in which learning takes place becomes important for the learning process, extending in this way traditional cognitive theory by Nicolini et al. (2016) and confirming previous research (e.g. Billett, 2009; Gherardi, 2009). In this process, managers' work-integrated learning was enhanced by interaction with others and through cooperation. So, in managers' work-integrated learning, learning took place within and in interaction with others (e.g. Tynjälä, 2013; Vallo Hult & Byström, 2021; Vallo Hult et al., 2022). That is, the findings showed that learning was embedded in managers' work practices and did not necessarily include sufficient training time. However, managers learned together by reflecting on own experiences and through joint cooperation and information sharing. This confirms Star and Strauss (1999) and extends their previous research by finding that workplace learning is not always visible as it more often involves informal learning instead of formal learning.

The research outcomes also revealed that academic library managers' everyday learning practices emerged from the specific setting and arisen contingencies during their work cooperation. Managers' local accomplishments made distinct actions significant. The cooperative work practices that constituted the situated character of managers' work were practical expressions of shared articulated generic activities organized and ordered by established procedures. Integral to and instantiated within managers' learning practices, use of computational artefacts supported work and their learning at work.

The role and importance of the context for managers' cooperation and learning was observed confirming and extending previous research (Schmidt & Bannon, 1992, 2013; Suchman, 2007). At the same time, the concept of practice (Schmidt, 2018) was used to describe managers' ways of engaging with the context and provide an understanding of the role of meanings that managers assigned to their actions when using computational artefacts. In academic library managers' everyday managing in action and, therefore, in their everyday learning practices, managers incorporated elements of the library work context, such as the computational artefacts, to accomplish their work. Computational artefacts were found to be integral parts of the library context. Likewise, cooperating managers were embedded in the library context and within their situated practices. Thus, the library context and the computational artefacts' use of the specific library's context, around which managers' everyday work practices were organized, were continually recreated and readjusted. They were appropriated depending on the development of managers' cooperative work practices, confirming Suchman's (1997) previous research. That is, the managers were observed to appropriate the computational artefacts to respond effectively to the needs of their everyday cooperative work practices, as emerged in their library context. Hence, the appropriation of computational artefacts' use was inherent to the emergence of the managers' cooperative work practices and learning in the specific library context.

Appropriation also implies learning. For cooperating actors to support the adaptation of certain computational artefacts to a certain practice, they need to learn how to use these computational artefacts and, therefore, they may need new knowledge and skills (e.g. Mörtberg & Elovaara, 2010; Vallo Hult et al., 2022). Managers' learning was done as part of the everyday work, but it did not necessarily include extra time for cooperating actors' training and learning. Instead, learning was embedded in the existing practices and cooperating managers learn together, which supports the findings of Mörtberg & Elovaara (2010). In accordance with and extending previous research findings (Vallo Hult & Byström, 2021), it was identified how managers learn by reflecting together on their own experience and through information sharing.

Expanding the concept of appropriation, it can be said that cooperating actors adopt appropriate measures to support the adaptation of certain computational artefacts to a certain practice of theirs and, thus, cooperating actors' action and work-integrated learning

emerges in response to this adoption. Taking as departure point that human appropriated actions is the result of interaction between actors and between actors and their setting, the cooperating actors and their setting become inseparable. Appropriated actions incorporate elements of the setting to accomplish the work. Computational artefacts are part of the work setting and thus are incorporated to accomplish the work. Hence, the use of computational artefacts was appropriated for the accomplishment of cooperative work activities and learning. Thus, the work setting becomes important for integrating actors' learning. The learning was enhanced by interaction with other cooperative actors; through cooperation one can learn more than one can learn in isolation and, therefore, learning becomes part of actors' everyday cooperative work. Thus, appropriation of computational artefacts in combination with technologically enhanced cooperative settings provide deeper insights in cooperative actors' everyday work practices and learning. At the same time, appropriation empowers cooperative actors by offering learning possibilities and enhances their work practices by supporting them with the use of computational artefacts.

In conclusion, the research findings navigate the intersection of cooperative work, work-integrated and situated learning and computational artefacts in the context of academic library management. By embracing the complexities and nuances of these relationships, the research provides insights to understand and enhance the integration of technology into cooperative work environments. The research findings emphasize the need for ongoing learning, adaptation and a thoughtful approach to the use of computational artefacts among academic library managers.

Conclusion

This research has presented empirically informed insights into academic library managers' cooperative work practices supported by computational artefacts' use, with a focus on their work-integrated learning. Using a CSCW approach, we conducted a focused-ethnographic study in a Swedish academic library. Through participant observations, face-to-face interviews and document reviews, we thematically analysed the empirical data. The findings were discussed through a conceptual lens based on work-integrated learning and situated learning theory, with the incorporation of main CSCW concepts such as cooperation, computational artefacts, articulation work, awareness and appropriation.

Guided by the research question, How do academic library managers learn when cooperating among themselves and with other actors to perform their everyday work?, we concluded with the following research findings: Findings show that managers' learning is deeply intertwined with their cooperative practices. Collaboration, communication, coordination and decision-making activities were integral, facilitated by the use of computational artefacts. These tools played a vital role in supporting, facilitating and mediating cooperative practices, shaping managers' work-integrated learning. While learning to use computational artefacts was essential, challenges arose in managers' cooperative endeavours, influencing joint learning. Managers emphasized the importance of aligning organizational and technological changes with training. Despite acknowledging the significance of learning, time constraints hindered dedicated training, integrating learning into existing work practices. Reflecting on their experiences and engaging in joint cooperation and information sharing, managers learned collaboratively.

Future research could extend this investigation to information-intensive organizations beyond academic libraries, examining similarities, differences and the impact of computational artefacts on cooperative work practices and learning. Exploring additional artefacts or adopting alternative methodologies also presents avenues for further study. It is crucial to note that our interpretations are context-dependent, contingent on the specific

setting, participants and cultural values. Future investigations could explore outcomes in diverse settings with variations in workplace culture, beliefs and perspectives.

This research generates contributions for the informatics field by extending the understanding of managers' work-integrated learning in their everyday cooperative work practices, supported by computational artefacts' use. It contributes to all interested stakeholders in regard to providing insights about contemporary work and knowledge work, which requires continual workplace learning and about the use of computational artefacts that intensify the need for workplace learning. It also contributes to the intersection of the body of research on CSCW with workplace learning.

Notes

1. The words cooperation and collaboration are not used interchangeably in the research. Cooperation refers to working with other people to the same end and it implies interdependence. Collaboration refers to working with someone to produce something or achieve a single shared goal.
2. The empirical material was collected for the first author's PhD project. For this paper, in which the focus is on managers' work-integrated learning, the data were re-visited.
3. Efficiently: In a well-organized and competent manner.
4. Effectively: In a manner as to achieve the desired result.

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