Collaborative Reflection for Learning at the Healthcare Workplace

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Abstract This paper presents an analysis of collaborative reflection as a form of implicit learning at work. Theoretical assumptions about learning at work, group learning and work models are therefore described and enhanced by two case studies carried out in the healthcare sector to identify occurrences of collaborative reflection. The analysis of these studies leads to a differentiated characterization of processes, situations and circumstances in which collaborative reflection takes place. Further analysis covers the scope, roles and outcomes of reflection to guide the development of sociotechnical means for support of collaborative reflection and learning at the workplace.

Keywords Reflection * Collaborative Reflection * Reflective Learning * Collaboration

Introduction

As we know from practical experience as well as from the literature (e.g. Carell & Nolte 2010), human work has two main characteristics. On the one hand, it contributes to the completion of a concrete task and creates a value. On the other hand, every process of work has its history (Engeström, 2000). Therefore the same task is rarely conducted in the same way by the same group of people and the completion of a task leads to a process of adaptation through which the work environment, tools, information basis etc. are continuously altered. Workers improve their status through training and enhance their competence. Subsequently, learning at the job takes place. This kind of learning is considered as informal learning (cf. Eraut 2004). Learning on the job is a multi-facetted phenomenon, which combines the learning of facts (learning what), methods (learning how) the construction of new knowledge and the moving from the fringes of an expert community to its center (Lave and Wenger 1991). By contrast, formal learning takes place at occasions which are planned and scheduled in advance and within special behavior settings that are explicitly dedicated to learning as it is the case with classical trainings or courses (e.g. for using a computer software), symposia of experts etc. Other cases, like job rotation are in between formal and informal learning. The opportunity for learning is formally organized but the process of learning happens in relation to the work itself.

While CSCL-research has been primarily focused on supporting collaboration for preplanned courses and classes there is little attention for the question of **how informal collaborative learning can be integrated into the everyday work processes**. Therefore we argue that new ways of CSCL, as they are relevant in the context of work, are facing their strongest challenge with respect to informal learning.

Learning takes place when the learner reflects on what s/he is or was doing and draws conclusions from this by contrasting her experiences and knowledge with the experiences of others (Daudelin 1996, Murray & Kujundzic 2005, Schön 1983). We examine integration between informal learning (in daily work settings) and (critical) reflection (Prilla et al. 2011) about events during work to enhance problem solving and discovery of opportunities for organizational improvement.

Reflection is a cognitive process, which becomes apparent and observable for others when it takes place collaboratively during articulation work (Schmidt and Bannon 1992). We use the term "collaborative reflection" to describe reflection that is accompanied and enabled by communication between people who can contribute to it on the basis of their own experience. This collaboration can emerge spontaneously and does not require the context of an established group. Consequently, questions and results produced by reflection are shared with others. During collaborative reflection, existing knowledge contributed by others will be combined with the construction of new knowledge that emerges during the communication about work practices and the accompanying challenges. Therefore, we consider collaborative reflection as an important foundation for CSCL at work.

From this perspective one of the key questions to be asked is about how individual reflection and learning on the job can be intertwined with collaborative reflection, and how to provide appropriate technical support for collaborative reflection. Work-related reflection, whether individual or collaborative, is a constructive activity when:

a) Incompatibilities occur or exist between (1) the procedure of task completions and (2) the workers experience, expectations or competences e.g. with respect to facts or to methods.
b) Diverging opinions, experiences, or beliefs exist as they are expressed during communication with colleagues (Stahl 2000).

CSCL at work faces the challenge of supporting workers in both conditions where reflection is called for. Workplace triggers for reflection are different than what is found in more typical CSCL scenarios, like the university oriented one depicted in Figure 1.

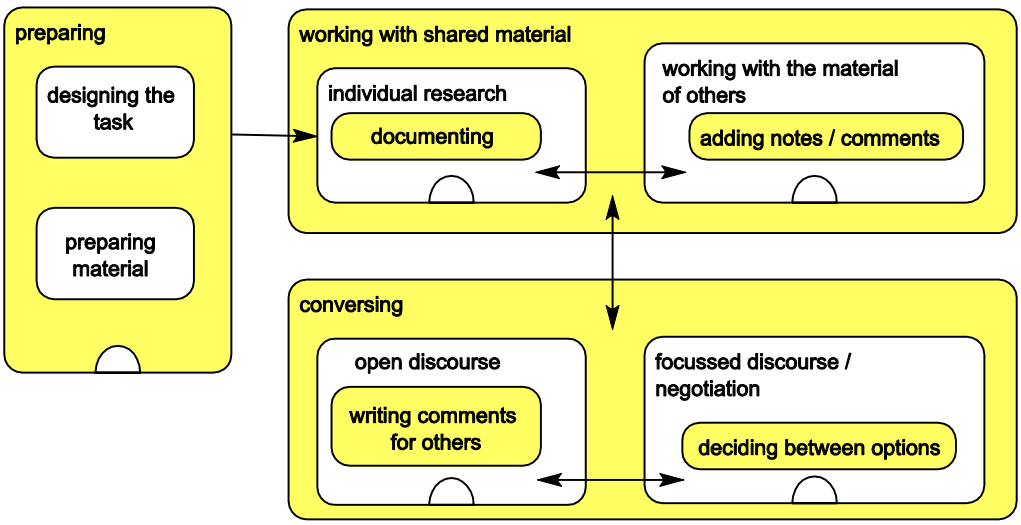

Figure 1: Typical schema of course-based CSCL.

It helps to explain the differences between informal and prepared learning opportunities at schools or universities. At work, there is no teacher who prepares material or tasks. The material is generated by the workers activities. CSCL, however, can help to capture this material and make it a location for learning. In the workplace, "teaching" is supplanted by initiating, coaching or facilitating activity focused on collaborative reflection. Feedback regarding the success of learning will not be provided by a teacher, but partially by the work situation itself or by other people in the worker's organization who are interested in the outcome of her work, not necessarily in the progress of her learning.

This chapter presents an analysis of the prerequisites for CSCL at work with respect to the situations, roles, and material helping to initiate and to promote learning by collaborative reflection at work. Therefore, we present the result of two case studies that analyzed the extent to which reflection at work already takes place and possible ways to enhance workplace reflection in support of CSCL at work.

Sociotechnical support for collaborative reflection and learning has to consider several question which arise in each case:

- How can different processes of reflection – e.g. planned and unplanned – be supported?
- Where does reflection start, individually or collaboratively (what is the topic, individual work or group work)?
- How much time, material and support should be available (few minutes or several hours; strict guidance or just orientation)?
- Which roles are relevant to support collaborative reflection?

These questions are closely related to those raised by Fischer (this volume), related to the role of media in facilitating discussion and dialogue for reflective communities. When designing sociotechnical systems for learning situations in which the answer to a question is not known, modes of reflection including the differentiation of roles (e.g., participant and helper/facilitator, see e.g. table 4, as well as opportunities for reflection at the workplace need to be considered.

Collaborative Reflection at Work: Background and Open Issues

Here, we present models of work and their relation to learning.

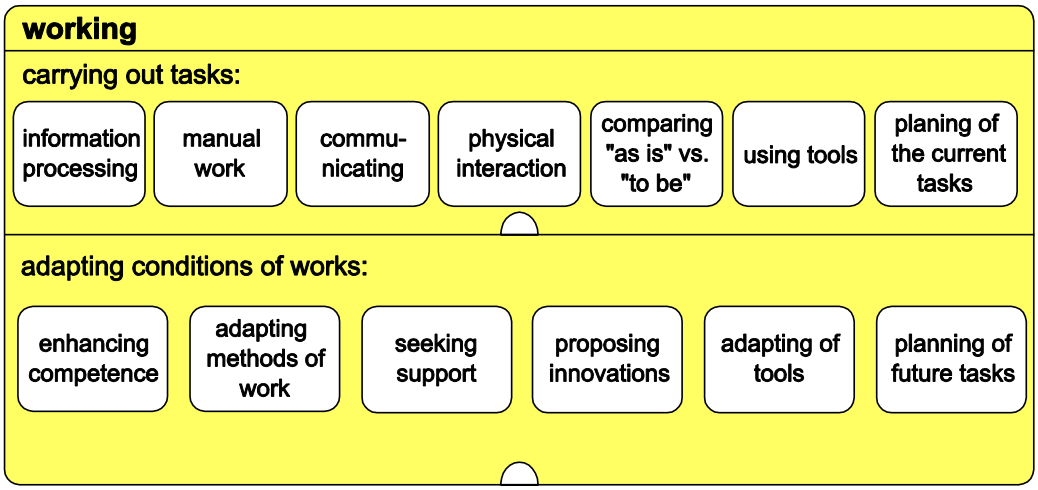

Figure 2: Work Task Adoption

Figure 2 differentiates two perspectives on work and will be used to explain their relation to reflection and informal learning in the following. As shown in the figure, human work usually combines manual and cognitive work, as well work in solitude with communication and collaboration. Human work becomes the more complex and interesting for the workforce as needs for planning and coordination increase – this is typical for distributed work. Planning is triggered by a comparison between the projected goal and the current status of task completion. Subsequently, these comparisons can reveal that the workers have to adapt their strategies and work conditions. This leads to a higher level of work, during which learning takes place, methods are altered, support is sought, tools are appropriated differently and other forms of adaptation occur. These indicators are accompanied and supported by a kind of implicit reflection that is – if it takes place – inseparably combined with the daily work. There is a possible fluent transition to explicit reflection, which leaves traces in documents or becomes articulated if it takes place during communication with others. Figure 2 expresses that *carrying out tasks* can, but does not need to be combined with the reflection and *adapting of work conditions* and behavior during work. There are cognitive and communicative activities which are mainly focused on completing the task, but not on learning how future work can be carried out more efficiently, less stressfully, more satisfying, etc.

Reflection as a Decisive Mechanisms of Learning at the Workplace

Learning at the workplace, when done informally, means learning from experiences rather than learning from cases presented by a teacher or facilitator (cf. Eraut 2004). In this context, reflection is viewed as a decisive mechanism for learning and for learning at work (cf. Argyris and Schön 1996, Boud et al. 1985, Kolb and Fry 1975). Such reflective practice can lead to a deeper understanding and enables the learner to advance her thinking beyond reproduction of what e.g. a teacher has said.

Reflection can be defined as going back to (past) experiences, re-evaluating them and drawing conclusions for current or future behavior from those reflections (cf. Boud et al. 1985). Re-evaluating experiences can then lead to a different or better understanding of practice and thus enable learning about it, potentially leading to changes in future behavior (cf. Järvinen and Poikela 2001, Moon 1999). Learning by reflection has to be seen as closely related to other types such as problem-based learning (cf. Schön 1983) – learning from problem solving requires reflection on past problem solving experiences, particularly in those cases where problems may be solved by reflecting on the occurrences in practice.

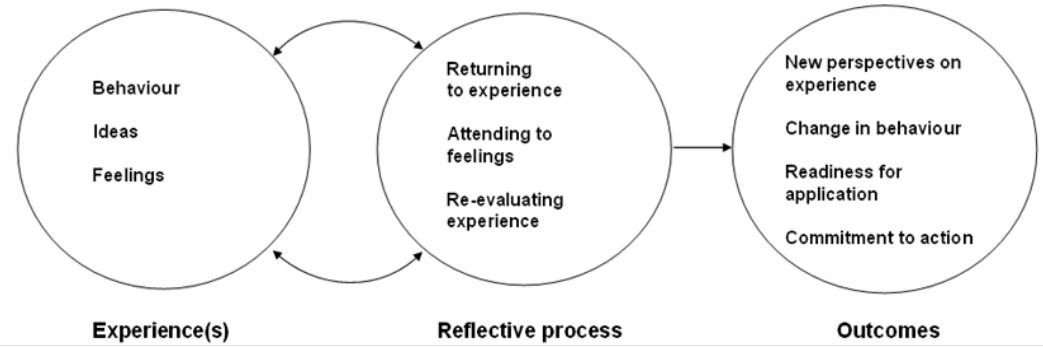

Figure 3: Reflection model by (Boud et al. 1985).

According to Boud et al. (1985), experience consists of past behavior, ideas and feelings towards these (see Figure 3). Reflection requires the person to mentally return to past experiences and feelings to re-evaluate them. What differentiates the reflective process from mere ruminating is that reflection has an outcome. Boud's model shows that this outcome includes new perspectives on one's own experience and either changes in behavior or at least knowledge and readiness for changing it. It is at this point when learning occurs through reflection. The model in Figure 3 also indicates that reflection can occur multiple times during a workday. Thus, reflection should not be thought of as a restricted, episodic process, but as one that is frequent and ongoing.

Returning to one's own experiences is central to reflection. Individual memory is, however limited. Memories fade and can be hard to return to without recorded data or prompts from others. Groups of people working together can help to trigger memory. Individuals can support their own reflection through personal journals (e.g. Loo and Thorpe 2002), personal learning environments, (e-) portfolios (e.g. Scott 2010) or pictures (Fleck and Fitzpatrick 2006). In addition, data produced during everyday work, along with artifacts produced in work can support reflection (Knipfer et al. 2011).

Most models and approaches to explaining or supporting reflection are focused on individual reflection and the individual process of learning. As a consequence, individual reflection processes are well understood (cf. Boud et al. 1985, Schön 1983). Collaborative reflection, in contrast, is a more social process that is less examined in current literature. Collaborative reflection and collaborative learning by reflection are the focus of our work, and explained in the next section.

Collaborative Reflection

Informal learning is a primary means for learning in the workplace (Eraut 2004) and learning through collaborative reflection is potentially an important contribution to CSCL at work (e.g. Dyke 2006, Hoyrup 2004 and van Woerkom and Croon 2008). Research examining reflection as an essential part of workplace learning is, however, still in need of further research (cf. Knipfer et al. 2011).

The difference between collaborative and individual processes of reflection is where the reflection is focused. In individual reflection, the focus is on individual cognition, while collaborative reflection requires communication and coordination between participants. Collaborative reflection processes can be thought of as *"people engaged in finding common meanings and making sense of the collective work they do"* (Hoyrup 2004) or as *"tool(s) for explicating and making implicit knowledge embedded in contexts"* (Järvinen and Poikela 2001). For collaborative reflection to occur, people must share their experiences and communicate about them. This leads to shared meaning making (cf. Daudelin 1996, Forneris and Peden-McAlpine 2006 and Scott 2010). Learning by collaborative reflection may then occur when an individual links her knowledge to the experience of others (Daudelin 1996) or when a group combines different viewpoints stemming from its members' experience and reflects on them collaboratively (Hoyrup 2004). Therefore, supporting collaborative reflection requires support for the communicative interaction and experience of people reflecting together.

Collaborative reflection is often focused on specific situations, such as debriefing sessions and project review meetings (e.g. Boud et al. 1985) or regarded as an activity initiated by an individual seeking help for her/his own reflection (e.g. Yip 2006). However, there are also voices claiming that collaborative reflection can happen along a spectrum ranging from informal talks to scheduled meetings (cf. Dyke 2006; Daudelin 1996). Research focused on how commonalities or differences in such settings contribute to collaborative reflection is limited. To support learning from collaborative reflection, it is therefore necessary to explore the characteristics of effective collaborative reflection in practice and to differentiate between various settings in which it occurs.

Understanding whether or not collaborative reflection is occurring is difficult. Not all discursive interaction or collaborative problem solving situations and be considered as collaborative reflection. To observe and analyze situations of reflective learning and not conflate them with other learning processes is, therefore, critical. One key perspective on collaborative reflection in practice can be found in the work of van Woerkom and Croon (2008). They explain typical indicators for reflection such as "*critical opinion sharing"* during discourse, not sticking to agreed upon opinions and standards but "*challenging groupthink*, *asking for feedback"* on ones own actions, "*experimenting with alternatives"* when solving issues and "*openness about mistakes"* during daily working situations are vital components of collaborative reflection. Errors are not mishaps, but opportunities for learning. Using these indicators facilitates recognition of reflection in practice. Moreover, observing collaborative reflection in practice can both reveal additional indicators and help to differentiate the existing set.

Open Issues: Research Questions for Case Studies

Existing work on collaborative reflection provides information on its contexts, advantages and problems as well as on its occurrence in practice. However, it is not sufficient to base the design and implementation of IT support for learning from collaborative reflection on insights from existing work (cf. Knipfer et al. 2011). Therefore, further work is needed to better understand the nature of collaborative reflection. In the next sections, we present an approach that builds on existing theory, and is guided by the following research questions:

Question 1 (RQ 1): Which processes of collaborative reflection are relevant in practice? What are their characteristics and what is their outcome?

Question 2 (RQ 2): How do communication structures and material influence learning by collaborative reflection in practice and how can these influences be used and supported?

Question 3 (RQ 3): Which roles and actors (the whole company or just special people) are present in collaborative reflection and what is their influence on learning in practice?

Since different scopes, participants and ways of collaborative reflection result in different requirements, support for collaborative reflection through technology is better understood through an examination of these questions. To address them, we developed differentiation criteria for collaborative reflection in order to formalize the problem space of reflection support. This differentiation is presented in the next section and was used to inform the case studies presented in the section after that.

A Differentiation of Collaborative Reflection: Outcome, Processes and Roles

Investigating collaborative reflection as a learning mechanism for CSCL at work requires an understanding and differentiation of processes and characteristics used for such reflection. As described in the section on “Collaborative Reflection” (see above), one important differentiation is that between individual and collaborative reflection. Our focus is on collaborative reflection. In this section we elaborate on this and propose additional dimensions for differentiating collaborative reflection. These include the consequences of individual and collaborative reflection on the outcome of reflection, in general, and its dissemination. Moreover, to identify the inherent structure of collaborative reflection and possibilities to support it, we will focus on the connections between different processes, roles and outcomes in collaborative reflection and elaborate on these facets.

Processes: Scheduled and Concurrent Reflection Occurrences

Processes of reflection take place in different settings and work processes, as Table 1illustrates.

Table 1: Reflection as a separate activity vs. reflection in parallel to work reflected on

Reflection occurrence	Example	Process
(Pre-) Scheduled	Team and project	Facilitated, planned,

	meetings, handover sessions	separated from other work
Concurrent / accompanying	Email-exchange on issues, iterative reflection on cases,	Recurring, irregularly, in parallel to the actual task, when failures occur or opportunities become apparent

Scheduled reflection occurs in (regular) meetings and is present in nearly every organization – reflection can therefore be the main goal of the meeting or occur as one aspect of the meeting. In such settings, reflection is usually facilitated, well planned (e.g. triggered and constrained by an agenda) and separated from the work reflected about. In contrast, concurrent spontaneous reflection is done irregularly and during or in parallel to the work reflected about. It may take forms such as email-exchange about work tasks or continuous reflection on cases like projects or, as in the case of healthcare, patients.

This differentiation implies that there is no single best way to support reflection, but there is a need to adapt support to different the different forms collaborative reflection can take in practice. We view this as a continuum, rather than two distinctive categories and has to be exploited and complemented in further work.

Scope: Individual and group work as the topic for reflection

There is a distinction between individual and collaborative reflection. Besides the level of communication and coordination present in collaborative reflection, these levels can also be differentiated by the kind of work reflected about, as Table 2 shows.

Table 2: Reflection by process (kind of reflection) and scope (kind of reflected work).

Kind of reflection / Kind of reflected work	**Individual reflection**	**Collaborative reflection**
Individual	Reflection on own work; based on own experiences.	Reflection on own work; complemented by experiences of others.
Collaborative	(Reflection of group work; needs **additional data** describing the work of others)	Reflection on group work by sharing experiences and communication.

Individual reflection is a suitable mechanism for learning about individual (own) work. As Table 2 shows, individual reflection can also be applied to collaborative work, but is not a good choice for it, especially if aspects of work done together are the subject of reflection. As noted above, thinking about group work requires sharing of experiences and perspectives. Such shared experience is, of course, not present in individual reflection. Thus, if individual reflection is to be

applied to group work, it needs to be supported by additional data representing these perspectives. In contrast, collaborative reflection can be about individual work when one worker articulates a problem and others share their experiences with her. This is a kind of collaborative work, as others can articulate their perspectives and experiences. This differentiation illustrates how collaborative reflection can be used as a learning mechanism.

Outcome: Individual and Collaborative Learning by Collaborative Reflection

One difference between individual and collaborative reflection can also be found in the quality or type of knowledge that is the outcome of learning by reflection. As Table 3 shows, individual reflection can only create individual knowledge (directly): the process of individual reflection cannot produce shared knowledge, as knowledge stemming from it will necessarily be bound to the individual in the first place. In contrast, both individual and shared knowledge might stem from collaborative reflection.

Table 3: Reflection by process (kind of reflection) and kind of knowledge as outcome.

Kind of reflection /Kind outcome	**Collaborative reflection**	**Individual reflection**
Individual knowledge	Knowledge about own behavior from discussion with others	Knowledge about own behavior
Shared knowledge	Knowledge on group behavior, already shared among participants	(not applicable)

Table 3 shows that collaborative reflection can lead to both individual and shared knowledge. A reflection participant may acquire individual knowledge and competences (see Table 4 for a description of roles in reflection) when she learns about her work during reflection on similar work with colleagues. Shared knowledge can be acquired by the participants when they understand aspects of their cooperation better by reflecting on it and implement changes. In contrast to that, individual reflection can only lead to knowledge of the reflecting individual, who might share it with others. This differentiation also shows the value of collaborative reflection as a learning mechanism.

Roles: Actors in the Context of Collaborative Reflection

The support of collaborative learning requires an understanding of the different roles which are part of the learning process (e.g. Herrmann et al. 2004) in order to understand the interaction processes, how it takes place, and the information flow demands of collaborative reflection processes and the support needs for each roles participating in the process. Our initial differentiation of roles included three roles in collaborative reflection, which are shown in Table 4.

Table 4: Roles being active in collaborative reflection.

Role	Task in reflection	Member of reflection group
Reflection initiator	Bringing up reflection topic(s)	Yes
Reflection participant	Adding experience in reflection, sharing context with initiator	Yes
Reflection helper (facilitator, coach, …)	Facilitating / supporting reflection process	No

In our conceptualization of collaborative reflection, topics are brought in by a role we called 'reflection initiator'. This role is taken either by an actor who perceives a discrepancy or opportunity as described above or by an actor who is responsible for triggering reflection, for example, in meetings. Once reflection has started, 'reflection participants' start to engage in collaborative reflection, sharing their experiences and perspectives with others in the context of the issue reflected about. As a third role, 'reflection helpers' can be present. These helpers may facilitate the reflection process or support it in any other way. From this description it is evident that one person may take all of these roles in one or more different reflection sessions and that the person may change roles during a session.

It is important to notice that these roles cannot only be differentiated by their tasks in collaborative reflection, but also by their membership in what we called 'reflection group'. This group comprises those roles being active in reflection, which share (parts of) the context of the issue reflected with those who are capable of actively adding experiences to reflection. Obviously, initiators and participants belong to this group, while helpers are only present to support the communication and interaction during reflection, but do not add to it in any other way. Therefore, an individual being coached in her reflection and her coach cannot be considered as a reflection group doing collaborative reflection. However, roles are not static and one actor may take different roles in the same reflection process. Further investigations as described below are needed to better describe the dynamics and impact of different roles in collaborative reflection.

Exploring Collaborative Reflection in Healthcare: Two Case Studies

Based on our insights from the literature (see section "Collaborative Reflection") and to find answers for the questions described above, we conducted two empirical case studies exploring the characteristics of collaborative reflection in healthcare practice. For this, we chose two organizations from Germany and the United Kingdom (both in healthcare services), which, aside from the obvious cultural differences, had similarities and differences that enabled broader insight into the practice of collaborative reflection in healthcare.

Our case study work was aimed at gaining an understanding of collaborative reflective learning for the purpose of developing tools to support such processes in practice. Our work in the two organizations was exploratory and focused on

gathering case study data. Next, we briefly describe the methodology and how it was applied in our two cases.

Methodology

The gap in understanding of the practice of collaborative reflection led us to conduct exploratory studies. We performed interviews and observations at two different healthcare sites, analyzed the transcripts and notes and subsumed our findings for each site. For analysis, we used a process aligned with Grounded Theory (cf. Strauss and Corbin 1998).

Interviews were mainly used to clarify rationales, needs and wishes of certain people within the environment studied. We explored reflection needs and possibilities in depth. We initially pursued a set of questions concerning the work conducted by the employees at each site, including its special characteristics, aspects of learning and motivation in daily work, communication and collaboration during the day as well as existing and envisioned practice of individual and collaborative reflection. Examples of questions posed are *"When and how do you communicate with others about your work?"* or *"Please give an example of when a colleague talked to you about his work-related experience"*. Interviews lasted between 45 and 90 minutes. Each interview was audiotaped and later transcribed literally. For analysis, we used a coding scheme containing indicators for collaborative reflection developed by van Woerkom and Croon (2008), described earlier. For example, *asking for feedback* is an indicator of reflection occurring when one person asks others to give feedback on her work from the others' experience. In our analysis, for example, we coded a situation in which nurses asked each other to assess and validate the treatment given to a patient during the day (see the description of case 1 for details below for details).

Observation was employed to understand what people in the test beds do all day. For example, when do they have time to communicate, what do they do in meetings or where do they gather for informal conversation? The observation methodology was adapted to the different settings at each site, as described in detail below. In general the observation documentation was based on a scheme developed to contain all relevant aspects we wanted to observe at the partner organizations. This included occurrences of reflection and their detailed description, data and artifacts used by people during the day, IT support for work and interaction among people. During the observation, each situation was written down with context data such as time, place and participants. These notes were then transcribed and coded with the categories from the observation scheme and the scheme used for the interviews. To include different perspectives in observations and to avoid a bias, we always had two researchers doing observations in parallel, working with different subjects. In the studies, we observed two people for two days at case 1 and several meetings of caregivers in a timespan of three days at case 2 (see the details in the case descriptions).

In the analysis of the studies, we used interviews and observation to complement each other. In interviews there is a risk that outcomes are based on particular episodes and incidents not typical for everyday work, observation allows for insights into daily work to overcome some limitations of interviews. Moreover, reflection can happen unconsciously and tacitly. Thus, interviewees might not be

able to sufficiently describe their practice of reflection and the value of interviews is limited. Observations can then help to recognize reflective behavior of workers and make it explicit. On the other hand, a few days of observation cannot result in an overview of all aspects relevant for workers. To fill this gap we triangulated interview data with observations, and asked informants to provide an overview of their work as part of the interview process.

Cases

Our case studies were done in two healthcare organizations. One was a neurological hospital from Germany (case 1). The other was a home care association for dementia patients from the United Kingdom (case 2). These cases share some characteristics, but also differ from each other in order to allow for more solid and general results of our studies.

The target group we interviewed and observed for case 1 consisted of physicians and nurses serving in a hospital stroke ward (cf. Table 5). All of the employees in the ward were highly trained and educated to provide care to stroke patients and increase patient's well-being, leading them to be eager to continuously learn about their work and patients. However, time pressure is a barrier to informal learning and in the ward, there is hardly any IT support for nurses, though physicians have access to computers and the internet. In case 1, we observed the work of physicians and nurses for two days each by accompanying them throughout their workday. This, as described above, included coordination and communication of people in the ward (both within professional groups and between nurses and physicians), data being used and produced during work as well as occurrences of collaborative reflection during the day. Since both professional groups work in shifts, we included handover meetings in the observations as well. In addition, we interviewed the physicians and nurses being observed and conducted three additional interviews with nurses in order to gain broader insights into the work at case 1 (see Table 5 for details).

Table 5: Hospital staff interviewed and observed at case 1.

Participant	Profession/Position	Age	Observation	Professional experience
P1.1	Nurse	41	-	8 years at case 1 / 25 in total
P1.2	Nurse	27	2 days	5 years at case 1 /10 in total
P1.3	Physician	29	2 days	2,5 months at case 1 / 2 in total
P1.4	Therapist	25	-	3,5 years at case 1 / same in total

At case 2, the target group consists of so called caregivers, who are responsible for the daily care of residents in care homes (cf. Table 6). This includes all but medical help during the day (medical help is provided by the home's nurse, who is a superior to the caregivers) such as washing residents, serving them food and keeping them entertained during the day. In contrast to case 1 and according to the

care home management, caregivers at case 2 are usually not well educated and even literacy may be a problem. For example, one caregiver we interviewed was 19 years old and had been a kitchen helper before working as a caregiver. Caregivers, like their higher status counterparts in case 1, were highly motivated and willing to learn how to improve their care for people. One mitigating factor in case two is the high turnover rate in care homes. In the home, there is no IT support except a care management system in which caregivers document their work. In our study at case 2, we were able to observe several meetings of caregivers in a period of three days, which included both regular meetings and handover sessions between shifts. In addition, we conducted four interviews with care staff with different levels of professional experience, ranging from the 19-year-old beginner to senior caregivers doing their job for over twenty years (see Table 6 for details).

Table 6: Caregivers interviewed and observed in case 2.

Participant	Profession/Position	Occupation	Age	Professional experience
P2.1	Senior Caregiver	Home 1	48	20 years
P2.2	Caregiver	Home 1	49	3 years
P2.3	Senior Caregiver	Home 1	39	3,5 years / 6 years in total
P2.4	(Junior) Caregiver	Home 1	19	1 year

As can be seen from the description above, besides similar domains, the cases share certain characteristics such as care for people being the main work done, little IT support and constant time pressure. On the other hand there are differences in country and thus working culture, in education of employees and in the tasks done (medial and care vs. only care). As a result, the level of knowledge relevant for learning differs between the caregivers in case two and the nurses or physicians in case one. These similarities and differences show that our cases reflect different perspectives on healthcare workplaces and thus provide a helpful contrast, presented in the results.

Collaborative Reflection in the Healthcare Workplace: Results from the Case Studies

The analysis of both cases led to detailed insights into processes and other structures influencing collaborative reflection at work. In the following sections, we present the most significant findings corresponding to our research questions, described above. In particular, we will refer to the characteristics of reflection in and outside meetings, to opportunities and constraints of collaborative reflection at the healthcare workplace and to the roles and actors engaging in the collaborative reflection processes.

Reflection in Meetings

During our studies of both cases, we observed several occasions in which collaborative reflection happened during meetings. Due to the characteristics of the healthcare work place such as working in shifts and patients being the center of work, there are daily meetings for handovers between shifts and fewer organizational level meetings. Less frequent meetings can be held regularly (e.g. monthly ward meetings at case 1) or sporadically (e.g. spontaneous 'reflective meetings' triggered by current issues at case 2).

We observed handover sessions between different shifts at both cases and daily ward rounds comprising physicians and nurses at case 2. At case 1, handover sessions were run by a nurse, who summarized the shift for her colleagues and informed them of the most relevant issues to be taken care of. At case 2, these meetings are not run by a caregiver, but by the home's nurse. In both cases, there are also handover talks between individual caregivers or nurses responsible for the same resident or patient respectively. In handover meetings, staff collaboratively reflect by asking each other for feedback on care given to a resident during the day (case 2) or by making proposal for interaction with patients based on experiences with similar or the same patients (case 1). In daily ward rounds, reflection is done across hierarchies between physicians and nurses when physicians ask about patients' well-being to understand how their treatment worked: *"I just ask: What happened? What's up? She [the nurse] tells me what happened yesterday or during the night and I reflect"* (physician from case 1).

During meetings held bi-weekly or once per month, we observed reflection to be more structured, yet also more difficult with respect to creating a shared context. In both cases, such meetings were managed exclusively by senior staff such as senior physicians or head nurses (case 1) and managers or senior caregivers (case 2). At case 2, we observed so called 'reflective meetings', in which a senior caregiver gathered other caregivers between shifts and triggered reflection by asking them to comment on some issues she had collected. In addition, caregivers were allowed to raise additional issues to be reflected about. As an example of topics discussed, we observed a meeting in which the senior caregiver told her colleagues that there was a problem in the on time supply for sanitary pads and asked everybody to comment how this affects their work and how they would change the situation. Reflection was done similarly in case 1, except for the additional component of a public agenda sheet where staff wrote down issues to be discussed. For example, the head nurse proposed to change the way breaks are taken in the morning because, on some days, these break times caused difficulty in the operation of the ward. After that, a critical exchange of opinions and experiences started on the topic. In both cases, follow-up tasks from collaborative reflection, such as dealing with open issues and implementing or propagating decisions, are left to the superiors who run the meetings. Returning to the example of the sanitary pads, during the reflection several alternatives and proposals were brought up, but the final decision what to do was taken by the senior caregiver.

Informal Reflection outside Meetings

Besides reflection as a part of meetings, we also came across occasions of reflection during the day. Although these occasions are harder to recognize both for

our interviewees and the observers, our analysis shows that there are plenty of such situations and that they may play an important role in the support of collaborative reflection. Typical occasions of reflection outside meetings are breaks, working together on the same task or patient (resident) and spontaneous encounters on the hallway.

Most often, reflection outside meetings is done apart from the work to be reflected on. Such reflection then occurs when staff talks about problems in daily work during regular occasions such as breaks: *"we […] do it on breaks really. We can sort of reflect on, if someone needs help or, if like we're doing well"* (caregiver in case 2). Additionally, there are implicit routines asking each other for help with specific issues when sitting together during breaks: *"Are there – any problems or something like that. Every problem we talk about together"* (nurse from case 2).

Collaborative reflection oftentimes happens when e.g. nurses or caregivers meet in the hallway and start a brief talk or when caregivers at case 2 intentionally approach colleagues perceived as knowledgeable partners on a certain topic: *"Well, the seniors are always there, so mostly the girls go up to the senior and say 'Oh I've got a problem' or 'Come and discuss this'. And so we'll take them aside and discuss it and hopefully deal with it"* (caregiver at case 2). Such occasions of reflection are usually related to special situations, such as incidents happening during the day or with emotionally positive and negative experiences. At case 1 nurses also intentionally involve other nurses in their work to ensure that their treatment of patients is correct and to explore ways to improve it. As an example of this, we observed groups of nurses iteratively going through the treatment documentation of patients during their shift and talking about similar cases they had been involved in.

Opportunities for Reflection

In both cases we observed, interaction with patients (or residents respectively) and incidents of them were perceived as the dominant opportunities for collaborative reflection. Other opportunities, such as coordination and organizational issue meetings, were less prominent. For example, the majority of staff from case 2 reported that reflection was usually triggered by problems or interesting interactions with residents. One caregiver told us that a resident had aggressively attacked him and that he later reflected on his behavior before this attack with a colleague. Likewise, collaborative reflection occurred in case 1 in situations when an individual lacked understanding of a patient's situation or treatment and asked others to reflect on this situation together: "When I hand over the patient and something has happened during the day which I did not understand, I ask [a colleague]. Then I am on the safe side." (nurse from case 1). In addition, this also shows that reflection can serve the purpose of re-assurance if its result is that everything was done properly.

In addition to the motivation of treating patients (residents) better, we found the healthcare staff from case 1 and 2 to frequently reflect for the purpose of preserving the well-being of nurses (caregivers) themselves. This became obvious both in situations in which nurses from case 1 approached other nurses to ask them what had happened because they perceived them to be emotionally affected or when caregivers from case 2 told us that they actively communicate emotional

states to others in order to receive support or feedback: “if you come into work feeling low or something” (caregiver from case 2). Actively caring for others was especially present with more senior staff – for example, in case 2 a senior caregiver told us she felt a responsibility to add to the emotional stability of her younger colleagues.

In both cases, we stumbled upon situations where using artifacts together turned out to be an opportunity for collaborative reflection. In interviews with caregivers from case 2, for example, we were told that they often go back to notes they made during their work on previous days to find out more about the behavior of a resident. In addition, we observed a handover meeting at case 2 in which the caregivers talked about a resident’s state and went back to older documents in order to see what had happened some days before. At case 1, we found reflection during the day to be partially guided by the documentation nurses and physicians made for each patient. Many times we saw two or more nurses gathering around this documentation and reflecting on treatment given to a resident. Both of these examples show that artifacts can guide and support the process of collaborative reflection, giving it one or more anchors to be discussed. It also suggests that closely binding the outcomes of collaborative reflection to existing documentation and other data is somewhat natural.

Constraints for learning by collaborative reflection

Besides these opportunities, our studies also revealed some blind spots and more difficult areas for learning by reflection. We found a difference between junior and senior staff for both case 1 and 2 in their willingness and ability to adapt work or behavior as a result of reflection. For example, senior care staff at case 2 told us that they do not like to compare themselves to others, as they had found their way of working and thus, differences to others’ ways were not relevant for them. This, of course, may constrain learning from other experiences. In addition, we found staff to be aware of reflection on organizational and coordination issues only for a short time. Coming back to the break example from case 1, we observed nurses often reflect on how to deal with an issue for a short time and then turn to other tasks. In this way, the outcomes from their reflection are less persistent because they are not articulated or made explicit in any other way. It was mentioned that these constraints on learning from collaborative reflection are not results of intentionally neglecting these issues. In contrast, they show that making nurses more aware of certain topics and supporting the sustainability of these topics creates opportunities for extending reflection at the healthcare workplace.

Group dynamics and preferences in collaborative reflection

Our description of the planned and unplanned occurrences of collaborative reflection provides insight into the dynamics of reflection groups, including responsibilities for following up on reflection outcomes and the deliberate selection of collaborative reflection partners. In addition to that, we made observations which contribute to an understanding of who is chosen to be a reflection participant and when these participants are chosen.

First, at case 2 we noticed preferences in the choice of an adequate reflection partner. When asked, caregivers often reported that they had a preference to reflect

with more experienced staff. Some caregivers also told us they used issues and other occasions deliberately to ask for feedback on care for residents or to ask a more experienced caregiver to provide feedback on performance. There were a small number of instances when caregivers expressed a preference for reflection with individuals who have a similar experience level. Such preferences, however, were not present at case 1, where nurses and physicians told us that they mainly reflect with colleagues from their professional group, but indicated no particular preferences for reflection partners. This suggests that for less educated staff, experience delivered by seniors is more highly valued in collaborative reflection than it is for highly trained professionals.

Second, in both cases, when different *professional* groups were involved in work on the ward, we observed that only people from the same professional group reflected together. While this observation is easy to explain – staff from the same profession work more closely together and thus have more opportunities to reflect – it identifies possible future opportunities for learning from other professions in collaborative reflection. Furthermore, this observation reveals the importance of bringing together the right people in a reflection group, and it becomes apparent that there is space for improvement for reflection between less experienced caregivers. In addition, support by facilitation and guidance by more experienced employees can positively influence reflection between professional groups.

Results

In summary, we observed several occasions in which collaborative reflection took place. From meetings explicitly organized for reflection to reflection during regular meetings, like shift handovers and less formal situations during breaks especially when something unusual had happened. Reflection in both cases was mostly related to patients and their well-being as raising this is the primary motivation for caregivers as well as nurses. Less effort was therefore spent on reflection about organizational issues less often articulated and sustained by writing them down and coming back to them. Besides material to return to, the appropriate reflection partner(s) was reported to be another important factor for starting a collaborative reflection. Especially more experienced staff members or those with the same professional background were consulted for collaborative reflection.

The insights from our case studies as described above allow for a deeper understanding of collaborative reflection processes and learning in these processes in the healthcare environment. In particular, it helps to answer the research questions described above, which we strive to do in this section.

Question 1: Processes of collaborative reflection in practice

Our initial understanding of different modes of collaborative reflection as described above included a differentiation of scheduled and concurrent occurrences of collaborative reflection. While in general this can be held up, our data shows that there is a need for a more detailed differentiation. As a consequence, we derived a two-dimensional scheme to describe modes of reflection along an axis between planned and spontaneous reflection and another axis representing reflection on past work events and reflection occurring during work. Table 7 shows the resulting

matrix and gives examples for **situations** in which collaborative reflection happens according to this differentiation.

Table 7: Occurrences of reflection (planned, spontaneous) and relation to work reflected about (separated, concurrent).

Type of occurrence / Relation to reflected work	**planned**	**spontaneous**
Reflection on past work events / with a distance to work reflected about	Scheduled meetings in which reflection is the main task or may occur.	Breaks, talks between tasks or at the beginning and end of work
Reflection occurring during work: integrated reflection	Handover sessions as part of daily work, in which reflection may occur	Continuous experience exchange on a patient while caring for her

Table 7 shows that there are regular (scheduled) occasions, in which reflection can happen as part of the agenda or just spontaneously: While in meetings we oftentimes observe that reflection was triggered by explicitly asking for comments or feedback and was thus planned to happen, we also observed many situations in which it just occurred e.g. during breaks by chance. In addition, a closer look at reflection during the work to be reflected about showed that this can also be bound to meetings being part of daily work such as handover sessions or ward rounds and that it oftentimes occurs spontaneously, meaning that a topic is pursued by a group of e.g. nurses reflecting a patient's case over a period of some days, but that they do not explicitly arrange situation in which this reflection happens.

This differentiation shows that support for collaborative reflection depends on the mode of reflection to be supported. While more traditional methods such as facilitation and agendas were still applicable in many meeting-like situations such as handover sessions and staff meetings, for spontaneous reflection the foremost need seems to be maintaining a shared context, as reflection in this case cannot be built on a well-defined description of the issues to be reflected about. Additionally, there is a need for short-time preparation of agendas in planned situations during work such as handover meetings. A challenge remains regarding the best way to support sustained collaborative reflection. While in meetings, minutes might be created, this is less likely for breaks and not applicable for brief talks on the hallway. This does not necessarily influence the process of collaborative reflection itself, but the sustainment of its results, the possibility to share them with others and their influence on future behavior (cf. Kimmerle et al. 2010 for the influence of externalizing knowledge on behavior). In addition, outcomes from one reflection session may be valuable for the next: for example, results from a reflection session during a break might be interesting for a weekly meeting but might be forgotten if not documented. Further research will need to shed light on such issues if collaborative reflection is to be supported adequately in healthcare workplaces.

Question 2: The role of communication and material for reflective learning

Communication in collaborative reflection observed was oftentimes related to artifacts representing data and information on work. At case 1, nurses regularly revisited the folder with patients' data together with other nurses to rethink whether the treatment given was suitable for the situation. At case 2, handover meetings where supported by sheets showing a list of patients and a summary of important information to review, including the most recent events and plans for the upcoming shift. We have a few observations about the relationship between modes and context of communication and artifacts around which communication is centered:

- In spontaneous reflection there is a need for rapid context rebuilding, which is normally done verbally; for example, by telling stories about special events or explaining the excitement of the group. The relation of communication to artifacts is only present implicitly e.g. when caregivers at case 2 refer to the information they got from the care sheets at handovers during reflection.
- In reflection occurring during work, artifacts are used more often and relations between them and communication are explicated. For example, during the reflection about a patient's case at case 1, nurses and physicians stand in front of the patient's folder and point to X-Ray pictures and entries, using this data to reflect about the case.
- In planned meetings, artifacts are sometimes directly referenced. These artifacts are altered e.g. by adding a comment expressing similar experiences and also structure the explication of reflection outcomes. For example, at case 1 during daily ward rounds physicians look at every patient's curve folder – the patients' health record at the bed side – review the data and discuss possible treatments. Results of those discussions are directly noted down in the folder to guide treatment during the day.

As our observation indicates, the process of collaborative reflection and the dissemination of its results can benefit from verbal articulation, which keeps topics and results alive in the communication between workers. In addition, the act of formalizing communication by e.g. writing it down can be understood as an initial process of individual reflection. Moreover, written artifacts such as minutes of meetings and other documentation can make experiences from communicative interaction available to a broader audience than direct communication, which can only be perceived by witnesses. We therefore propose to weaken the conceptual differentiation between what is regarded as data or material and what is seen as a result of articulation. For example, some entries into the curve folder by a nurse, such as a statement on a patient's progress during the day, can be seen as documented data on the patient *or* as articulations of the nurse's experiences with the patient – in the former sense, it is used as the mandatory documentation and in the latter sense, it becomes a useful communication statement for others working with the curve folder. The same applies for notes written into the daily care sheet by caregivers at a care home. Thus, while not every entry or note is related to reflection or becomes important for later reflection, understanding this dual character of documentation – work related annotations and articulations of

experiences – can be beneficial for conceptualizing the usage of data for collaborative reflection.

This usage of artifacts is related to the need of context re-construction we observed at the beginning of reflection sessions, especially in scheduled and concurrent situations and when there are several people and perspectives included. Rebuilding is then done by telling stories or through existing, aggregated information. We observed different facets of this in each case: For example, when the break problem was reflected about at case 1, nurses needed to reconstruct occurrences of this problem by stories from the last weeks. At case 2, when the senior caregiver talked about the ordering of sanitary pads, participants of the corresponding meeting needed to tell stories about their work in order to illustrate this topic. Supporting this contextualization by documented stories might speed up the process of context reconstruction and thus leave more time to reflect on these topics.

Question 3: Roles and actors in collaborative reflection

The **roles** we identified from theory as described in Table 8 help to increase understanding about tasks done during collaborative reflection and needs stemming from them. These may include initiating topics and communicating them to potential reflection participants, either in meetings or less formal, spontaneous collaborative reflection sessions. However, underpinning our assumption that this initial categorization was too coarse-grained, the analysis of our observation revealed additional types, which are shown Table 8. This also shows another dimension of how our studies extend the understanding of collaborative reflection as a mechanism for learning at work.

Table 8: Detailed differentiation of roles in collaborative reflection.

Role	Relation to old role	Task in reflection	Reflection group
Topic owner	Part of reflection initiator	Being interested in reflecting about an issue and responsible for triggering reflection	Yes/No
Reflection initiator	Part of reflection initiator	Becoming aware of topic to be reflected about and telling it to others / facilitator	Yes
Reflection sparring partner	Temporary reflection participant	Supporting a topic owner in (short-time) collaborative reflection without following up	Yes, temporary
Topic aggregator	Part of reflection helper	Collecting bits and pieces of issues to be reflected about and connecting them to topics	No
Session preparer	Part of reflection helper	Preparing an agenda and underpinning topics with tangible background (stories etc.)	No
Reflection executive	-	Making decisions based on collaborative reflection results or following up on results	Yes/No

Table 8 shows six additional (and preliminary) roles we were able to derive from our studies. Four of these roles are specializations of the roles presented earlier, another is a special instance of one of the earlier roles and we also identified an entirely new role.

For the specialization of roles, we found that there is a need to differentiate between what we called a ‘topic owner’ and a ‘reflection initiator’. This differentiation stems from our observations described in the last section, in which we found that in meetings at case 1, some issues were brought into the meeting by a facilitator after she had been told about it by a co-worker, while others were explained directly by meeting participants. Therefore, we decided to differentiate between the role perceiving a need for reflection (the reflection initiator) and another role actually triggering reflection and being responsible for the topic (the topic owner). This refers to observations in both of our cases, in which the person perceiving the need to reflect sometimes took charge of the topic in a meeting and sometimes handed over the charge for the topic to another person, who then brought it up. In support for collaborative reflection, our differentiation of these roles will allow a person to decide herself whether she just wants to communicate an issue or whether she wants to be the one standing in for it.

Another differentiation we found to be necessary are the roles of a ‘topic aggregator’ and ‘session preparer’. The topic aggregator collects statements made by co-workers and identifies a comprehensive reflection topic from them. The ‘session preparer’ is responsible for providing the foundation for collaborative reflection, including a collection of stories to illustrate the practical impacts of certain topics. Although in practice this role is sometimes taken by the same person, this differentiation is necessary: As described in the results of our studies, we observed some situations in which a facilitator had brought up a topic, but the reconstruction of its context needed support by some other participants, as they were the ones who have experienced the situation to be reflected about. For the support of collaborative reflection this means that a topic aggregator should be able to involve session preparers actively into a topic.

We also found that there is a subtype of a reflection participant, which we called ‘reflection sparring partner’ and who is involved in spontaneous occurrences of concurrent reflection. For example and as described above, at case 1 we often observed situations in which one nurse asked another to reflect with her the treatment given to a patient. These situations can be seen as short-term collaborative reflection, as one nurse asks the other for feedback and the other nurse contributes her experiences to the assessment of the treatment given. However, the other nurse afterwards goes on in her work, while the continuous reflection of the case (the patient) is centered on the nurse triggering the reflection. For the support of collaborative reflection, this means that there should be a possibility to temporarily involve others in spontaneous reflection processes.

There is also a new role in our concept of roles in collaborative reflection: The ‘reflection executive’ stems from observations of meetings in which many people engaged in reflection, but decisions and follow-ups on reflection results were done by one (or a few) person(s). This was common across both cases and thus led to the new role. For applications supporting collaborative reflection, this means one the one hand that there is a need to determine one or more people being responsible for

following up on results and implementing them. On the other hand, it also suggests implementing mechanisms for increased transparency on what happens after meetings with the results of reflection.

Our extension of the roles described in Table 8 can inform the creation of applications for collaborative reflection support. However, despite the level of details we were able to derive from our studies, we expect further explorations of collaborative reflection in practice – in healthcare contexts or elsewhere – to shed further extend the work we have done.

In addition to the focus on roles described above, our observation – that different professional groups reflect primarily within their group and that younger caregivers preferring seniors for reflection – point to the notion that the composition of the reflection group may be decisive for successful learning from collaborative reflection: If group composition influences reflection and its outcomes, then the characteristics of people, who were part of a group and make a difference in collaborative reflection (e.g. in comparison to other groups with different people) help to understand success factors and barriers to collaborative reflection in general. More practically, incorporating the composition of groups into a theory of collaborative reflection supports the preparation of scheduled reflection. However, to our knowledge there are no insights in effects of group composition of collaborative reflection available.

Conclusion and perspectives for support of collaborative reflection

Figure 4 summarizes the most important activities occurring in the course of collaborative reflection. The differentiation of roles as shown in Table 8 has been transformed into the corresponding activities. The numbers in Figure 4 represent anchor points for technical support.

Figure 4 displays a process model of how reflection is interrelated to the work on actual tasks. It indicates where technical features and reflective communication can be integrated into a sociotechnical solution (Herrmann 2009). The figure depicts the central characteristics and preconditions of collaborative reflection on the job. The following details suggest potentials of integrating technical support into the process of collaborative reflection as they can be derived from our work described above. They can also be considered a contribution to the question of *how media can facilitate the dialogue within communities or organizations.*

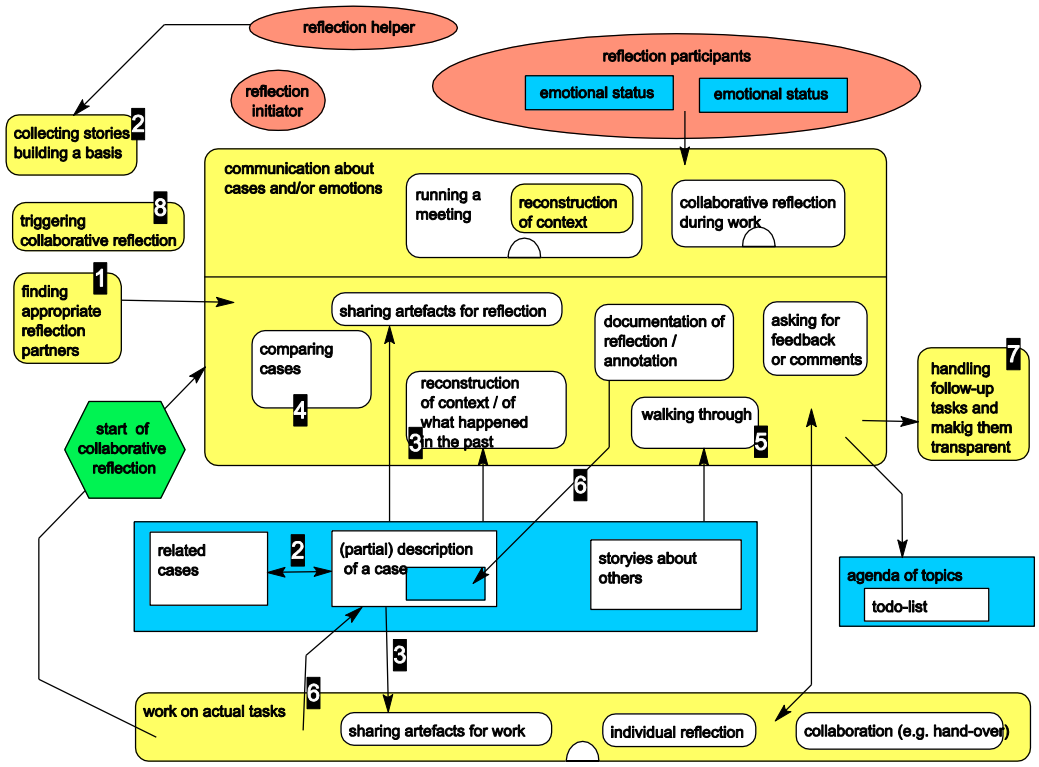

Figure 4: Process of collaborative reflection and work.

We see possibilities to support the composition of reflection groups and bringing together the right participants for reflection sessions. This is a question of the role a person has and might play in a reflection session as described above. A technical system could make proposals which help identify appropriate reflection partners (Figure 4, #1) based on user profiles and matching similar to online communities. Based on the users preferences it could propose a close colleague with a similar background and level of experience or a person from another profession which could provide an external view on a situation.

In reflection sessions we see a need for computer support when working with material (Figure 4, #2) as this helps building a large picture and re-construct the context (Figure 4, #3). This could be semi-automated comparing or aggregation of cases as input for reflection (Figure 4, #4), and support for working with material during reflection session. Especially a walkthrough (Figure 4, #5) should be supported for searching and sorting the right material, linking cases, trimming information to the right level, annotating with text, images or sketches, sharing and comparing of documentation and articulation etc.

The source material which could be used either already exists or should be collected during regular work. As time is a huge constraint in most businesses, additional documentation should not take large additional effort. Note taking and articulation should be made as easy as possible with standalone applications and integrated into applications like a handbooks and manuals to allow articulations whenever possible (Figure 4, #6). Articulation in these cases should not be restricted to written text but could also include audio recordings as well as sketches or pictures.

Additional data, helpful for later reflection, could also be captured automatically by sensors. This kind of data collection implies flexible adaptation to the privacy requirements of the workers as well as to clients or customers. To be able to use all the material during reflection sessions, computer support should enable walking through the data on different paths and offer visualization tools to view and surf through the data like hypertexts (Figure 4, #5).

Reflection support tools should also enable participants to sustain the outcomes of reflection sessions (Figure 4, #7), e.g. in form of todo-lists, to track planned changes in behavior. The visualizing of the outcomes and plans for future activities could serve as a basis of motivation for future reflection sessions.

The sociotechnical solution is intended to integrate reflection seamlessly into the work on the actual task as expressed by Figure 4, and to support reflection which takes place during occasions being separated from the actual tasks. Separated reflection may be planned or spontaneous. The advantage of planned reflection is that there is more time available, it is easier to bring relevant people together, and the distance from every day stress promotes a good opportunity for in-depth reflection on what has happened. The disadvantage of planned reflection is de-contextualization: aspects of real work life might be neglected and documents must build a bridge to what has really happened during work.

Therefore, spontaneous reflection and reflection during work has the advantage that details are present and can be taken into consideration. However, the workload and pressing tasks might prevent extensive reflection in such situations. In addition, relevant people are often not available at the moment when the reflection is most appropriate. Consequently, it is a technological challenge to support lightweight, short-term reflection which is smoothly integrated into the carrying out of tasks. Technical means may help to interrupt reflection and to resume it easily when possible. The same requirements have to be taken into consideration with respect to user-driven gathering of data that aims to support reflection: The data capturing has to be smoothly integrated into the documentation taking place anyway as a part of daily work and should be as simple and non-obtrusive as possible. For this purpose, people must be able to employ those means of documentation they are used to.

Since employees may be prevented from reflection by their actual task it is sensible to provide help which triggers reflection (Figure 4, #8): from a technical point of view, reminders can be provided giving hints on aspects that should be subjects of reflection. Such reminders need to be based on models of the users and their situation.

From a more general point we can aggregate our observations and conclusions by suggesting that a sociotechnical solution for supporting learning-oriented reflection at work has to build bridges

- between actual work and reflection occasions,
- between several short-term reflection events on the same topic,
- between work and experience as well as their context on the one hand and phases of separated reflection of this work on the other hand and
- between people who have similar experiences, problems, or occasions for improving their work situation.

This kind of reflection support is highly relevant in situations where knowledge and competences have to be acquired for solving those problems where the answer of how to do it is not known by a trainer, consultant or supervisor. Reflection is one important element to support critical thinking and to help workers in new situations where innovative behavior is needed.

The technical features described above and the basics of a sociotechnical solution have to be to be spelled out more concretely, evaluated in experiments, sorted out and be completed by further features which aim on active structuring and promoting of communicative reflection and on building synergies between the various perspectives of the collaborators. This completion requires research by conducting several design cycles.in which prototypes are employed in real test beds and feedback is produced to trigger the improvement of the sociotechnical solution. Initial work for such design and prototyping in healthcare have already been done in the context of case 1 as described above (Prilla et al. 2012).

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