
Linking Reflective Learning and Knowledge Maturing in Organizations

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Abstract: Reflection is a key activity for learning in organizations. While technology support for reflection on the individual and collaborative level is promising, it remains challenging to embed these learning activities into the organization. To better understand and support reflection in the workplace, it is important to see the mutual dependencies between reflective learning activities and knowledge maturing. In this paper, we seek to bridge the gap by presenting a conceptual model linking reflection and knowledge maturing. Based on the model we put forward three propositions: In reflective learning, expertise moderates knowledge maturing, discrepancies between knowledge elements trigger reflection, and the maturity of knowledge used in reflection influences the reflection process. We use findings from empirical studies in two care homes to support the propositions. We address implications for the design of technology enhanced reflection support by discussing a prototype reflection tool for care homes.

1 Introduction

Reflection is a key learning activity for organizations, but generally not very well performed or supported [1]. Reflection allows organizations to implement continuous improvement with double loop or deuterio learning [2]. Critical and collaborative reflection is necessary because organizations have to operate in complex situations of change, with multiple stakeholders and interests [3]. Reflection is currently mostly approached from an individual or collaborative perspective, focusing on individual participants and the micro-level of learning. How reflection is embedded into the organization and contributes to the organization's goals remains rather challenging.

Knowledge maturing [4] describes knowledge development within and across organizations from a macro perspective. It concentrates on the evolution of knowledge from early ideas to standardization. The framework bridges bottom-up, individual and group driven knowledge processes with top-down organizational perspectives and is a good candidate for exploring the connections between reflection and organizational knowledge development.

The goal of this paper is linking the micro-perspective of reflective learning with a macro-perspective that embeds reflective learning processes into the organization. We

present an integrated model of reflective learning and knowledge maturing. We outline theoretical perspectives (section 2) and present a conceptual model and three propositions (section 3). We next present two cases (section 4) and use them to illustrate how our key propositions give insight about the cases (section 5) with implications for technology support (section 6). We conclude in section 7.

2 Background

In this section we provide a background for our research contribution, addressing existing work on reflective learning and knowledge development in organizations. We identify a gap in current research with regard to how these processes are connected and argue that research on knowledge maturing can be used to fill the gap.

Reflective learning can be considered as the *conscious reevaluation of experience for the purpose of guiding future behavior*, acknowledging the need to attend to feelings, ideas and behavior [5]. The essential role of experience and reflection in learning has long been recognized [6, 7]. In the workplace, work and reflection on work feed into each other in reflective learning [8, 9].

Reflection can be individual, but can also be a collective activity [10] involving the articulation and sharing of experiences, and collaborative knowledge construction (e.g. [11]), and also involves transitions between levels in the organization [12]. Reflection on work can be considered as interconnected learning cycles in which work experience is reconstructed and re-evaluated in reflection sessions (individual or collaborative) and the outcomes are fed back into work. Reflection cycles differ in their characteristics, with implications for what types of tool support may be adequate [13].

Whereas individuals and groups may reflect to reconstruct and elaborate experiences and thereby contribute to work-related problem-solving, an organizational perspective on reflection sees reflection as a way of addressing organizational matters and the implementation of structures and collective action: reflection is a collective capacity to question assumptions [10]. Key differences between the organizational, collective and individual perspectives on reflection include the type of reflection contents, access to the contents, and the language used [10]. These differences are related to the degree to which the knowledge involved is explicit, shared and formalized.

To understand reflection at work, it is necessary to see the bottom-up and the top-down perspectives in combination. The structures and collective actions implemented from an organizational perspective have to support reflective processes as seen from an individual and collaborative perspective [10]. Supporting reflection from the organizational perspective means creating the opportunities for employees to question current assumptions and knowledge. There is a trend for increasing decentralization of problem-solving in enterprises, which implies a need for active reflection processes challenging and confronting existing knowledge [3]. Whereas a standard process might be automated, more knowledge-intensive processes are hard to pre-define, and they emerge and change in unforeseen ways due to the knowledge developed throughout the process. Certain work-processes are in addition emotionally intensive, thus parts of the process needs to be adapted in the interaction between people there and then. Processes can 'move' through increased process maturity (as a process is better understood, and thus possible to formalize to a larger degree) or through break-

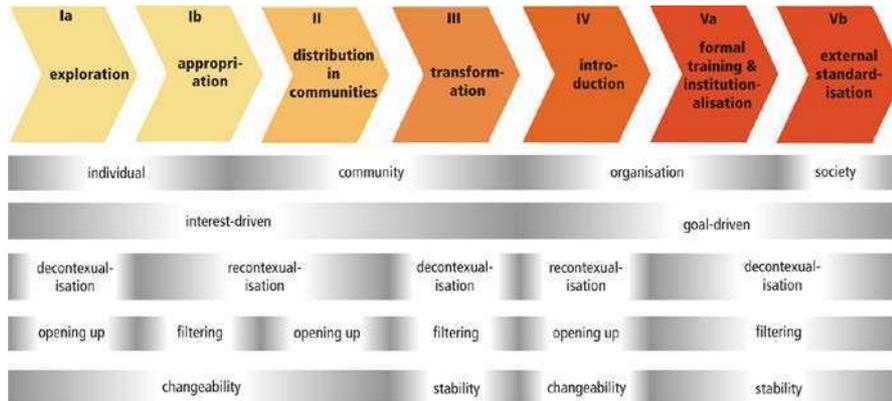
down in the underlying assumptions behind a formalized process, leading to a work-around. Workarounds can have positive effects (e.g. triggering reflection to instill improvement in the processes) or negative effects (on compliance, security and safety).

To understand and support reflection, then, taking into account the organizational perspective as well as that of individuals and groups, it would be helpful to explore in more detail the connection between reflection and knowledge in an organization. The reflection cycle model in [13] does not explicitly address the role of knowledge in the process. Research addressing the use and development of knowledge through individual and collaborative learning [11, 14] is not directed at reflection in the workplace. An adaptation of the model of Stahl has been developed [15] to show how reflection acts as a catalyst for organizational learning on a general level. What remain open are the more detailed connections between reflection and knowledge development, as well as implications for the design of technology support.

Nonaka and Takeuchi's theory on organisational knowledge creation [16] link knowledge to human activity. Central to their theory is that organisational knowledge is created through a continuous dialog between tacit and explicit knowledge performed by organisational "communities of interaction" that contribute to the amplification and development of new knowledge. They also identify four patterns of interaction between tacit and explicit knowledge commonly called *modes of knowledge conversion*: Socialisation (creating tacit knowledge from existing tacit knowledge through shared experience), Externalisation (conversion from tacit (or unstated explicit) to explicit knowledge), Combination (creation of new explicit knowledge from existing explicit knowledge), and Internalisation (conversion of explicit knowledge to tacit knowledge)

The internalisation mode of knowledge creation is closely related to "learning by doing"; hence the internalisation process is deeply related to action. When tacit and explicit knowledge interacts, innovation emerges. Nonaka proposes that the interaction is shaped by shifts between modes of knowledge conversion. Adding Nonaka and Takeuchi's ontological dimension of knowledge creation, we end up with the idealized *spiral of organisational knowledge creation*, which shows how the organisation can mobilise tacit knowledge created and accumulated at the individual level, organisationally amplified through the four modes of knowledge conversion and crystallised at higher ontological levels. Thus the authors propose that the interaction between tacit and explicit knowledge becomes larger in scale as the knowledge creation process proceeds up their ontological levels. The spiral process of knowledge creation starts at the individual level and potentially moves upwards through expanding interaction communities crossing sectional, departmental, divisional and possibly organisational boundaries. Note that it is not given that we want all knowledge to move to the organizational level

Knowledge maturing is a perspective on knowledge development that aims at bringing together the manifold forms of knowledge inside organizations. Following Nonaka's knowledge spiral [16] the knowledge maturing perspective describes knowledge development as a process that can be structured into discrete phases, each of which have different characteristics. Knowledge development starts with *exploration* (Ia) and *appropriation* (Ib) on an individual level, referring to the *emergence of new ideas*. After the *distribution in communities* (II), knowledge gets *transformed*



(III) for further outreach, and in phase IV, it enters the organization’s scope with ad-hoc training (for a more instructional path) or piloting (for a more experimental path, e.g., for process knowledge). In phase V, knowledge first gets *institutionalized* within the company, and finally it moves to *external standardization*.

Fig. 1. Knowledge maturing phases and its characteristics (from [17])

Knowledge maturing connects the characteristics of each of the phases to forms of learning and to characteristics of design tools, and shows what has to be accomplished for a transition. This leads to the insight that learning in early phases is more appropriate for those who have high level of expertise in the relevant area, while mature knowledge allows interaction with those considered novices.

Knowledge maturing not only considers the knowledge level, but also the artifacts that represent knowledge, such as notes, and documents, but also process models, or tags or taxonomy terms. While similar development phases can be identified in artifacts, e.g., associated with their formality, the relationship between knowledge and artifacts is more complex: artifacts can use a level of formality that is not appropriate for the knowledge maturity it represents, which has been found to be a common problem in enterprise information and knowledge management.

Furthermore, knowledge maturing also identifies activities that contribute [1]. One of those activities is “reflect on and refine work practices”. Looking at work process knowledge, one first attempt to analyze the connection between knowledge maturing and reflection has been made in [18] based on an empirical study in a hospital, and it was found that the maturity of process knowledge influence the quality of reflection.

Knowledge maturing is a promising perspective on knowledge development to better link reflection to organizational knowledge development. Particularly the identification of different characteristics of knowledge at different stages of maturity, based on [15, 18], are important starting points for a further integration. However, to provide guidance for design of reflection tools we need to look further at the interplay between the individual and the collective level, which we will address in the following section.

3 A Model Connecting Knowledge Maturing and Reflection

In the previous section, we have identified that knowledge maturing appears to be a promising perspective to linking reflection with organizational knowledge development. For informing technology design for supporting reflection, we need to have a closer look at how elements of a reflection process are influencing and are influenced

by knowledge maturing. We concentrate here on the interplay between the individual and the collective level. Towards that end, we have created a model by digesting the theoretical findings as outlined in the previous section and iteratively refining them with empirical findings that will be used in the following section.

As depicted in Figure 2, we have introduced the two main levels: the individual level and the level of collective knowledge. On the individual level, it is useful to distinguish between *experience*, *expertise*, and *background motivation*. An important basis for reflection is the set of individual experiences, an experience being “the total response of a person to a situation, including behavior, ideas and feelings” [5]; reflection addressing single experiences as well as conglomerates of experiences [19].

Individual *knowledge* develops from an aggregation of these experiences, but experiences clearly go beyond knowledge as they capture the context in which they have been made. Individual knowledge and experiences in turn, form part of *expertise*. This is in line with [20] who identifies *knowledge*, *experience* (as in how long / how many times one has been doing something), and *problem solving* as fundamental components [20]. *Background motivation* finally captures that reflection on the individual level is not only connected to expertise, but has an underlying complexity of goals/motives of the individual. This is particularly important as early phases of knowledge maturing are driven by individual motives [17].

On the collective side, knowledge maturing adopted a pragmatic view that collective knowledge is an abstraction of individual knowledge of the members of the collective [21]. The relationship is not a simple sum. Individual knowledge can exist without turning into collective knowledge, if it does not become effective on the collective level (e.g., knowledge related to private activities). On the other hand, collective knowledge always depends on the learning of individuals.

Artifacts are manifestations, touchable or visible items, either in physical or electronic form [17]. They are important to communicate knowledge and to construct new knowledge. Their relationship to knowledge is not an easy one: they can represent knowledge (both on the individual and the collective level). But while the notion of knowledge maturing would suggest that artifacts that represent more mature knowledge is also more formalized, less mature knowledge can be over-formalized (e.g., formal process models of not well understood processes), while mature knowledge might lack an adequate representation.

To characterize reflection, the *reflection session* as a time-limited activity, planned or spontaneous, individual or collaborative has been introduced [13]. Reflection sessions are often connected to each other, which is in line with the basic assumption of interconnected learning activities in the knowledge maturing perspective. An important characteristic of a reflection session is the *object of reflection*, i.e. “what is the reflection about”. This object can be on different levels of abstraction [22] and is usually connected to some knowledge element in focus. In the reflection session, individual work experiences, other relevant knowledge and artifacts, to which we refer as the *background* of reflection, are used to (re)construct and re-evaluate the object. The *Outcome* of reflection involves a change in individual and/or collective knowledge and artifacts. Not each advancement on the individual level leads to advancement on the collective level, and collaborative reflection may lead to differing outcomes for individual participants. *Triggering* of reflection happens when people

perceive a discrepancy [15]. In the workplace, these triggers may have various reasons, such as needs for sense making and problem solving related to work tasks [23].

Based on these basic conceptualizations, three main propositions have been derived based on a theory-driven analysis of real-world examples, which characterize the relationship between reflection and knowledge maturing:

Proposition 1) Expertise moderates knowledge maturing through reflection.

Following the observation from knowledge maturing that expertise has a major influence on individuals' capabilities to interact with knowledge of different characteristics, we can also find different approaches to reflection between novices and experts in a field. Novices tend to take collective knowledge for granted, and reflect on their understanding and internalisation of the collective knowledge, while more experienced individuals also challenge existing collective knowledge. Particularly in collaborative reflection sessions, it is important to consider that novices will bring in unfiltered and less interpreted experiences, but will need more experienced individuals to actually bring about the development of collective knowledge.

Proposition 2) The maturity of knowledge used in reflection moderates the reflection process.

Generalizing the findings from [18], the maturity of knowledge that is the object of reflection (and to a lesser degree also the maturity of background knowledge), influences the reflection process. On a general level, more mature knowledge appears to have more authority and legitimacy [4]; on a more specific level characteristics of maturity phases such as changeability vs. stability, opening up vs. filtering, or interest-driven vs. goal-driven influence how individual experiences are related to the knowledge, and how easy knowledge is further developed. The same experiences relating to immature knowledge may lead to advancing the knowledge, while they might get rejected if interpreted with respect to more mature knowledge.

Proposition 3) Discrepancies between knowledge elements trigger reflection and thereby affect knowledge maturing.

As identified, discrepancies between the actual and the expected are a major trigger for reflection. Our integrated model provides more specific insights in how discrepancies between different *knowledge elements* (i.e., collective knowledge, artifacts, individual experiences, knowledge, or expertise) might be exploited to trigger reflection:

Discrepancy between collective and individual knowledge and/or experiences can lead to challenging the collective knowledge and thus developing it towards a higher degree of maturity. It can also lead to individual learning from collective knowledge, and to increased knowledge in appropriating collective knowledge.

Discrepancy between collective knowledge and artifacts include over-formalization, when artifacts are presented to be more mature than the knowledge they represent, particularly if associated with requirements for compliance. This can lead to challenging the knowledge/artifact, workarounds, and to re-developing the artifact. Discrepancy between collective knowledge and artifacts can also result from under-formalization, e.g. when information is not appropriately recorded. This can lead to re-development of the artifact. Also the characteristics of interaction can differ from the characteristics of knowledge, e.g., when knowledge is in a phase where

changeability and openness prevail, but the interaction possibilities restrict this, e.g., through access rights and lack of possibilities for contribution.

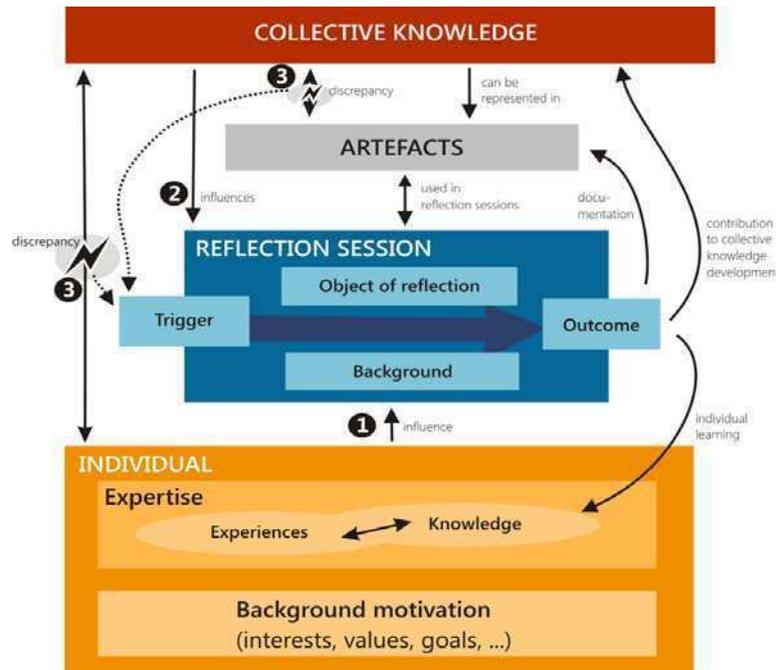


Fig. 2. A model connecting knowledge and reflection

In the next section we present two cases from care homes. This is a type of workplace in which reflective practice is relatively established and recognized as important, giving good opportunities to collect data on the interplay of reflection and knowledge maturing. In Section 5 we use the cases to illustrate the relevance of our three propositions.

4 Cases: Work and reflective learning in two care homes

In this section we present two cases from care homes: Case 1 (The Rose Garden) and Case 2 (The Community Care Home). The homes are located in different European countries. The residents of the homes are generally elderly people, many suffering from dementia. Our focus in both of the cases is the work of the carers. This section presents the research approach and gives some general context about the two cases.

4.1 The Rose Garden Care Home (Case 1)

We conducted an exploratory case study addressing work and reflection among carers at the Rose Garden, a small-sized, private residential care home. We observed over

two days, mainly in the lounges in which the residents spend most of their day receiving care from a team of carers. We conducted brief interviews and talked informally with different categories of staff (including owner, manager, and nurses) when possible. We collected data on the (at the time largely paper based) information infrastructure. Photography and note taking were restricted due to residents' privacy.

Three in-depth interviews (each 60-90 minutes) with carers (C1, C2 and C3) about their work and workplace learning are the main source of data from the case. C1, who had been working in the home for three months, is in her early 20s. C2, having worked in the Rose Garden for about a year, is in her mid 20s. She is a team leader in the home and an educated nurse from her home country, waiting for accreditation to be a nurse also in her current country. C3 is a senior carer in her mid 40s, with many years of experience from care work. The three carers were selected to cover different degrees of experience, and was the largest group that could be taken out of their daily work for interviews. The interviews took place in the lunchroom, largely undisturbed, and were audio recorded and fully transcribed.

A prior study exploring the data from the care home from a different research perspective indicated that the relationship between carers' reflection and the development of knowledge in the organization were important to the reflective learning. This along with the theoretical work presented in Section 3 guided a detailed data analysis of the carer interviews with a focus on key aspects from the model in **Fig. 2**. The analysis confirmed the relevance of the propositions presented in section 3; we selected an illustrative set of examples in section 5. In what follows we provide a brief description of relevant aspects of the work and learning practices at the Rose Garden, to give a context for the examples:

In the country of this study, there are no requirements for formal qualifications to start working as a carer. The majority of the care staff at the Rose Garden is young and inexperienced (e.g. C1), and the turnover is high.

Carers and residents spend much of their time in daily lounges. Medical supervision and administration of drugs are done by a nurse. Medical status information about residents is documented by the carers in various charts/reports. One of the carers on the team is team leader (e.g. C2) responsible for coordination and reporting. There is one senior carer (C3) in the home, acknowledged for her expertise. She is consulted by less experienced carers on care work, and by management to help e.g. in changing a care plan or take care of a difficult conversation with relatives of a resident.

The carers often have to handle challenging situations with residents. This requires knowledge about the resident (e.g. life history, prior interests) and general knowledge about care work. The Rose Garden follows a philosophy of person-centered care: Focus is the person with her life history, interests and integrity [24] To convey the care principles internally to staff and externally in marketing, a model of person-centered care is used. A diagram of the model is found on the wall in areas frequently visited by staff and visitors. The model includes a representation of the main psychological needs of people with dementia (see description in Section 6), connected to the process of care work, with *personhood* as a core element. The model is generally focused on care *principles*, not detailed procedures.

Doing care work in the lounge, the carers talk aloud. They explain to the residents what is happening and frequently ask their opinion or consent, in line with person-

centered care. The carers also update each other, explaining about episodes that they have experienced or been told about. The work in the lounge facilitates coordination that enables the carers to help each other out. The information sharing also helps the carers develop individual and shared knowledge of the residents.

Care work is mainly learnt by doing and from observing peers. The first week as a carer is spent following a more senior carer. After that the newbie starts doing care work. On-the-job training and reflective learning are strongly encouraged, the owner being actively involved in staff training. In the daily morning meeting with the care staff, the manager goes through the status of all residents, and then typically facilitates a general session on care work, linking recent events and current issues to the more general care principles pushing phase V knowledge (see fig. 1) to the attention and repeating key points from the bi-weekly lecture. The carers participate with answers, questions, and comments, e.g. on their individual experiences. The information shared in the morning meeting provides a rationale for action, e.g. for carers to handle immediate issues or for the manager to change care plans.

4.2 The community care home (Case 2)

Following the study in the Rose Garden care home, we have conducted an exploratory interview with a senior elderly care nurse in a community care home operated by a non-profit association. It houses about 75 residents. It is not specialized on any type of residents.

The researcher had prior contact to the care home so that the interview, which lasted for about one hour and was conducted outside the care home, could be focused on aspects of reflection and knowledge maturing. A second researcher took notes.

The care home is characterized by stability, both in terms of residents and staff. Some of the residents have stayed for about 20 years, and the last new full-time staff member started three years ago. Staff is composed of a mixture of certified elderly care nurses and care worker with little training in addition to on-the-job training.

However, the care home is currently undergoing a change of its processes, facilitated by an external consultant, to better accommodate to legal requirements, which favor a documentation-centric quality management for control. These changes particularly address an insufficient level of documentation of care activities and improvement processes, while care quality as such is not perceived as an issue.

5 Illustrating our Propositions with Findings from the Cases

In this section we illustrate the relevance of the propositions presented in Section 3 by referring to examples from Case 1 and Case 2. The examples originate in the interviews and observations. For the sake of illustrating our points we have occasionally combined elements into a more coherent narrative than what is found in the raw data.

5.1 Prop. 1: Expertise Moderates Knowledge Maturing Through Reflection

Case 1 illustrates how carers at different levels of expertise use organizational knowledge at a high level of maturity, e.g. the care principles outlined in the model of personalized care, in different ways when reflecting on experiences from care work.

The new carer C1 says: *“If we work every day and do not use [care model], we would be like a robot, not being happy about the job, not working from the heart.”* One day when C1 interacts with a resident in the lounge she finds that he reacts unexpectedly. She tries to do the things that normally make him at ease. However, nothing works; the resident is obviously still in a distress. The carer is confused. (As she later explains in the interview: *“I know the resident, I know when something is not right.”*). She asks the other carers in the room, who explain about a change in the medical condition of the resident which might have had some effects on his behavior. One of the other carers explains about how she approached a similar situation with another resident the month before, and that it worked well. The explanation from her colleagues makes it easier for C1 to understand the behavior of the resident, and she starts approaching him in a different way. This works better. In the following morning meeting, the status of the resident is discussed. The manager explains about his condition. A carer illustrates the challenges with an episode from the day before. The manager suggests a couple of measures that should be taken in the interaction with the resident. Doing so she reminds about the importance of respecting his personhood and asking his consent, as described in the care model. The young carer C1 now feels she understands even better the residents’ reactions the day before.

C1 is learning the care principles by heart and keeps them in a note in her pocket, to be able to prepare for possible questions from the manager or a care home inspector and demonstrate legitimacy as a carer. Key questions for her in the use of the principles include what principles to apply in a specific situation, and how. In specific situations, the general principles are clearly not sufficient, as seen in the example with the resident with the inexplicable behavior. When C1 acquired the resident-specific knowledge about the medical condition, she was able to re-apply the general principle of ‘working from the heart’ in her actions towards the resident, perhaps having slightly extended her individual knowledge of what it may mean.

C3, the senior carer, says about using the care model in practice: *“[it is] about the residents, how you treat them, their dignity, how you can give some activities for them, give them some choice. [] Respect, privacy, dignity for everything.”*

C3 explains that she makes tradeoffs in her work, to “do the right thing” under resource constraints. C3 says that the management is aware that tradeoffs and minor workarounds have to be made in daily work. She thinks carers should learn from each other by *“[picking] the good things!”*. Whether a particular action is good or bad is a result of considering several, possibly conflicting concerns. When the manager involves C3 in work to update care plans, C3 sometimes disagrees with the manager’s suggestions, arguing about the resident’s personhood: *“The person comes first”*.

5.2 Prop. 2: The Maturity of Knowledge Used in Reflection Moderates the Reflection Process

In Case 2, it was recurring in the interview that the relevance of documentation to deliver good care and its role in everyday work is a frequent object of reflection. The documentation is largely prescribed by legal requirements. While employees are determined to deliver the best care possible within time and resource constraints, the artifacts they need to comply with are not perceived as best practice, even though they are presented as level V knowledge. This triggers reflection both on the individual and team levels. The reason why the knowledge is not recognized as best practice could be (i) that the artifact is unclear about the knowledge it contains, (ii) a mismatch between artifact and knowledge (i.e. exemplifying Proposition 3), or (iii) that the maturity of the knowledge is disputed, meaning that making it prescriptive and unchangeable creates conflict. The interview indicates a combination of (i) and (ii): the documentation serves two purposes - one is compliance, which requires much documentation, the other is improving care, for which meetings are more useful. The example shows that a high level of formality of artifacts can lead to recurring reflection sessions which center around the artifacts and their purpose *without* advancing the knowledge the artifacts should represent. Mixing maturity levels can turn reflection unproductive. It may be that the actual knowledge maturity phase indicates changeability (see **Fig. 1**) which is not allowed by the artifacts and their associated prescription. This can be linked to evidence from MATURE [1] that a high level of formality of artifacts (e.g. processes) constitutes a barrier to further development of knowledge.

A contrasting example, in which mature knowledge serves its purpose, can be found in Case 1, in which the care principles play a central role in work and reflection. Institutionalized throughout the Rose Garden, they serve multiple purposes: Providing practical guidance when a carer reflects on her daily work, principles (not procedures) giving some flexibility and encouraging the consideration of a situation from multiple angles. The principles can be connected to concrete examples and individual experiences. The examples, some of which are formalized, help carers understand the principles, and the principles are used to make sense of examples, especially the carers' own, individual experiences. Second, the care principles - used externally vs. authorities and being a clear example of phase V knowledge - legitimize decisions (e.g. to make a change to a care plan). Finally, the principles are used to strengthen the feeling of purpose, motivation and togetherness, e.g. giving meaning to work.

5.3 Prop. 3: Discrepancies Between Knowledge Elements Trigger Reflection and thereby Affect Knowledge Maturing

C3, being an expert, has a lot of individual knowledge enabling her to "read" challenging situations with residents. She is typically able to immediately see from a situation what are the essential elements that will affect how the situation evolves, and what tradeoffs will be involved. The discrepancies of knowledge elements may or may not lead her to reflect and develop her knowledge. It is however clear from the interview that to her, an additional concern is not only the residents, but the learning and well-being of her younger colleagues. The discrepancy between displayed indi-

vidual knowledge to handle certain situations and the collective knowledge needed to do so, is a trigger for her reflection on how to bring younger carers up to the desired level of competence. The learning resulting from C3's guidance of younger carers adds to the organization's ability to train its employees.

C3 furthermore contributes to the development of formalized knowledge in the organization through involvement in the updating of care plans (artifacts). The need for change in a plan is rooted in a discrepancy between the current state of a resident and the effects of continuing to implement the existing care plan. The representation of the state of the resident and the current care plan largely consist of collective knowledge, and often medical expertise plays a key role in the decisions. Still, expertise with care work helps combine and weigh the parts of the often complex picture of 'the whole person' in order to create a good plan.

C2 sees that there is often conflict between the ideals of the care model and resources, e.g. time. *"Yes, it is, it is there. The model is fine [] but if for example I have to ask people if they want a shower or not, some will not give consent even if they are really dirty or soaking wet"*. Goal conflicts (e.g. what priorities have to be made) are often discussed in morning meetings. *"We discuss solutions, alternatives to organize the work. Even <manager> says to keep up quality of work, if a person is not washed in the morning before breakfast we can do it after lunch"*. C2 has individually over time been reflecting on the goal conflicts: *"We can ask [the residents] many times, offer a cup of tea and ask again later, but at the end of the day we have to force it. Being soaking wet on a chair, they will get a sore bottom []. But still, if we are forcing them, we are just considering that we are doing good for the residents. [] But always, when there are inspections [from the authorities] they will look if we are involving the residents in the care. "* C2 reflects on this in our interview: *"If we just have to stick on to theory, the practice is definitely going to be poor. If we are just sticking on to the practical point of view, some or other day the theory is going to be..."* C2 has been talking to the owner about these issues on several occasions and thinks that management understands: *"They do understand []. I just told him, see: [] If somebody will not drink we have to send them to the hospital."*

The difference between C2 and C3 is not just one of expertise in care work. C2, with her nursing background, has more vocabulary to discuss certain aspects of care with the owner, e.g. referring to medical issues and not just the care model. C2 both has the needs of a carer to handle discrepancies between knowledge elements (e.g. need to be on schedule; need to have the residents' consent) and the ability as a carer and nurse to confidently verbalize these concerns, both with management and for collaborative reflection e.g. in the morning meeting. Again we see a link between expertise and the way knowledge is questioned, shared and potentially developed. The case of C2 may illustrate the advantage for knowledge development as an employee can take different perspectives, e. g. by being assigned to two or more roles.

6 Implications for Design

In this section we use an existing tool prototype to illustrate how the insights from this paper can guide the direction of tool design. For that purpose, we use the Flower

Power (FP) app, which is a simple tool for note taking on work experiences in a care home applying the care principles presented in Case 1. The tool links note taking to the psychological needs of the resident (represented as a flower in the model) that must be met in the person-centered care. The app runs offline on an iPad intended to be available in the lounge in which the daily care work takes place. The carers can take reflection notes and examine existing notes whenever they have the time, and one device is to be shared among the carers in the lounge. Every user can read other users' notes. The manager can also read the notes, e.g. to prepare discussions.

The main screen in the FP app shows a key part of the care model – a flower with a petal for each key psychological need of a person [24]. Clicking the question mark on a petal opens a window with text explaining this aspect of care in the same way as in the book and consistently with how it is explained in lectures and morning meetings. If a user clicks anywhere else on a petal, the list of notes associated with that petal is shown. Existing notes may be opened, read, and commented. From the same screen, the user may also create a new note. The header of a note says what care principle is involved. When the user has written the note and saves it, the note will be added to the list of notes for that petal. On the main screen, the number of notes indicated in the respective petal will be incremented. A note can be associated with several petals, if the user thinks the respective care aspects are all relevant to the note.

Considering the three ways in which knowledge maturing impacts on reflection, as identified in this paper (see Section 3), we will briefly outline the directions that could be taken in further developing the FP app to take this into account.

We have seen that expertise moderates knowledge maturing through reflection (Proposition 1) in the care home. An improvement of the FP app based on this insight could go in the direction of allowing users to choose between two levels designed to differentiate the needs of carers at different levels of expertise in care work. One level, more intended for new carers, may be directed at supporting the learning of care principles and the linking of work experience to specific principles. The other level may support the linking of experiences to discrepancies between principles (i.e. mature knowledge in the organization) and experience, and/or between principles.

We have learnt that the maturity of knowledge used in reflection moderates the reflection process (Proposition 2) among carers. Accordingly the tool could support the promotion of notes to a higher level of maturity, e.g. by categorizing notes into two or more levels. A second level might reflect that the contents represent knowledge recognized on a community level. A possible third level could be notes taken into account in organizational development. Importantly, promotion to a higher level of maturity would not imply just sharing the note, but also transforming it through processes involving reflection, e.g. individually by the manager or collaboratively in a team meeting. In doing so, the origin could be preserved by keeping links to the original notes at a lower level of maturity to facilitate understanding of the rationale. Linking to the original experiences and ideas is simultaneously a way of acknowledging the role of contributors in the process, making the impact explicit. A promotion of knowledge to a higher level of maturity is likely to change the object of reflection towards the more abstract/general. However, the form of a note could still be a narrative of a single experience, if it is recognized as fit for conveying the message in an effective/interesting way, i.e. serving as a representative example.

Finally, in the care home, we found discrepancies between knowledge elements triggering reflection and thereby affecting knowledge maturing (Proposition 3). To support this in the tool, knowledge-related reflection triggers could be made explicit by supporting the linking of notes to artifacts, knowledge and experience perceived to be in conflict. The linking could help carers, as they write reflection notes, make sense of the discrepancies. Describing discrepancies in the shared, organization-wide language provided by the care principles may create greater awareness of discrepancies as the notes are read by colleagues and possibly trigger their reflection. Referring explicitly to discrepancies also supports the transformation to higher levels of maturity by linking work experiences to more general patterns (e.g. “a X vs. Y conflict”) which might be used to structure the higher-level notes.

The discrepancies seen in Case 1 involve concerns that are not explicit in the flow-er model. This indicates a need for the app to support explicit referencing to other care principles applied in the carers’ reflection on work, for instance *personhood*, which is also a key part of the model of personalized care applied in the home. The set of concepts to which examples and discrepancies can be linked must be large enough to capture conflicts between the ideals and the reality of care work, suggesting that concepts such as *time* and *consent* may be included.

7 Conclusion

In this paper, we have shown that knowledge maturing provides a useful framework to embed reflection models into the overall organizational knowledge development. The integrated model that has been developed in section 3 reveals important insights about how the organizational perspective and the individual perspective interact: (1) individual expertise moderating reflection and its contribution to knowledge maturing, (2) the maturity of collective knowledge involved in reflection sessions moderating the reflection process, and (3) discrepancies between individual knowledge, experiences, artifacts and collective knowledge being triggers for initiating reflection sessions. Qualitative empirical research in two care homes underpinned the relevance of the propositions in real work settings.

These insights are important foundations for designing reflection support in organizations, both from a technical design point of view, but also from an organizational point of view. Such reflection support has to be aware of (i) the expertise of the individuals involved, and of (ii) the maturity of knowledge that is reflected upon and developed further as part of reflection. Ignoring the different characteristics of reflection resulting from varying levels of expertise and knowledge maturity may result in barriers to productive reflection. Furthermore, the integrated model also provides hints how conflicts between collective and individual perspectives trigger reflection.

Future work will refine the model by applying it to other types of cases, with a focus on its descriptive power in analyzing reflective learning and knowledge development, and its utility in informing the development of technology for reflective learning. The findings in this paper may be used to enrich current models on reflective learning as well as models of knowledge development in organizations.

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