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# A Method Combining Deductive and Inductive Principles to Define Work-Related Digital Media Literacy Competences

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**Abstract.** How to infer the digital media literacy competences of office workers related to distant teamwork from the observation of collaborative practices? This paper presents a qualitative method that combines deductive and inductive approaches to analyze interviews and observations carried out in ten organizations. From a deductive standpoint, our analysis is anchored in a review of the literature in Computer-Supported Cooperative Work. From an inductive standpoint, our analyses use principles from phenomenography and grounded theory to abstract a theoretical understanding of the studied experiences. The combination of these approaches allows us to examine the way workers experience distant teamwork activities and to consider how their competences reside in their ability to frame the work situations they encounter, and to develop responses accordingly.

**Keywords:** Digital media literacy · Grounded theory  
Phenomenography · Collaborative practices · Distant teamwork

## 1 Introduction

The ubiquity of information and communication technologies in the workplace has fostered a surge in distant teamwork practices. The LITME@WORK project aims at studying the digital media literacy (DML) competences of office workers related to distant teamwork. Digital media literacy extends the concept of literacy to information and communication technologies by emphasizing not only their informational or digital nature, but also the social dimension and critical understanding of the activity of using technology as a medium of communication [1]. Three complementary angles of analysis are combined by the research teams working on the project:

- The macro-level is focusing on the process of social and discursive construction of DML competences;

- The meso-level is focusing on the effects of work organization, workplace design and structural conditions (e.g. support, training) on DML competences;
- The micro-level is focusing on understanding digital media uses to define competences in distant collaborative work practices, from the point of view of workers.

The methodological contribution presented in this paper relates to the micro-level analysis conducted to understand how workers use digital media to work collaboratively at a distance and to define the competences they call upon to do so. Instead of defining such competences a priori and attempting to validate their definition, the objective pursued in this project is the very definition of these competences, from the perspective of workers, based on field observation. Hence, our approach to DML competences in distant collaborative work is an interpretive one [2].

The research also veers away from tool-oriented approaches that reduce digital competences to technology-related operational skills [3]. Such approaches define their unit of analysis based on the use of specific software or hardware tools by workers. Rather, we focus on the observed workers' distant collaboration activity, which involves a variety of technologies.

This paper will be dedicated to the description of the qualitative methods we use to pursue these objectives. The question we propose to examine in this article is how to infer competences from the observation of collaborative practices. The first section will detail the type of data that are collected (and how they are collected) as part of this project. Secondly, we will cover the methods for data analysis, which combine deductive and inductive principles. It will be the occasion to discuss the theoretical and methodological consequences of taking an interpretive approach on the definition of competences. Finally, we will use examples from the data we have collected so far to illustrate these principles.

## 2 Collected Data

We have selected ten cases of Belgian organizations that have introduced changes in their work environment with the intention of enhancing teamwork and distance work with information and communication technologies (ICT) as “flex desks” or teleworking policies for example. The selected cases represent a variety of working contexts in terms of: public/private companies, activity sectors, organization sizes, etc.

For each case, the data collection starts with a global visit of the organization, generally lead by a member of the organization's Human Resources team. Then, six guided-tour interviews are conducted with the team leaders and team members of two teams from two different services. Forty workers and twenty team managers will have been interviewed by the end of the study. A “guided-tour” interview is a camera-recorded interview conducted in the informants' everyday context of work, including their devices and tools [4]. The interview questions (see “selected activities” below) are complemented, whenever relevant, by follow-up questions such as “can you show me how you do that?”. These questions invite the informant to show us and comment what is achieved (or not) through collaborative tools to manage a given type of activity (e.g. planning a team meeting). Here, we adopt the principles of connective ethnography [5]

to avoid considering the experiences people have online and offline as worlds apart, and examine their online and offline practices as an integrated whole. This leads us to consider the complementarities between the aspects of collaborative work that are achieved by individuals either in the physical presence of their colleagues or in the distance. To do so, the collected data from interviews are complemented by a half-day observation of the team's work environment and practices. Interviews are transcribed and coded using NVivo 11, along with observation notes and field traces (photographs).

### 3 Data Analysis Principles

#### 3.1 An Interpretive Approach Articulating Deductive and Inductive Coding

We consider competences as not being limited to generic sets of attributes that workers possess and use, defined independently of their context. Indeed, “two workers may be identified as possessing identical attributes but may accomplish work differently, depending upon which attributes they use and how they use them” [2]. Consequently, we aim at defining competences based on the “lived experience of work” [2], i.e. the relationship between the worker and their work environment, taken as inextricably related. In this context, phenomenography [6, 7], which has already yielded abundant discussion in the field of information behavior (see for example [8–11]), comes as an important inspiration for the construction of our method, as it proposes “a research method for mapping the qualitatively different ways in which people experience, conceptualize, perceive, and understand various aspects of, and phenomena in, the world around them” [7].

Adopting an interpretive approach to the workers' perspective on distant teamwork calls for inductive analysis. However, the early stages of our analysis are guided by deductive categories. Our coding process can be seen as a hybrid approach [12] balancing inductive coding from themes emerging in our informants' discourse and deductive coding derived from our theoretical framework. This can be considered as an “abductive matching” in a sense that we create the opportunity to capture and combine the systemic character of the field with the systemic character of our theoretical framework [13]. A first “deductive scan” is applied to the interview transcripts and observation notes, in which we code each part of the material according to the structure of our interview guide. The interview guide covered a series of activities involved in distant collaborative work. These activities were identified by reviewing the literature in the field of Computer-Supported Cooperative Work (CSCW), which provided us with a representative overview of the types of collaborative work activities that are (or could be) supported by existing (and future) technologies (for more details, see [14]). These activities are:

1. Making collective decisions regarding tasks distribution, team governance and roles, and overall team functioning;
2. Managing one's tasks in relation with others;
3. Planning the team's activity;

4. Planning a meeting;
5. Working synchronously in the distance with other team members;
6. Organizing one's workspaces for collaboration;
7. Managing incoming information;
8. Managing outgoing information;
9. Using others to find information;
10. Sharing a collection of documents;
11. Authoring a document collectively.

In our interviews, informants were prompted to describe each activity according to up to eight dimensions: task management, time management, space and distance management, information management, awareness, collective decision making, reflexive tool use, and comprehension of “sociomatics” (for more details, see [14]). The initial coding of our data reflects these deductive categories (activities x dimensions), which were used as a tentative list of activities in which distant collaboration may arise and call for digital media literacy competences. This list allowed us to ensure that a variety of work practices were covered in our data. It also distributed the object of the investigation on several practices and allowed for a fine description of each of them (and possibly for a grouping of some of them based on the data). This represents an alternative to existing phenomenographical inquiries in information science, where researchers have tended to focus on the way people understand a single broad concept, as Bruce [15] did with information literacy, Sandberg [2] with competence in engine optimization, or Smith and McMenemy [16] with political information. In our case, instead of explicitly asking our informants to describe their conception of a general category, such as “distant collaboration” or “digital media literacy for collaboration”, we asked them to describe an array of specific collaborative practices they engaged in, and we are using these descriptions to infer what the digital media literacy of distant collaboration is (see below).

Our method shares a combination of inductive and deductive coding and a focus on the description of job expertise with other job analysis methods, such as cognitive task analysis (CTA) [17]. However, CTA seeks to identify strategies and knowledge used by experts to perform one specific complex task, to inform the design of expert systems and instructional material. By comparison, we study the variety of conceptions held by workers (not just experts) regarding a whole range of distant collaboration activities, as they contribute to defining various levels of competence.

The application of the deductive activity categories is followed by the inductive coding of the informants' experiences, with codes describing their actions. From an inductive standpoint, our analyses use principles from the grounded theory method [18, 19] to build a theoretical understanding of the studied experiences. Our informants' discourse and our observations are coded to identify “properties of the subjectivity of actors” [20], which are gradually articulated to define conceptual categories. The categories account for the variation in the different conceptions of distant teamwork practices, in accordance with the principles of phenomenography [6]. This process of deductive and inductive coding is systematically documented in coding memos, which are cross-referenced both with the coded data (interview transcripts and field notes) and with the theoretical memos that articulate conceptual categories into a new conceptual

framework. This web of memos guarantees both the grounding of our interpretations into the data [20], and the possibility of internal auditing through dedicated research team meetings, where important coding decisions are explicitly discussed and justified to ensure the visibility, comprehensibility and acceptability of the analysis [21].

### 3.2 Inferring Competence Definitions

How we infer competences from this coding is not a straightforward process. Two principles of phenomenography define how we initiate this step of our analysis. First, our unit of analysis is the practice, not the individual. A practice is a goal-oriented activity that is potentially distributed across different people, tools and contexts. Distant teamwork practices are coded based both on the informant's discourse on them, and on their traces in the guided tours and in our observations. Second, the coded practices are pooled across our whole sample of informants, so that practices can be compared, contrasted, or grouped both within each informant and between different informants.

Our objective of competence definition imposes at least two requirements on our analysis: we should be able to describe the objects of competence (in terms of situations workers are able to deal with) as well as the nature of a competent response (in terms of situated intentional action).

The issue of the objects of competence is twofold. On the one hand, by describing their practices, our informants provide descriptions of the situations they need to address as part of their work. We use these descriptions as a basis for our analysis to build an inventory of typical problem situations that call for DML competence from the perspective of workers. This inventory may or may not correspond to the eleven activities we surveyed in our interviews. On the other hand, the way they describe these situations depends on their competence. Indeed, a key aspect of professional practice is the ability to properly frame the problem situations that are constitutive of one's work: setting its boundaries, attending to its most relevant features, and imposing a coherence upon it. What Schön [22] calls the "reflective practitioner" is able to frame known situations, and to construct new frames to face novel situations based on their experience.

Our focus on practices (not individuals) as the basic unit for analysis allows us to pool descriptions of practices across all informants, so that we can group together descriptions that refer to the same problem situations, and then, for a given situation, group together descriptions that correspond to qualitatively similar conceptions of that situation. Essentially, our analysis works towards both the identification of the set of distant collaboration situations that call for DML competences, and the identification of the different conceptions of (i.e. different ways of framing) each situation.

As Limberg [8] noted, different conceptions of the same phenomenon can often be hierarchically ordered in terms of their increasing complexity. "More complex ways of experiencing means that the categories comprise more dimensions and a simultaneous awareness of these dimensions." [8]. The analytical process through which we define competences relies on this hierarchical ordering. As one's ability to frame a situation in more or less complex ways is indicative of their competence [2], the ordered conceptions of distant teamwork partly define levels of DML competences.

However, our analysis does not stop at describing how workers understand (i.e. frame) their experience of work in qualitatively different but increasingly complex ways: it must also encompass how they are able to respond to the work situations they encounter. Here, our analysis shifts its focus to the intentional actions performed by our informants based on their understanding of the situation. In this case, competence is not necessarily indicated by the complexity of actions, but rather by their matching with other parameters of the situation. Specifically, we seek to characterize how our informants are able to adjust, in each situation, their actions (what they do) with their tasks (what they are expected to do), their goals (what they want to do), and the actions of the members of their teams (what others do). In this context, although most of the time not all four of these dimensions (actions, tasks, goals, and others' actions) appear together in the description of a given practice, we identify their "successful practices" (when the described dimensions match) and their difficulties (when mismatches occur between them) as markers of greater or lesser competence, respectively.

Of course, framing a problem situation and responding to it are related: "a capability for acting in a certain way reflects a capability of experiencing something in a certain way. The latter does not cause the former, but they are logically intertwined. You cannot act other than in relation to the world as you experience it." [23]. We consider the relationship between these two terms to be a conditional one, with framing being a necessary but insufficient cause to responding.

#### 4 Preliminary Analysis

The following examples illustrate the first steps of the method outlined above, as the analysis is currently underway, which precludes us from presenting its results. The four excerpts presented below feature difficulties expressed by informants about different kinds of distant collaborative practices, representing different types of mismatches between their actions, goals, tasks and others' actions. While the presentation of single excerpts for each problem situation may give the impression of taking the individual (as opposed to the practice) as the unit of analysis, the next steps in the analysis (grouping the pooled practice descriptions by problem situation, and ordering them by complexity) will allow us to contrast different experiences around the same practice. All excerpts are translated from French. Square brackets indicate edits by the research team.

**Excerpt 1.** In this excerpt, the informant explains how she shares coordination documents by e-mail with her team: "[...] *I've just sent them a brochure and they had to send me their comments back. But it was only comments, not specially working on the brochure. But in that specific case, I found their answers very synthetic. M., the expert, told me, "you should ask them more precise questions if you want more feedback". [...] So, it's more in the way I manage distant meetings that I must be more precise in the way I communicate.*" (Informant #1, team leader).

From a deductive perspective, this description is coded as: 'authoring a document collectively' and 'space and distance management'. The inductive code we applied to the same excerpt was 'fostering involvement', in reference to the informant's intention

to enhance her team members' participation to a project. The informant noted that her former practice did not bring the expected results as it produced answers from the team members that showed too little involvement. Thanks to external support, she then identified how to consider the "distance" parameter of the situation when asking for feedback about future projects by e-mail. This example shows both a mismatch between an ICT-supported action and its initial purpose, and the informant's ability to frame a problematic situation by analyzing the others' actions and finding a solution to improve one's way of working.

**Excerpts 2a and 2b.** The two following excerpts show how two team members consider the same activity from their own perspective. Informant #2 was asked if he identified any disadvantages to the tools he shares with her teammate: *"As I said earlier, the accounting software for example, it has limitations. The encoding [by multiple users] in the same journal at the same time is not enabled."* (Informant #2, team member).

In a subsequent interview, his colleague was asked to explain the constraint of the tool on parallel encoding: *"No except if... In fact, there are two companies. If somebody's busy with one, you can work on the other. [...] When it concerns certain operations, we organize ourselves. "What are you up to?", "What are you doing?". It's not difficult because we are next to each other. [...] But if you change company [in the accounting software], we can do everything in parallel. [...] Nothing is linked. I can do what I want, he can do what he wants. [...] It's the only time when we can both work on the same tasks at the same time."* (Informant #3, team member).

Both excerpts are related to our deductive codes 'sharing a collection of documents', 'working synchronously from a distance' and 'reflective tool use'. Informant #2 states that the tool they share prevents them from working at the same time. Informant #3 also considers this limitation, but describes an alternative procedure that enables them to work on the same tasks, but on different companies. Her framing of the situation introduces several additional dimensions, compared to Informant #2's own framing: the possibility of 'managing one's tasks in relation with others' (one of our deductive activity categories) and the way 'being physically present with others' (an inductive code that specifies our deductive 'space and distance management' category) impacts the mutual 'awareness' (another deductive code) of the two colleagues.

**Excerpt 3.** In this excerpt, Informant #3 explains that she's not able to plan her tasks using a shared calendar, even though she tried: *"I've never been able to plan my workload here. I've tried. I told myself "let's go", I'll take my [Microsoft] Outlook and I'll put the things that I have to do in there. [...] I know that it's my task to encode bank statements for the LLC, everything about the clients, and L. is in charge of the structure. So I would write 'Bank statements'."* (Informant #3, team member). Asked if she used to visualize her tasks before, she answers: *"Yes, what I had to do, by setting, more or less, the schedule, the number of hours I had to spend for it. For example, I would plan one hour to encode [...] let's say 50 invoices. If I planned one hour, it would never be enough because all the others [tasks and requests] are accumulating during this time so it's impossible to keep a schedule. So, I stopped."* (Informant #3, team member).

The problematic situation identified by Informant #3 involves the impossibility to plan her tasks using her calendar (which is shared with the whole team). While she is able to ‘estimate the workload for each task’ (an inductive code that specifies our deductive category of ‘managing one’s tasks in relation with others’), her difficulty reflects her inability to manage her time, her tasks and the incoming/outgoing information (corresponding to three separate deductive codes) at the same time. Informant #3 attributes this problem to an external cause, namely the work organization in the company. This example points both to the informant’s ability to frame the situation in terms of mismatches between her job’s requirements, her goals and her actions, and to her inability to find an appropriate alternative to her past practice that would function for her and her teammates.

**Excerpt 4.** This last excerpt covers the description of the evolution of a practice that results, for the informant, into a more “successful practice” than the previous one. Informant #4 explains how he set up specific tools to better support teamwork and team meetings: *“Whenever we have a team meeting, I’ve set up tools in Excel where we schematize and categorize actions as open, closed, decisions that are made and so on. [...] This is not the most flexible thing there is but... [...] To sum up, I have the agenda on Excel, and I have everybody’s to-do list. When we meet, we look at when we did the list, if a task is open, or I can show everything that we have already done, what is closed, what’s in progress, to whom it is assigned, when it needs to be done and a small comment. [...] There are difficulties for those who are less used to that kind of tool, tools that more “project management” oriented. [...] Rather than remembering “what must I do?”, the thing is to remember to go check it. It’s more about time management for some team members and having the reflex to go in that kind of tool. But it starts slowly. It’s been only under way since this year. Before, I would work more on the basis of the meeting minutes... that no one would read. And so I wanted to have something more synthetic.”* (Informant #4, team leader).

Informant #4’s goal, as a team leader, is to maintain a high level of ‘awareness’ (one of our deductive codes) between team members to coordinate the team’s different tasks. Consequently, he developed a new project management tool to review and ‘plan the team’s activity’ (another deductive code) during meetings, which he considers as a positive evolution compared to previous practices, like using the meeting minutes as a monitoring tool. He is also able to perceive how this new tool challenges his colleagues’ project management habits (which we coded deductively under ‘comprehension of sociomatics’ and ‘reflective tool use’).

Informant #4 framed the situation in a way that highlighted its shortcomings (i.e. mismatches between his actions, his goal and the actions of his colleagues: no one read his minutes), and ‘experimented new ways of working’ (inductive code) to overcome them. This prompted him to ‘redefine the terms of collaboration’ (inductive code) during team meetings, and to create an instrument that affords collective task reviewing in the future. Besides, he envisioned how the potential pitfalls of the new practice have changed and moved from ‘task management’ to ‘time management’ (both deductive codes), and to acquiring the habit of ‘remembering the work procedure’ (inductive code).

## 5 Conclusion

Our contribution emphasizes the benefits of combining deductive and inductive approaches to infer the definition of DML competences from the analysis of qualitative data in new or emerging domains of practice. On the one hand, the deductive approach ensures an adequate coverage of the activities and dimensions of the domain of interest, in our case: collaborative ICT-supported work practices. On the other hand, the inductive approach anchors the analysis in the complexity of human practices by examining the individuals' (in our case, the workers') lived experiences without enclosing them in a priori categories defined by experts. The ordering of the informants' conceptions of the problem situations they encounter in terms of their complexity, coupled with the matching of their intentional actions with other parameters of these situations provide the foundation of an interpretive perspective on digital media literacy.

Beyond the specific context of distant work collaboration, we argue that this method affords understanding elements of inter-subjectivity (and not only individual experiences) of an observable phenomenon. It also veers away from monolithic evaluations of competences based on standardized indicators, towards a multidimensional approach of context-based capabilities. However, difficulties may arise when comparisons must be made between different informants and modes of expression, with the risk of either reducing the individual experience of a practice to its simplest form, or to multiply the subjective views without being able to articulate their common ground. This is why this approach requires a time-consuming iterative process between the various cases, thoroughly documented, to obtain a robust analytical model that accounts for the richness of the data, but will potentially be challenged by future societal transformations.

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