

Collaborative Reflection at Work: Supporting Informal Learning at a Healthcare Workplace

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ABSTRACT

Reflection is a common means to improve work: Every day, people think back to past work and – oftentimes in a group – try to find out whether they can improve it or whether they can derive better practices from it. However, especially collaborative reflection is neglected in research and design and consequently, there are hardly any insights on how it takes place in the practice of daily work and how tools can support it. To shed light on these questions, this paper presents a case that has been analyzed in a hospital as part of a series of studies on collaborative reflection in practice. Focusing this case and backing it with the other studies, the paper presents peculiarities and needs of collaborative reflection in healthcare workplaces as well as a more general formalization of collaborative reflection characteristics. Based on these results, an application to support physicians in their reflection was prototyped and tested. The presented results primarily apply to healthcare workplaces, but also cover general findings for the support of collaborative reflection.

Categories and Subject Descriptors

H.5.3 [Group and Organization Interfaces]: Computer-supported cooperative work

General Terms

Design, Human Factors

Keywords

Reflection, collaboration, workplace, learning, healthcare

1. INTRODUCTION

Reflection is a frequent and ubiquitous task performed explicitly and (more often) implicitly during and after everyday work: People think about whether they acted appropriately in a certain situation, whether their cooperation with others runs smoothly and how things can be improved. This process includes going back to past experiences, reassessing them and deriving consequences for future behavior [2] and is typical for most of nowadays' workers.

Reflection has been recognized earlier on as an integral task for (cooperative) work and learning [14, 20]. This holds especially true for workplaces with a strong emotional influence on workers such as in healthcare, where emotional stress needs to be reflected

in order to learn for the future instead of affecting employees on the long run [9, 23]. Accordingly, reflection has been found to be a well-established task among healthcare workers [24].

The ubiquity of reflection in daily work and life does not mean that it is always applied successfully or supported sufficiently. One striking issue of reflection is that – without further support – it is mainly based in memories of past situations, which may have become hazy and, in terms of describing the situation reflected about, can be incomplete. Subsequently, this can lead to improper conclusions drawn from reflection. While this can be diminished by using existing documentation of work, such material is often not at hand immediately or it is insufficient to support reflection. In addition, the majority of work on reflection support regards reflection as an *individual* and *cognitive* process (see section 2 for an elaboration on this). This leaves out reflection as a *communicative* process happening in *collaboration* – e.g. meetings in which a team reflects on its practice, or discussions in which workers mutually reflect on stressful situations. Thus, important and potentially fruitful occurrences of reflection lack proper support.

As a result of the shortcomings addressed above, there is hardly any tool support for collaborative reflection. Such support needs to provide users with data complementing their memories of certain situations, help them structure this data and make sense of it for reflection, including both subjective perspectives and objective data on what has happened. With respect to *collaborative* reflection, it needs to support groups reflecting together to mutually make sense of their experiences and learn from each other. However, little is known about the process of collaborative reflection and how to support it with tools.

This paper reports on research done to investigate and support collaborative reflection. It presents a case study eliciting the characteristics and needs of collaborative reflection in practice and follow-up work in developing and evaluating a tool for its support. The paper mainly draws on work done in cooperation with a German hospital and is backed up by similar studies conducted in parallel¹. The initial study in the hospital covers an exploration of collaborative reflection in practice and its results have been checked against the other studies. The tool developed according to the resulting insights into collaborative reflection was evaluated formatively in workshops with physicians from the same hospital. This paper describes the whole cycle of exploring collaborative reflection, operationalizing results from this exploration as well as developing and initially evaluating a tool based on these results.

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In the remainder of this paper, we first discuss existing work on (collaborative) reflection, IT support for it and its specific characteristics and constraints at the healthcare workplace (section 2). After that, we describe our case study at the hospital and observations stemming from that (section 3), which – in accordance to results of the other studies done in parallel – will be analyzed in section 4. Based on this analysis, which form an initial framework to support collaborative reflection, we describe the design and evaluation of a prototype to support reflection in healthcare contexts (section 5). The paper concludes with remarks on our work and plans for the continuation of its underlying research.

2. REFLECTION AT THE WORKPLACE

2.1 Characteristics of reflection

Reflection is a common activity at workplaces. It occurs frequently and more or less implicitly, as there is not always a conscious decision to reflect. It can be described as “those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations” [2]. Reflection consists of three steps: going back to past experiences, re-evaluating it and deriving insights for future behavior from this reassessment (Figure 1, [2]).



Figure 1: Phases of reflection, based on [2].

As Figure 1 shows, experience consists of past behavior, ideas and feelings towards past events. Reflection means to mentally return to these elements of experience and to re-evaluate them. Outcomes of this process include new perspectives on own experience, changes in behavior or at least knowledge on or readiness for changing behavior. The model shown in Figure 1 also indicates that reflecting and going back to experiences do not necessarily lead to outcomes in a linear fashion, but make reflection an iterative with loopbacks. With respect to reflection support, it has to be emphasized that reflection is not limited to resolving problematic situations, but can (and should) also be applied to identify and sustain good practice. Reflection in this sense means learning from experiences and has been identified as a decisive mechanism in modern workplaces [1, 2, 14]. Schön [20] added that there is a differentiation between reflection “in action”, which is happening during the conduction of an action, and reflection “on action”, which covers reflection happening after the action is finished. Although Schön originally focused on individual reflection in this distinction, it also applies to collaborative reflection. It is obvious that both modes pose different needs and constraints for support.

Reflection needs to be differentiated from other forms of thinking about past or current issues. What differentiates it, for example, from rumination is that reflection needs to have an outcome, meaning that new insights on past behavior are derived from a reflection process. Reflection is also close to problem-based learning [20], which requires reflection on experiences past with problem solving, particularly in those cases where problems may be solved by reflecting on their past occurrences in practice. However, it can be differentiated from problem solving by the premise that reflection is based on past behavior. Reflection and sense-

making [25] also have a lot in common, but again the strong orientation of reflection towards reassessing past events does not account in general for sensemaking. The triad of past experience, reassessment and learning for the future thus makes reflection a unique process of learning and knowledge construction.

2.2 Collaborative reflection

The majority of research on reflection is done with a focus on individual reflection. Therefore, most models of reflection have a strong individual focus (e.g. [2, 14, 20]). Collaborative reflection, in contrast, is far less covered by current literature [13].

Collaborative reflection can be described as a social process in which “people engage in finding common meanings in making sense of the collective work they do” [11] or as “tool(s) for explicating and making implicit knowledge embedded in contexts” [12]. The main difference between collaborative and individual reflection is the process taking place: for individual reflection, it is mainly made up by individual cognitive activity, whereas collaborative reflection is based on communication and coordination: engagement in dialogical interaction as well as sharing and processing of mutual experiences have to be seen as core elements of collaborative reflection [4, 21].

For collaborative reflection, people must share their experiences and communicate about them, ideally leading to shared sense making [3, 9, 21]. Collaborative reflection then occurs if an individual links her knowledge to the experience of others [3] or when a group combines experiences of its members to reflect on them collaboratively [11]. Thus, collaborative reflection may be about individual *or* collaborative work and requires support for the communicative interaction of people reflecting together. Compared to individual reflection, collaborative reflection has the advantage to learn from each other and to craft new knowledge from shared experiences. However, it is also more complex in terms of structuring communication and experiences exchange.

Existing work on collaborative reflection is often restricted to specific and static situations such as debriefing sessions and project review meetings [2], or regards reflection mainly as an activity triggered by an individual seeking assistance in individual reflection [27]. Therefore, most insights on processes of reflection and on tool support (see section 2.3) deal solely with such situations. There are contributions emphasizing that collaborative reflection also happens in more dynamic situations [3, 4], but little is known on collaborative reflection support in such situations. Therefore, further research on characteristics of collaborative reflection in practice is needed.

However, it is hard to determine whether collaborative reflection actually occurs: not each discursive interaction about past events is collaborative reflection. A key to recognizing it can be found in the work of van Woerkom and Croon [26], who describe indicators for reflection such as “critical opinion sharing” during discourse, “challenging groupthink” as opposed to sticking to norms, “asking for feedback” on own actions and “experimenting with alternatives” [26]. In the work described here, these indicators were used to identify collaborative reflection.

2.3 IT support for reflection

Returning to own experiences is central to reflection, but human memory is limited: memories fade and thus, returning to past experiences is hard. Therefore, reflection can be supported with data describing past experiences, ranging from simple heart ratios indicating stress to written notes describing experiences (cf. [13]). While this data may be captured and shared among collaborators

with generic tools like databases and notebooks, there are only little insights on specific tool support for collaborative reflection.

Among the scarce literature on reflection support, the usage of personal journals for individual reflection is mentioned often (e.g. [15]). In such journals, people can note experiences as in diaries or collect other artifacts such as pictures. Later, they can return to this data for reflection. Other authors propose digital portfolios for learners, including learning material and personal notes to reflect about the success of learning processes ([21]). While these tools can be beneficial when returning to the data contained in them, they need the user to write down all experiences that could possibly be valuable for later reflection.

Among tools for more special purpose reflection support, the Microsoft SenseCam, which takes pictures when the scenery in front of it changes, has been reported to support reflection well, even in reflection groups [7, 8]. Individuals and groups use the resulting pictures to recreate the events in which they wore the SenseCam and to point to certain experiences during these events. To the knowledge of the authors, besides this and very few other special purpose tools, there is no proper tool support for collaborative reflection available. What can be seen from these few examples is that all kind of IT-support has to be flexibly integrated into the context of work practice, acting as a socio-technical solution [6].

2.4 Reflection at the healthcare workplace

At healthcare workplaces such as hospitals, reflection has been found to be well established [9, 17, 24]. The majority of existing literature points to applications of reflection in two areas: medical issues such as diagnosis [17, 24] and training for work [9, 17].

Concerning *medical aspects*, literature assumes that reflection is mostly triggered by medical problems such as difficult diagnoses. Its conduction depends on personal inclinations and preferences [17]: For example it was found that the tendency for physicians to reflect on their daily work decreases in parallel with an increase of years of practice [16]. Concerning support for reflective practice, literature mentions guidance and supervision. Typical applications of reflection involve evaluating previous assumptions on a patient's health development, comparing difficult situations with past experiences and challenging own diagnoses [16]. While this is primarily done individually, it is also common in healthcare environments that staff (especially physicians) holds meetings and discusses patients and their states.

Reflection is considered to be an important practice of nurses and caretakers in *training* before and on the job, as these groups need to develop a habit of critical thinking and to gradually adopt good practice by learning from others [9, 10, 24]. In such situations, using a journal to write down experiences and learn from them for later practice is common, although it has been shown to reduce face to face communication and reflection [9].

Research on the reflection of nurses also points to the *collaborative* dimension of reflection in healthcare workplaces. Collaborative reflection has been observed when nurses developed ideas and solutions for care problems together [10] or to improve their behavior in certain situations [24] – both situations transcend medical or training issues and show the need to collaboratively create better work practice at such workplaces. Thus, aspects such as work organization and social issues also need to be regarded in reflective practice of healthcare workers. However, besides describing reflection in supervision or meetings, literature does not provide details on reflection processes or needs in such cases.

3. COLLABORATIVE REFLECTION IN HEALTHCARE: A CASE STUDY

There are hardly any insights into collaborative processes of reflection. To gain such insights for the development of proper tool support and as part of a series of workplace studies on collaborative reflection², we conducted an exploratory study at a German hospital ward dealing with stroke patients.

3.1 Methodology

The study was conducted as an exploration of collaborative reflection practice and needs – the state of the art in research on collaborative reflection and tool support for it did not allow us to build sufficient assumptions prior to this study. Therefore, we conducted explorative interviews and observations in the stroke ward of the hospital, which included physicians and nurses. In total, we observed two workers and conducted interviews with four people, which we consider sufficient for an exploration.

During the work observations, two researchers followed a nurse and a physician during their whole shift for two days, documenting all situations of their work with a special focus on reflection. The purpose of these observations was to understand the work done in healthcare environments as a basis for tool development, including habits of communication and cooperation, constraints imposed by the workplace and actual practice of reflection as opposed to literature. For this, the observers oriented their notes towards an observation scheme containing aspects of reflection such as interaction with colleagues (participants, place, time etc.), occurrences of reflection (participants, topic, data used etc.) and technology used (purpose, relation to work etc.). The resulting notes were transcribed and coded with the categories from the observation scheme.

The interviews were conducted with the observed workers and additional staff of the ward with the main purpose to clarify rationales, needs and wishes of healthcare staff with respect to (collaborative) reflection. The interviews lasted 45 to 60 minutes each and contained questions about the interviewees' workplace, special characteristics of learning and motivation, communication and collaboration during the day as well as existing and envisioned practice of individual and collaborative reflection – some of these were omitted for the persons who had already been observed for two days. Sample questions from the inventory 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*". Each interview was audiotaped, transcribed literally and coded in a process aligned to Grounded Theory [22]. This was complemented with preset codes representing the indicators for collaborative reflection described in section 2.2 (cf. [26]). This approach was taken to be open for the identification of characteristics and needs of collaborative reflection on one hand and to be sure to detect situations of collaborative reflection completely and correctly on the other hand. 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 to be collaborative reflection as it is an example of asking for feedback (see sections 2.1 and 2.2).

In the analysis, interviews and observation complemented each other: while in interviews outcomes can be based on particular episodes and thus not represent daily work, observations allow for

² Additional studies were conducted at e.g. British care homes and, to broaden the view on collaborative reflection, at a German IT consulting company.

insights into daily routines. Likewise, interviewees might not sufficiently describe their practice of reflection since it often happens implicitly. On the other hand, observations cannot result in an overview of all aspects relevant for collaborative reflection. Therefore, for the staff both observed and interviewed, we intertwined the resulting material in our analysis.

3.2 Background: Work in the hospital ward

The target group we interviewed and observed consisted of physicians and nurses working in the stroke ward of a German hospital. Before we present observations from this study, we briefly describe work on this ward to give a context of the study.

Staff on the stroke ward is highly trained. Nurses, for example, need special skills to be allowed to work with acute stroke patients. Their primary motivation to work on the ward could be found in the desire to help people. Providing good care, saving lives and improving the quality of patients' lives are examples for this we found in the material. Work is organized in shifts for both nurses and physicians: physicians work in a two shift system covering days and nights, nurses work in shifts for the morning, the afternoon and the night. Between shifts, handovers are done within and between these two professional groups. Work at the ward highly depends on communication and cooperation: while physicians are responsible for monitoring patients, diagnoses and decisions about medical treatment, nurses do the daily tasks of assistance, care, and drug application based on physicians' prescriptions. Nurses do most of their work in the patients' rooms and help each other in difficult or exhausting tasks. Physicians partly spend their day in patients' rooms, e.g. during the ward round and daily check ups, in their offices, e.g. doing documentation and research and around the ward, e.g. talking to relatives of their patients.

Work in the ward is constrained by time pressure. Physicians have a highly packed day consisting of ward rounds, daily meetings with colleagues to discuss patients' cases, examinations, documentation and emergencies. Nurses are taking care of one or two patient rooms per day, giving them treatment and care. In parallel, they need to do the documentation of treatment given, physiological data such as blood pressure, medications given and incidents happening during the day. We were told that because of the resulting time pressure staff often completes mandatory documentation tasks after their shift has finished to guarantee that patients are being cared for properly in the first place.

In order to coordinate work under these circumstances, physicians and nurses use a chart placed at the bed of each patient, which they call "the curve" and in which each change in the status of patients or in treatment as well as results from examinations are written down in a protocol and serve as a basis of the work of nurses. In addition, some documentation such as patients leaving or joining the station is done in a hospital information system.

The work of physicians and nurses is emotionally stressful. Nurses need to work closely with patients who may not be able to articulate what they need or get worse every day. Physicians need to make decisions, which might affect patients' lives or at least their quality of life. Moreover, they need to talk to relatives of patients, which oftentimes include telling bad news. In an example, we observed a physician deliberately looking for other tasks to do in order to avoid holding a potentially different conversation with relatives. Therefore, supervision is considered to be an important mechanism by both nurses and physicians and the solidarity among all members of the ward is very high – mutual help in stressful and sad situations is a matter of course in the ward. The

other way around, we observed collective happiness when patients recovered quickly from a stroke.

This solidarity is also mirrored in the regular meetings of ward staff. Besides the daily meetings and handovers, once in a month there is a meeting for all staff members. We even observed staff from the night shift joining this meeting, although they had finished their shift a couple of hours ago. The meeting is announced with a bulletin in the break room, and everybody can add topics to this bulletin. We observed the discussion culture to be very open, as everybody is taken for serious and may pose a problem or comment on certain issues.

The usage of information technology differs much between nurses and physicians. While nurses have access to shared computers, they may not access the Internet but only the hospital information system and a digital quality management handbook on the intranet. Physicians, in contrast, can use computers connected to the Internet in their offices for research purposes.

3.3 Reflection practice in the hospital

Our analysis of the hospital study also contains detailed insights into the structures and constraints influencing collaborative reflection at this workplace. This contains different reflection settings, barriers and opportunities for reflection as well as insights into the collaboration of reflection participants.

One insight in reflection practice is that reflection happens both in (scheduled) meetings and spontaneously during the day. It is prominent among staff if topics concern interaction with patients and incidents of them and occurred mostly when an individual lacked understanding of a patient's situation or treatment and asked others to reflect on this situation together.

As for **reflection in meetings**, we found the daily meetings of physicians, the handovers between shifts and the ward meetings to be most important. In handover sessions, which are usually run by one of the nurses summarizing the shift for her colleagues and informing them about the most relevant issues to be taken care of, staff often collaboratively reflect for short periods of time, e.g. by asking each other for feedback based on experiences with the patients or similar cases. In the daily meeting of physicians, reflection may occur due to one of the physicians presenting a case and others stepping in on aspects such as diagnosis or treatment based on their experiences with similar cases. In the ward meetings, we observed reflection to be more structured, but also more difficult with respect to creating a shared context. Such meetings, as explained above, are prepared with a public agenda, which all members of staff may edit. As a typical example, we observed a meeting in which a nurse proposed to change the way breaks are taken in the morning. As some participants of the meeting did not understand why this was proposed, she gave examples how slight deviations of break times interfered with the daily ward round. After that, others reported on their experiences with this issue and the participants decided to change the break times. In another example, the head nurse complained that physicians too often enter rooms without talking enough to patients. As physicians did not understand the problem immediately, she explained that this often results in patients asking the nurses afterwards about what happened and if there was something new. Some physicians explained that they could not always start a conversation with the patient because this would take too much time. After a discussion they agreed that both groups should make it more clear to the patients in which situations (e.g. ward rounds) they can ask questions and when not. They also agreed that during handover meetings between physicians that take place at the bedside, they would

do short conversations with patients, as these are the first contacts between them on each day.

Reflection outside meetings is more informal and significantly shorter than reflection in meetings. Although these reflection situations are oftentimes implicit and embedded into other communication, which makes them harder to recognize both for interviewees and observers, our analysis shows that there are plenty of such situations and that they have more relevance for the support of collaborative reflection than literature represents. Typical examples of such occasions are breaks, in which nurses and physicians sit together, working together on the same task and reflecting on it, and spontaneous encounters on the hallway, during which staff briefly reflects on (mostly) small issues. Such reflection occurs when staff talks about problems in daily work, such as supply with equipment, or as a result of implicit routines, such as asking each other for help or reassurance during the day. For example, we observed nurses reflecting frequently on how supply with specific medical gloves could be organized more efficiently.

Looking at **constraints and challenges** for supporting collaborative reflection, we observed that many small outcomes from spontaneous reflection were not sustained. Taking the example of break times described in section 3.2, we observed how nurses briefly reflected a couple of times during one day on how to deal with this issue (e.g. on the hallway) and then turned back to work with patients. However, follow up actions were never planned in such situations and the nurses never took notes. This shows that outcomes and topics of spontaneous reflection are less persistent. Such behavior may then result in situations such as described for the meeting above (section 3.2), in which some people cannot remember problems or are not consciously aware of them.

Moreover, we also found that in terms of **documenting experiences**, physicians and nurses do not take notes unless they see an immediate or at least mid-term personal benefit or if it is inevitable to e.g. legal restrictions. This is not a new insight, as personal benefit is a critical precondition for knowledge exchange in general [5]. However, in healthcare settings documentation is even more critical in terms of time and priorities: given the highly packed work day of staff, they are cautious to take unnecessary efforts, which may then result in less time for patients. Therefore, solutions supporting reflection at such workplaces need to show the potential benefit. Nevertheless, we found that *existing* documentation was often used as a trigger or guide for reflection: Documents like the abovementioned curve at patients' beds often guided the reflection of nurses and physicians, for example when two or more nurses gathering around this documentation and reflecting on treatment given to a patient. This suggests that documented experiences can be valuable guides for collaborative reflection in healthcare.

3.4 Discussion: New insights into reflection at healthcare workplaces

The study shows that staff in healthcare is faced with scarcity of time and emotionally demanding, responsible tasks. In addition, the teamwork aspect is very present in such workplaces: nurses and physicians formed a collective and help each other in stressful situations. This underpins the insight that reflection is a common practice at healthcare workplaces.

There are two novel foci of support to take away from our studies with respect to reflection specific for healthcare workplaces. First, reflection in healthcare is not limited to medical and training aspects, but is also common on team coordination, communication and similar aspects. Therefore, in addition to literature (see sec-

tion 2.4), a focus of reflection support should also be set to these issues, as these are crucial for good care. The topic of communication with patients described above is a typical example for this, as it is a matter of ward organization but directly affects the quality of care. Second, tools to support the documentation and reflection of experiences need to be flexible in space and time: Staff did not have much time to explicitly step back and reflect – in contrast, we observed nurses and physicians to reflect often during and between tasks or after their shift. The challenge thus is to fit support into these constraints.

Our study indicates that support for collaborative reflection is both underdeveloped and needed in such workplaces. Means to deal with e.g. stressful situations such as supervision are too infrequent. Thus, we observed many situations in which colleagues started to reflect in place of this external support – one example is nurses asking each other for reassurance on treatment given to a patient. In addition, we noticed situations in which the opportunity to reflect in a task would have been needed but was not there, e.g. when the physician tried to avoid talking to relatives and giving them bad news.

4. ANALYSIS: MODES, TOPICS AND THE PROCESS OF COLLABORATIVE REFLECTION

Analyzing the observations from the study described above and combining them with insights from other studies run in parallel allows for an operationalization of collaborative reflection (see [18, 19] for details of the analysis of all studies). This includes modes of collaborative reflection, the relation between topic contextualization and aggregation as well as process characteristics of collaborative reflection. In what follows, we will describe the resulting constructs with a focus on their occurrence in healthcare workplaces like the hospital ward.

4.1 Context: Modes of reflection

There are different settings of collaborative reflection and necessary documentation of experiences: Sometimes, reflection happens in a **planned** meeting, whereas in other occasions it is **spontaneous**. In addition, it may happen **during** the task reflected on or **after** it – this is closely related to Schön's distinction between reflection in and on action (section 2.1). Based on this distinction, we developed a two-dimensional scheme describing **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 1 shows the resulting matrix and examples for **reflection sessions** from the healthcare study. Looking at the examples shown in Table 1, it is obvious that these modes need to be sup-

Occurrence / Relation to reflected work	planned	spontaneous
Reflection on past work events, "on action"	Scheduled meetings in which reflection is part of the agenda	Breaks, talks on the hallway, before / after work
Reflection on current task, "in action"	Daily handover sessions, meeting of physicians	Reflection on a patient while caring for her

Table 1: Occurrences of reflection (planned, spontaneous) and relation to work reflected about (on action, in action [20]) with examples from the healthcare study.

ported in different ways. For example, reflection in scheduled meetings can be prepared by an **agenda** (e.g. announcing topics) and may benefit from e.g. **facilitation**, whereas spontaneous reflection needs to be done without these aids. In addition, both spontaneous reflection and reflection on action restrict the **time** for reflection. Our observation of staff making mandatory documentation in their free time shows that support for the non-mandatory task of documenting experience needs to be very flexible with respect to time. Moreover, all modes have a different timeframe for **following up** on earlier and planning later reflection: In meetings this may be done systematically by minutes, but in other modes existing topics have to be at hand spontaneously.

Although done in different modes, different sessions of collaborative reflection might be about the **same topic** or at least share a **common context**. Results from e.g. a reflection session during a break might be needed or at least be interesting for a regular meeting but forgotten due lacking documentation. Support for collaborative reflection therefore also needs to provide means for transitions between outcomes stemming from different modes and to establish a shared context between reflection actors.

4.2 Topics: Context and aggregation

Besides different modes of collaborative reflection, the topical level – whether a concrete situation or a more abstract problem is discussed – is important for reflection support. The description of collaborative reflection practice in section 3.3 already indicates corresponding problems of starting and successfully practicing collaborative reflection on different topic levels: For example, in handovers, nurses do not have much time to reflect and mostly stay on an **instance** (i.e. an **episode** happening during the day) or **case** (i.e. a patient) level, but only rarely relate episodes or cases to more comprehensive topics such as general care practice. Thus, problems are discussed redundantly and existing resolutions are not (re-) applied. The example of nurses discussing about medical gloves underpins this, as it happened frequently on the hallway but, according to our interviewees, had never been discussed in a meeting. The other way around, reflection in meetings tends to be about more **comprehensive** topics (i.e. organizational issues) that can be announced on an agenda. This may lead to situations in which participants lack the context of such a topic: Like the examples of changes in the break structure and of communicating with patients show, this context often has to be reconstructed by communicating episodes in which the problem have occurred.

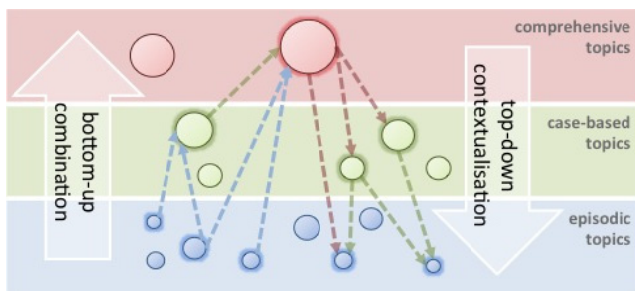


Figure 2: Topical levels in collaborative reflection.

Figure 2 describes the relations between the levels of episodes, cases and comprehensive topics in collaborative reflection and the corresponding bottom-up and top-down processes. In the healthcare study (and in parallel studies) we found that collaborative reflection in practice oftentimes is made up by multiple bottom-up and top-down cycles. This can be seen in the example of medical gloves and break times. Therefore, collaborative reflection support must relate these topical levels to each other, com-

plementing comprehensive topics with context from episodes and cases and enabling workers to derive (aggregate) comprehensive topics from episodes and cases.

4.3 Process: A blueprint for collaborative reflection support

As another result, our observations show that there are five ingredients of collaborative reflection support. First, there is need to support the **documentation** of experiences and the **capturing of data** contextualizing experiences in order to form a thorough base for returning to experiences. Second, workers need to **individually reflect** on experiences in order to understand them better and to develop ideas for resolutions. It should be noted that these phases might also happen in parallel as the documentation of experience may trigger individual reflection of it. Third, **collaborative reflection** takes place, which includes sharing experiences, communicating about them and negotiating resolutions. After that, **sustaining outcomes** is done to not let results go but document them properly. These phases include and are connected by **articulation**, which serves different purposes such as explicating and explaining experiences or writing down outcomes. Figure 3 shows the resulting blueprint for the implementation of tool support for collaborative reflection.

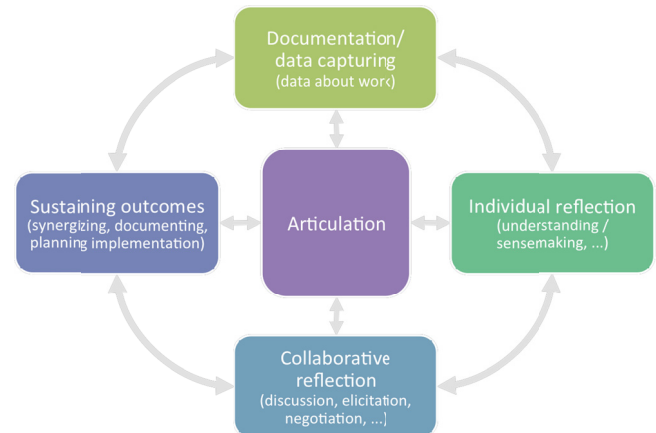


Figure 3: A blueprint for collaborative reflection support.

This blueprint can be illustrated by the example of physicians' communication with patients. Nurses had documented this issue for the head nurse, who had started to reflect on her experiences with this issue. Then, she had prepared the topic for reflection in the ward meeting and nurses and physicians present in the meeting reflected on it collaboratively. After that, they agreed on outcomes and the head nurse wrote down their resolution.

The blueprint is not meant to prescribe a **linear sequence** for collaborative reflection, but explicitly allows going back to other steps. Examples such as the break time discussion at the ward, in which staff went back to individual reflection of episodes in the meeting, shows that this is necessary. Likewise, the blueprint also allows **loops** within single steps like in the example of short-term, iterative collaborative reflection on the hallway. It also emphasizes the need for articulation and the need to support people in sustaining outcomes. However, steps of the process may also be left out if e.g. collaborative reflection on a new topic emerges spontaneously from a talk between workers, omitting phases of individual reflection.

5. SUPPORTING COLLABORATIVE REFLECTION

Based on the insights on collaborative reflection in general and for healthcare workplaces in particular, we developed the “Talk Reflection App” for its support. It is designed for the reflection of different topics. For first field tests, we tailored it to support the collaborative reflection of physicians’ talks to patient relatives, (see section 5.2). Its concept was also tested for the collaborative reflection of nursing work by using a paper prototype.

5.1 Pre-Testing the Process Blueprint

Before we designed the app, we conducted a workshop to pre-test our blueprint described in 4.3 to find out whether the process was applicable in practice. For this workshop, we gathered five employees of the ward (four nurses and a physician). In the workshop, we asked them to reflect on scenes taken from their daily work such as a patient complaining and a patient missing her valuables. The scenes were illustrated by a picture (see Figure 4). For reflection, we asked the participants to follow a scripted process, which asked them to first **write down** similar scenes they had experienced (documentation, see section 4.3) on paper cards and briefly **reflect on them individually**. After that, they were asked to share their experiences by pinning the cards to a board (Figure 4) and explain them to the others. In a third step, they were asked to **discuss** different experiences of a respective scene (collaborative reflection) and to write down **resolutions** for the scene (sustaining outcomes). Articulation was present in many ways, e.g. to explain experiences to others and discuss them.

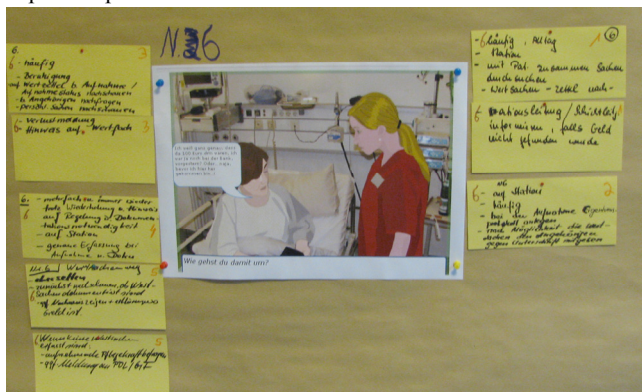


Figure 4: Results of the pre-Test of the process blueprint for collaborative reflection support.

The workshop produced rich results and the participants reported that had achieved new insights on their work. In particular, the participants wrote 41 paper cards, among which we found 13 stories of experiences and 17 resolutions for problems identified in the scenes. This indicates that documenting stories of experiences is a proper means to support reflection – it took only a short time and was expressive enough to support later reflection. The number of resolutions suggests that the process we scripted for the participants in combination with the paper prototype was adequate and helpful to derive insights on how to change future behavior. In addition, for some resolutions the participants agreed on further actions such as proposing a different way of handling patients’ valuables for as a new standard of the hospital.

The participants referred to each other in the way we had planned: They documented their experiences regarding the respective scene and added personal reflection results such as potential resolutions. They easily articulated their experiences to explain them to others and derived many insights from the different experiences dis-

cussed. This suggests that our blueprint can be used as a basis to create tools supporting collaborative reflection. In an informal talk after the workshop, three participants reported that they had reached a level of certainty and agreement among colleagues that would not have been possible without the collaborative reflection of their different experiences.

5.2 The Talk Reflection App: A prototypical tool for reflection support of relative talks

Based on the evaluation of the paper prototype, we implemented a mobile application to support collaborative reflection. As a pilot area for evaluation of this application, we chose physicians’ talks to relatives, which is an area in which physicians are usually not trained during their education. Talking to relatives is a frequent and very important task for physicians, as physicians are obliged to inform and emotionally assist relatives and need information from relatives to better judge the case of the patient.

As described above, physicians were unsure about this task, as they perceive it as stressful, and even tried to avoid it (see section 3.2). They told us that they were interested in improving their skills for this task and agreed to support each other in this process. As they told us, there is a relation between how good one manages talking to relatives and whether relatives complain about the treatment of patients – better conversations apparently lower the complaint rate. Because of this, supporting relative talks was found to be more pressuring than other tasks such as supporting the reflection of nursing work as described in the paper prototype evaluation. However, as can be seen from the description below, the prototype can also be used for this task with minor changes.

The Talk Reflection App is aligned to the blueprint of collaborative reflection presented in 4.3: Aiming at supporting physicians in the articulation and collaborative reflection of relative talks, it consists of four basic elements representing the phases of the blueprint: a form for **adding documentation** (Figure 5), a private space for **individual reflection** (Figure 6), group spaces for **collaborative reflection** and a space to **sustain outcomes** of the reflection process (Figure 7). It also supports articulation in the self-assessments for documented cases (see Figure 5) or comments on own and shared documents (e.g. Figure 6, number 4).

Implementing the need to be used flexibly and to fit into the work of physicians, the Talk Reflection App runs on mobile devices such as tablets (iPads), and it is connected to a server enabling the exchange of data among users and enable cooperation by exchange of comments (see below). This way, physicians can carry it around with them and use the same interface and device in different modes of reflection. Considering the form factor, we had proposed smaller devices, as these are better to carry around than iPads, but the physicians preferred display size to mobility.

For the **documentation of conversations**, the app allows physicians to describe conversation content and, being prompted by questions, assess their own emotions as well the reaction of relatives during the talk. Given that a physician had a difficult conversation with relatives, she can document the talk, using the soft keyboard built into tablet devices to create title and description of the conversation and chose a (medical) topic³ for it (no. 1 in Figure 5). After she has described what happened, she is prompted to assess her and the relative’s feeling (**self-assessments**, e.g. “How

³ To sustain the confidentiality of real documentation made with the app in the hospital, all entries in the figures have been created by the authors (but resemble real entries).

did your conversation partner presumably feel”, second question in Figure 5, no. 2). To remember the talk later in collaborative reflection, she can mark it (3). As physicians already have to document these talks as part of their work, e.g. to prove that relatives have been informed properly, the app fits into their work and provides direct benefit for documentation work.

The figure shows two side-by-side app screens. The left screen, titled 'Add Documentation', has a 'Public Documentation' section with a 'Topic/Title' field (containing 'Bringing bad news'), a 'Choose Topic' dropdown, and a 'Description of the talk' text area (containing a paragraph about a difficult talk with Mrs. X). Below this is a 'Personal Note' field. The right screen, titled 'Private Documentation', features a series of self-assessment questions with sliders and radio buttons. Questions include 'What was my feeling during the talk?', 'How did my conversation partner presumably feel?', 'How much will this conversation be uppermost in my mind?', and 'How good was the understanding of what I said?'. Each question has a slider from 1 to 7 and a radio button for 'Too very bad', 'Too very good', 'Too very low', or 'Too very high'. A final question at the bottom asks 'I would like to talk about this with my colleagues' with a radio button.

Figure 5: Interface for documenting conversations (left) and self-assessments (right).

After this input, the documentation is available only for the physician who has created it and can be shared with others. Physicians can add comments to their own content (**individual reflection**) and to the content shared with them (**collaborative reflection**). Figure 6 shows the respective interface, which enables the navigation to own (1a) and shared (1b) content spaces. It also shows that a user can share her documents easily while inspecting them (2). The document itself is shown in full length to enable physicians to remember own and understand others' conversation descriptions. In addition, Figure 6 shows traces of individual and collaborative reflection: In the comments below the documentation (yellow boxes in no. 4 of Figure 6), the upper comment (“I did not know that ...”) stems from the author of the document, who has realized that she was missing information, and the lower comment (“I had a similar case...”) shows how a colleague has thought about the case and reflects on it based on his experiences. Using comments in the latter way enables collaborative reflection and communication asynchronously. Sharing the resulting set of information on experiences can then help others to better understand the situation and makes it available for collaborative reflection.

The figure shows a mobile app interface with a sidebar on the left containing navigation options: 'My Documents' (1a), 'Shared' (1b), and 'Outcomes' (1c). The main screen displays a document titled 'Difficult talk to relatives of old lady' (3). Above the document, there are controls for 'Owned by Test User?' and 'Share This Documentation' (2) with a 'Compare' button. The document content includes a 'Sample entry' dated '24. April 2012' and a 'How to answer this question?' section. Below the document, there is a 'Spider graph' visualization showing 'Own feeling' and 'Understanding' on axes. At the bottom, there are two yellow comment boxes (4): the top one says 'I did not know that the son and daughter were coming, so I did not prepare myself well for the talk.' and the bottom one says 'I had a similar case and asked the relatives to sit down for a second before I talked to them longer. That gave me time to look into the documentation of their relative and to think about a good way to talk to them.' There is also an 'Add a comment' field and an 'Add' button.

Figure 6: Individual and collaborative reflection spaces: Each documentation can be viewed, shared and discussed. Assessments displayed in spider graphs for a quick overview.

Activities such as reading own and shared conversation documentation as well as commenting and discussing them should lead to **outcomes** – the physicians should **learn from collaborative re-**

flection of the conversations. **Figure 7** shows how such outcomes can be documented and sustained within the Talk Reflection App: Once reflection participants have agreed on a certain outcome (e.g. “Calm down relatives in stressful situations” in no.1 of **Figure 7**), they may open the outcome documentation view (1c in Figure 6) and add both a title and a description of the outcome (1 and 2 in **Figure 7**). To contextualize these comprehensive outcomes with concrete examples, the app displays recently used documentations and enables the users to link them to the outcome documentation (no. 3) – this supports the **top-down linking of comprehensive topics to their episodic and case-based context** (see the topical levels described above).

The figure shows a mobile app screen titled 'Document Outcome'. It has a 'Set a topic or title that describes the outcome:' section with a text field containing 'Calm down relatives in stressful situations' (1). Below this is a 'Write down the outcome of your reflection about the documentations marked above:' section with a text area containing a paragraph about calming down relatives (2). At the bottom, there is a 'Please select those documentations related to the outcome.' section with a list of documentations (3): 'How to answer this question?, Wednesday July 18, 2012', 'Last Sunday, the daughter of a resident came to visit her mom. She was shocked to see that her mom h...', 'Difficult talk to relatives of old lady, Wednesday July 18, 2012', and 'Had a difficult talk with the daughter and son of Mrs. X, as I had to tell them Mrs. X was in bad co...'. There is a '+ Save' button at the bottom.

Figure 7: Outcomes of collaborative reflection sessions can be saved and related to cases.

The app covers all steps of the process blueprint presented above and integrates them into the daily work of physicians, fitting constraints of time and space by running on mobile devices. This also makes it applicable in all **modes of collaborative reflection** – be it meetings as described above or spontaneous reflection in breaks, as physicians can take the mobile devices with them. Likewise, the app supports the aggregation and contextualization of topics by using talk documentation to identify comprehensive topics (bottom-up outcome generation) and relating them back to documentation (top-down contextualization).

The app also supports the **bottom-up and top-down relations between the topical levels** described in section 4.2, as it enables physicians to **collect episodic or case based documentation** and **derive comprehensive topics** from them during collaborative reflection. The outcome shown in **Figure 7** (numbers 2 and 3) is an example of this, showing the comprehensive topic of coordinating relatives derived from two episodic documentations (checked cases in **Figure 7**, number 1). The other way around, the app can also be used for the reflection of comprehensive topics, e.g. when there is a need to understand the background of topics or find examples in meetings.

5.3 Evaluation and Discussion

An initial evaluation of the app was done in two workshops, which were meant to provide formative information for further development. First, we conducted a workshop with three physicians, who used an early prototype of the app and were asked to give feedback on its applicability and potential utility. In a second

step, we conducted two workshop sessions with two physicians each. In these sessions, the physicians used an improved prototype in order to test-drive its rollout in the ward.

In the **first evaluation workshop**, we combined the elicitation of further requirements with an evaluation of an initial prototype of the app. In this workshop, three physicians took part, among which there was one young assistant physician, one experienced physician and the head physician of the ward. We asked these physicians about aspects such as motivation, topics and goals for collaborative reflection and gave them the opportunity to use the app. For the latter, we asked them to tell us about their impression on utility and applicability, missing or unnecessary features, proposals for improvement and situations in which they would like to use it. As one result, the participants told us that they liked the idea of using this app to document and reflect on relative talks – one physicians even said he and his colleagues might like the app because they can take it with them and use it during small leaks in their daily schedule (as opposed to doing all documentation at one after work). As a result of the workshop, the physicians also came up with proposals for organizational support of using the app for reflection. One of these proposals was to establish a regular meeting in which documented talks should be reflected on – according to one physician, this would also motivate colleagues to use the app, as they would know that there is an event in which they get feedback on their talks from others. This does not only show the fit of the app into physicians’ work but also indicates acceptance of the tool. Overall, the participating physicians stated that they liked the app and volunteered to take part in follow up workshops and a field test.

In the **second workshop**, in which three physicians took part (two from the first workshop and a different assistant physician, while the other assistant the workshop because of an emergency case), we asked the physicians to work through a script, using an improved version of the app. This script included the different phases of the collaborative reflection process blueprint (Figure 3) and linked them to the respective functionality of the Talk Reflection App. In particular, we seated the participants on the same table and asked them to enter one or more recent experiences, to *individually* reflect on them and articulate outcomes of this reflection by adding comments to the documentation. Switching to *collaborative* reflection, we asked them to share their material with others, to annotate others’ material and discuss the documented cases verbally by referring to the documentation shared in the app. To conclude this collaborative reflection, they were asked to create an outcome as shown in Figure 7 by writing it down in the app and linking relevant material to it. This approach was meant to simulate app usage in the real context of the physicians. In addition, we asked them to focus on whether the app could foster their discussion and reflection.

After the workshop, we interviewed the physicians about their experiences with the app and about how it could be integrated in their daily work routines. In general they were satisfied with the improved app and were looking forward to using it as part of their daily work. Discussing situations in which they could use the app, they developed a schedule for meetings in which documented cases could be reflected collaboratively. Besides this plan, which shows that the app fits the needs of the physicians, they asked for stronger scaffolding of articulation and a more differentiated input form including selection options for categories of the talks (e.g. “Information”, “Report about diagnostics”, “Discussion about therapy options”) in order to produce more structured documentation and better refer to it in later reflection. Moreover, they asked for a function to mark up certain parts of longer documentations

separately, e.g. as good practice, and share these with others, differentiating between different groups to share content with. This again shows the adoption of the app and the importance of articulation in collaborative reflection.



Figure 8: A physician using the Talk Reflection App on a tablet device during the second evaluation workshop.

While both of the evaluation workshops were conducted in a formative approach, they already show that the tool and the process it is based on can support collaborative reflection in healthcare workplaces: The physicians envisioned scenarios in which they wanted to use the app, they asked for adaptations to fit it even more to their needs and they liked the flexibility of taking the mobile app with them and documenting or reflecting in a time chose by them. This suggests that the intentions of the app as described in section 5.2 can be fulfilled in the hospital.

6. CONCLUSION AND FURTHER WORK

In this paper, we presented an approach in supporting collaborative reflection at the workplace as a means to improve work practice and create knowledge in organizations. Regarding the lack of insights into the practice of collaborative reflection and tool support for it, we used an exploratory approach to shed light on this topic. In order to show concrete options of support, we focused the description on a study done with a German hospital and complemented this with other studies done in parallel.

As we found, collaborative reflection in healthcare (and other workplaces) is characterized by a mixture of scheduled settings such as meetings and unscheduled occurrences of reflection such as spontaneous conversations on the hallway. We also found that in healthcare work, a special focus has to be set to unscheduled occurrences, as these happen more frequently than e.g. meetings. From the study, we derived a taxonomy for different modes of collaborative reflection, a model of topical levels in collaborative reflection covering episodic, case-based experiences and comprehensive topics and a blueprint describing the steps and course of collaborative reflection in practice. Most important, we emphasized the need to support articulation for collaborative reflection. We also showed how tools can support this task in healthcare workplace by describing a prototype for the reflection of physicians. As the feedback of users shows, the tool suits the various needs of this workplace well and was embraced by the physicians. Given the similarity of different modes of reflection and other aspects between healthcare and other workplaces we found in our studies [18, 19], our results also suggest that the tool – with slight adaptations – can be used as general support to reflect conversations in daily work and improve them. Examples of such conversations could be talks with clients or suppliers.

The results presented here show how tools can support collaborative reflection in different contexts. At the time of completing this paper, we prepare a field test of the app in the hospital, including an evaluation of app usage in different contexts such as spontaneous collaborative reflection or meetings. In further work, we will also evaluate it in different domains. Currently, additional evaluations are planned for domains such as care for the elderly, telecommunications and IT consulting.

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