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Studying evolving Knowledge Infrastructures

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Aknowledgements

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Kinga Horvati
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Abstract

This master thesis is about studying evolving knowledge infrastructures, through a case study at Ahus (Akershus University Hospital). The hospital integrated the knowledge repository, PPS (Practical Procedures for the nursing service) and the core information system for nurses work, the Electronic Patient Record (EPR) as part of establishing a comprehensive knowledge infrastructure to support professional knowledge work. I studied how the integration was implemented and explored nurses’ understanding and perceptions about when, how, why they use the integrated information systems, and how this adds to the already existing complex knowledge infrastructure at the hospital. The idea of integrating a knowledge repository in the core information system of health care workers, and thereby their core work processes adds to the notion of understanding technology-mediated knowledge practices in knowledge intensive organizations. The study draws on theoretical and methodological resources from the intersection between learning in organizations, organizational sciences, and information systems studies.

The main purpose of introducing the integrated PPS-DIPS was to improve quality of the given health care by promoting and facilitating evidence-based practice, staff development and use the clinical procedures. The empirical material and my analysis illustrates that it is possible to fulfill these purposes, if the organization, managers in charge and users reflect on the existing affordances in the knowledge infrastructure and build further on the social organizing of work processes in the infrastructure.
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1. Introduction

This case study is set out to explore and investigate what happens to knowledge practices as AHUS' (Akershus University Hospital HF) introduces a repository for practical procedures for the nursing service, as part of establishing a comprehensive knowledge infrastructure. The study draws on theoretical and methodological resources from the intersection between learning in organizations, organizational sciences, and information systems studies.

1.1 Background

I have been working as an IT –consultant in a medium-sized hospital for ten years. I experienced the complex and complicated world of professional knowledge work in the hospital, with traditional hierarchies, need for specialization and division of labor, but at the same time more and more need for cooperation and coordination between disciplines. I also participated in many IT implementation projects, often pilots, trying to improve work processes by providing solutions like document management, electronic patient record, operation planning system, economy and resource management systems, electronic procurement system and so on. Simultaneously the hospital had to upgrade and integrate their basic infrastructure, old and new IT-systems had to interact, often in order to serve the always ongoing reorganizing projects. I recognized the fact that emerging new technologies alone are by far not enough to handle this complexity.

My studies at the UiO, and the interdisciplinary Tool -program provided insights in the interplay between organizational, technological and pedagogical aspects in change processes in which information technology is present. I was introduced to theories and methods from the three disciplines involved, and to how skills and knowledge from each can be used as different perspectives, but in relation to each other. This kind of interdisciplinary studies gave me the possibility to explore several fields of interest, such as system design and development, human-computer interaction, organizational development, project management and others. Considering my job experience in addition, my main interest became the concept and practice of knowledge management, knowledge infrastructures and workplace learning.
1.2 Motivation

Quality improvement is not a new concept for health care institutions. Hospitals have worked with quality improvement in many ways and employed staff with such responsibilities for many years. What is new, however, is the rapid increase in the number of these activities and the escalating pressure on hospitals to participate. As part of the hospital’s quality improvement effort, standardized repertoires of clinical guidelines for patient care and staff’s competency development receives much attention. Nurses are well positioned to serve on the front lines of quality improvement since they spend the most time at the patient’s bedside and are in the best position to affect the care patients receive and experience during a hospital stay. The hospital’s main goals with introducing PPS (Practical Procedures for the nursing service) is to promote and facilitate evidence-based practice, staff development and use the clinical procedures to improve representation and documentation of nursing practice in the Electronic Patient Record (EPR) system.

From an IS-perspective in general, the health care sector is a good example for studying new IT-systems, when implemented and integrated with the existing infrastructure. From my interdisciplinary perspective, it is also important to see how these IT-systems become part of work practices adding to the already existing complexity of practices. It is therefore interesting to explore in details how such complexity is handled in the organization. InterMedia’s project in collaboration with the Akershus University Hospital is a case study where the research focus is to understand technology-mediated knowledge practices in professional networks. Adding and using knowledge repositories in the knowledge infrastructure is a subject investigated before (Davenport&Prusak 1998, Davenport 2007, Sveiby 2001) but the idea of integrating a knowledge repository in the core information system of health care workers, and thereby their core work processes, is fairly new, and therefore interesting to study. This thesis therefore aims to explore this topic in greater detail, and provide a better comprehension of how this integration plays a part in the total infrastructure of knowledge and knowing in nursing.
1.3 Research focus and question

My focus in this case study is to explore the perception and use of the PPS tool when integrated as templates in the existing Electronic Patient Record (EPR) system. The goal was to study the challenges and opportunities emerging from the way users received, related to and started to use the newly integrated systems to explore how the PPS becomes part of the knowledge infrastructure of nurses’ work practice.

The research question of this thesis is then:

*How is the integration of the PPS and DIPS contributing to the knowledge infrastructure?*

This question is explorative, in the sense that the empirical material provides a story of how the integration was implemented and at the same time attempts to explore nurses’ understanding about when, how, why they use the integrated information systems.

1.4 The structure of the thesis

In chapter 2 I will present the AHUS–case which is the context of the thesis. I explain about the hospital and the specific ward I studied, and then the visions and organizational changes expected to be realized in the new hospital. I also present the two information systems, the electronic patient record (DIPS), and the practical procedures for nursing service (PPS). Chapter 3 is about the theoretical framework I use in the thesis. I present definitions, concepts and how these terms relate to each other and are relevant in my research about knowledge, knowledge management and infrastructures. I also draw on existing literature about nurses working practice and hospitals as professional knowledge organizations. In chapter 4 I present the research method I used, from the preliminary design to how I actually collected data, the analysis strategy and reflections about my role as a researcher. In chapter 5 I present and discuss the empirical material. It was difficult to choose a framework for presenting data, and I ended up with combining it with the discussion or analysis, because it gave the material a more dynamic form. The challenge was then to be consequent in separating data from analysis. Finally, chapter 6 is about my conclusions and ideas for further study related to the subject.
2. Case setting

In this chapter I will present the Ahus-case, which is part of a larger study exploring evolving knowledge practices mediated by information technology. Ahus is in the process of building a new hospital and at the same time reorganizing their patient care and work flow systems. The information technology infrastructure is an essential means to achieve their visions about the operation of the new hospital. This thesis looks specifically into the integration of the practical nursing procedures with the existing electronic patient record. It sets out to explore if nurses detected changes, advantages, new possibilities, maybe new dysfunctional ties or drawbacks, when using the integrated systems.

2.1 Ahus

Akershus University Hospital (short name Ahus) is a hospital owned by the Norwegian state through the Southern-Eastern Regional Health Authority – Helse Sør-Øst. Ahus has 4200 employees and is located outside the Norwegian capital Oslo. The hospital serves an area of approximately 280 000 inhabitants, and is one of the most rapidly growing regions in Norway. It is estimated that the hospital will serve an area with 340 000 inhabitants by the year of 2015.

Ahus treats about 53 000 in-house patients and 150 000 patients in out-patient facilities each year. The annual budget for the hospital is 2,5 billion NOK. It serves as the local and central hospital for the inhabitants in the region Romerike, and areas Rømskog, Enebakk and parts of Oslo. Ahus has about 515 beds in somatic sector and 196 beds in psychiatric sector. It is one of the largest University Hospitals in Norway with a wide range of specialties, affiliated with The Medical Faculty at the University of Oslo and the Akershus University College and practicum for students in nursing.

The main tasks for the Akershus University Hospital are patient treatment, research and teaching.
2.2 New Ahus

One of the distinguishing characteristics with this organization is major transition as building of a new hospital is currently in progress at the same location. The new hospital will consist of 570 beds and has an estimated building cost of approximately 7,05 billion NOK (2001). The new hospital is due to be opened in October 2008. As part of the building project, Ahus has a stated vision for the new hospital:

“The New Ahus is committed to a clearly professional and high competence profile, in effective cooperation with other health care services. .... The hospital is committed to use the available resources to improve the populations’ health and meet the patients needs. The hospital shall conduct research and education, in cooperation with the university and other educational institutions. The value creation will take place through doing the right things correctly, effective and coordinated. .... New Ahus aims to be, in relation to comparable hospitals, among the most efficient and effective in the country, and will be organized and managed with great dedication” (Overordnet OU-strategi 2001, “Nye SiA - fra visjon til virkelighet”, my translation)

To achieve this ambitious vision anchored in the core values of availability, equity, quality and efficiency as stated in their strategy (SiA, 2001), the organization has emphasized organizational development projects. The main organizing principals for the new Ahus are value consciousness, focus on the new patient role, concentration on the core processes for the hospital, multi-professionalism and teambuilding, cooperation with other health care services, development willingness and quality awareness, focus on learning and development of staff, consistent and integrated IT-solutions, management development, operation efficiency, identifying key functions, (SiA, 2001). The organizational development projects are in progress, and many of their stated goals are achieved. To achieve ambitious visions, information technology is intended to be integrated, supporting and making all processes and routines more effective, in diagnosis, treatment, support functions, knowledge acquisition, knowledge adaptation, documentation, administrative routines and management systems (SiA, 2001). From the point of view of this thesis it is relevant to look at the integration of the PPS in the hospitals Extended Quality System (EQS) as a way of realizing the vision of securing streamlined information and knowledge available at the point of need.
2.3 The ward

The particular ward where I did my empirical work, N-7, is an in-patient unit in the surgical division at Ahus, specialized in urology\(^1\). The ward has 22-26 beds, with patients admitted for elective surgery according to waiting lists and as emergency admissions. The patients have a variety of different urology diagnoses, a lot of them suffer cancer. Therefore, in addition to the wards’ local nursing staff, they engage two nurses specialized in oncology, to ensure both therapy and palliative treatment. The staff consists of 22 nurses and 9 assistant nurses. They are organized into 2 working groups. Every patient is placed in one of the group and assigned a primary attending nurse. The nursing staff has a well coordinated competency development program (klinisk fagstige), for new as well as experienced ones. A “professional development nurse” (fagsykepleier), hereafter called pd-nurse, is responsible for introducing and training new employees at the ward, according to a continuous professional learning and guidance program. The ward offers practicum for students and foreign nurses working for their Norwegian authorization. The ward has several attending physicians and a professor specialized in urology. In addition, a number of resident and senior physicians and medical students see patients in the different wards in the surgical division.

In the new hospital, some important changes will be implemented regarding the functional processes and their workflow. The main idea is the ”patient first – always”. The most important turn will be an increased emphasis on “best practice” or evidence based practice in every level of patient care, and that staff competency should follow the patient. Accordingly, the new way to organize the former wards will be in smaller units. Instead of the former more frontier specific wards, the bed area model will take less consideration to types of disease, creating a seamless ward system. The bed areas will be organized in 28 beds, divided into 4 “bed yards”, each consisting of 7 beds. This means that the bed areas are to be so flexible that there is no need for a change in building structure when change in clinical profession is needed.

The vision document stated that demand for flexibility has to be reflected in use of professional labor, with opportunities for new and more functional division of labor and openness to new and different competency (SiA, 2001). Accordingly, nurses are expected to be “flexible” in the sense of being able to move around from former well defined

\(^1\) Urology is the branch of medicine that focuses on the urinary tracts of males and females, and on the reproductive system of males
communities of practice to step in to different units, when following the patient. This also means that nurses will have to use more of their general competency in addition to several specialized competencies. Of course it will be of great importance that nurses feel confident with all the different working tasks they can be asked to execute. Facing such changes and expectations, it is important to notice the significance of a well functioning knowledge infrastructure, which is intended to secure a supportive knowledge environment for knowledge workers, both nurses, physicians and other professionals in the hospital. The EQS’ component Practical Procedures for the nursing Service (PPS) is a knowledge object, and an important part of the supportive knowledge infrastructure they are creating.

2.4 PPS – practical procedures for nursing practice

PPS (Practical Procedures for the nursing service) is a repository of clinical procedures for documentation and quality assurance of clinical nursing service. As a knowledge repository PPS contains approximately 300 procedures that nurses perform. Each procedure integrates research based knowledge and new evidence, and adhere to legal regulations and recommendations as well as professional guidelines and national standards if identified and available (www.akribe.no, 2008). In addition to describe how to carry out each procedure step-by-step in text, illustrations and animations, there are detailed explanations and a comprehensive learning module providing more information related to the clinical area.

The PPS was presented to the hospital staff about one year ago. The local pool of nursing procedures were paper-based, written in-house, with up to 8 versions describing the same task, some procedures had local additions, and the procedure itself could be more than 10 years old (Størseth, 2007). To systematize and integrate these two repositories of clinical procedures Ahus has initiated a formal project with a project leader from the Competency department, and carried out processes to review and evaluate the procedures, and created one, single repository of hospital wide procedures (PPS). There were appointed 8 working groups to systematically work through each clinical procedure, and then a reference group had the professional approving role. In this process they eliminated old, existing procedures if they were available in PPS, they added explanations or note to some procedures, or they suggested additions to PPS or write procedures accessible in the quality management system EQS only– most likely as a procedure for a specialized department or unit kept critically important procedures reflecting specialized services in departments or units (Moen & Nes, 2007). The InterMedia-Ahus project carried out observations of the discussions and the
negotiation that took place in the working groups and also analyzed the PPS in relation to the changes done in light of the group meetings.

EQS stands for Extend Quality System and it is Ahus’ electronical quality-, and document-management system. The EQS contains process-charts and workflow descriptions, procedure descriptions, reports and guidelines for acting upon discrepancies, decision-making support and so on. EQS is meant to secure quality and provided information on all aspects of hospital work. The approved and consolidated procedures are classified as level 1 procedures in EQS at the hospital and are guiding for developing procedures at level 2. Then after final authorization from the CEO, the PPS was installed as a knowledge repository or a collection of references in the EQS, accessible from the hospitals Intranet. During September November 2007 it was also technically integrated with the DIPS all over the hospital. Training and implementation of the PPS has been carried out in all units, and adapting at every ward by systematizing care plan templates continues all over the hospital.

2.5 DIPS – EPR, nursing documentation and treatment planning

The electronic patient record (EPR) is the principal source of information about a patient’s individual health status, in which the nursing documentation of patient care is an essential part (Lov om spesialisthelsetjenesten, 2001).

DIPS is the electronic patient record and patient administrative system at Ahus. It is a comprehensive system with all the functionality needed to go paperless, and to manage workflow for physicians, nurses, other professionals and office clerks. So far, the system is implemented in more then 30 hospital sites in Norway (www.dips.no, 2007). The system covers a wide range of products, like electronic patient records, nursing documentation and treatment planning, workflow and process management, integrated EPR scanning system, medication and prescription, electronic document interchange (HL7 and XML), mobile solutions for PDA and bedside computing (ibid).

Implementation of DIPS at Ahus was carried out in 2002-2004. It represented a major change for nurses, as they had to redesign many of their work procedures from handwritten, paper-based records to use of the electronic journal. The implemented nursing care plan is a
The purpose of the nursing care plan is to have a reference easily accessible in the clinical setting that describes the patient’s needs and wishes and the nursing interventions that have been planned for the patient, and to assure the continuity of care among caregivers. When introducing the electronic care plan at Ahus, it became necessary to systematize nurses care plans, by working out local care plan templates for each ward / specialization. The practical procedures for nursing service are integrated in the care plan as links from the above mentioned interventions, as they specify the way interventions (or procedures) should be done.

An other major work flow change is the practice of “silent report”, where nurses now rely on almost exclusively written information in the electronic patient record when changing shift.
3. Theory - Review and positioning

In this thesis I wish to study, according to the research question, if and how the integration of the PPS and DIPS is contributing to a consistent and coherent knowledge infrastructure in AHUS.

In order to have a conceptual framework for analyzing the knowledge infrastructure in the hospital, I will first identify some epistemological-sourced classifications of knowledge. Then to get an understanding of the activity around the integrated PPS and DIPS, I will study the concept of knowing as a process. The hospital is a special kind of knowledge organization, and I will elaborate on theories about the professional bureaucracy and the expert-dependent organization, in particular on what kind of knowledge is important and how it is used within the organization. I will also include literature about the characteristics of nurses’ professional work. Evidence based knowledge is gaining acceptance, in the last decade the development of clinical practice guidelines has exploded, in order to improve the quality of health care. I will look into what this means for nurses’ support of knowledge work. I attempt to define knowledge infrastructure, consisting of people, organizational- and technological systems that support the complex interplay of knowledge and knowing. I will review literature about dimensions and properties of infrastructures, and some perspectives of how knowledge infrastructure relates to vision, organization and knowledge management.

Information technology is considered as an enabler, and an important part of knowledge infrastructures. I will draw on theories about exactly how new technologies are used and possibilities for how knowledge work is effected.

DIPS and PPS are the specific information systems in the large and complex infrastructure in this case-study, so I will also investigate what integration of information systems means from an IS perspective.
3.1 Knowledge and knowledge perspectives

To create, localize, use and share knowledge in an effective way is increasingly playing a key role in achieving organizational success. One reason to this development is that there is a constantly increasing number of knowledge workers and knowledge intensive organizations (Alvesson, 2004), because of the growth of knowledge intensive economy and the knowledge society (Drucker, 1993). Herein knowledge is the organizations main resource, as opposed to raw materials, capital and manpower. Another reason is that globalization, quick changes in marked, new technologies, new forms of competition occur daily, and this means the need to renew knowledge in an increased tempo. Knowledge management as a concept and a scientific discipline emerged to acknowledge this fact. Literature on knowledge management is overwhelming in amount, much of it presents “recipes” to how to manage knowledge in organizations. Others have a more critical look and try to ask questions about what knowledge is and if it is even possible to control and manage it (Hislop, 2005).

To define knowledge has been a fundamental question humankind has been reflecting on. Here are some general ideas: Knowledge often refers to what someone knows, think or understand. It resides in the mind and the brain. Knowledge is usually considered as the outcome of learning. Knowledge can be seen as part of the hierarchy made up of data, information and knowledge. Knowledge is then data and information added a layer of intellectual analysis. There is however no single agreed definition of knowledge presently, nor any prospect of one, and there remain numerous competing theories.

Johnston (1998) groups existing knowledge classification systems into three main clusters: administrative/pragmatic, epistemological-sourced and economically-oriented. An example of the administrative classification is an international attempt to report on national research and development, called the Frascati-convention. Classification is made by distinction of ‘basic’ or ‘fundamental’ research and ‘applied’ research, and further on strategic research, and experimental development (Johnston, 1998:13). Economically-oriented classifications provide the basis for an improved understanding of the contribution of knowledge to economic activity. One example is Lundvalls four categories of economically relevant knowledge: know-what, know-why, know-who (when and where) and know-how (Johnston, 1998:16). Another is Sveiby’s classification of the intangible assets of a company in terms of employee competence, internal structure and external structure (ibid).
Taking in consideration my study background and the nature of this case study, I choose to elaborate on some epistemological-sourced classifications of knowledge. According to Johnston (1998: 15) these systems of knowledge are scientifically grounded and hold considerable promise in supporting the understanding and development of improved models of knowledge strategy and management within organizations.

The perhaps most used and quoted category in knowledge literature is the distinction between explicit and tacit knowledge, based on Polanyi’s (1966) original concepts. For Polanyi, the latter is knowledge that individuals possess without being aware of it, or which they cannot easily, if at all, articulate. This implied also that this kind of craft knowledge can only be learned by observation and imitation (Johnston, 1998: 9). Researchers talk about an ongoing discourse on tacit knowledge, and they disagree on the view of tacit knowledge can be made explicit. Grimen (1991), referred to in the KP-Lab Deliverable 6.3 (2007) presents four different interpretations of tacit knowledge. The first one is about conscious under-articulation, something that is consciously avoided in articulation, for example in order to maintain a good relationship between people. In this sense, knowledge is tacit, because nobody talks about it. The second interpretation is the lack of articulating the necessary background by the agent, while doing a certain activity, because background articulation would get in the way of the performance. This kind of tacit knowledge can only be made explicit by others or after the performance. The third interpretation is that one can only articulate small parts of his knowledge systems at any given moment. The rest of his knowledge is then tacit. The fourth interpretation is the one pointing out a logical gap between our capacity of cognition, experience and action, and the capacity for verbal articulation. This means that language is not enough to obtain and transfer such tacit knowledge, and therefore we must also be aware of non-verbal articulation. These interpretations might apply in different learning-/knowledge obtaining situations.

Another categorization of knowledge is the one about knowledge as object and knowing as process. Cook and Brown (1999) states that the epistemology of knowledge cannot account for the knowing found in individual and group practice. Knowing as action calls for an "epistemology of practice." Moreover, the “epistemology of possession” tends to privilege explicit over tacit knowledge, and knowledge possessed by individuals over that possessed by groups. Organizations are better understood if explicit, tacit, individual and group knowledge
are treated as four distinct and coequal forms of knowledge (each doing work the others cannot), and if knowledge and knowing are seen as mutually enabling (not competing) (Cook and Brown 1999). Other researchers make similar notions, for example Gourlay (2000), who calls for a useful conceptual distinction between knowledge representations and knowing-in-action as a transactional process. He suggests the cultural or socio-historical perspective, also known as Activity theory, which emphasizes the importance of the historical, object-oriented and collective nature of human activity and knowledge (Blackler 1993). Activity theory can be seen as providing a way to expand beyond the dualism of viewing knowledge as determined either by an external objective world, or by the power of human rational thought, because it provides a way of showing that both sources are inseparable (Gourlay 2000). It provides a conceptual framework for knowledge as both inherent in and inseparable from behavioral transactions, and as representations of knowledge. In addition, it highlights the historically and socially situated nature of any knowledge management process. Knowledge is seen as situated in communities of practice, in actual ongoing behavior, and in neural form bound to both of these. It is integral to groups and their practices or activities and is therefore effectively inseparable from activity, and thus from the work of managing those activities, and the people who carry them out. Again, therefore, the emphasis must fall on managing the conditions of knowledge production and use. These approaches also recognize the potential role of knowledge representations, and therefore suggest that efforts to manage those, such as in this case study characterize knowledge repositories, may be useful. The use to which such representations are put, however, is what is critical for organizations, and this depends on the human dimensions of the organization (Gourlay 2000).

Blackler’s seminal paper from 1995 elaborates on this too, as he explores the terms knowledge and knowledge work. He distinguishes five different images of knowledge. Embrained knowledge is abstract, dependent on conceptual skills and cognitive skills, generally combined with scientific knowledge and treated as superior. Embodied knowledge is action-oriented and likely to be only partly explicit, it can be acquired by doing and is dependent of context. Encultured knowledge is related to the process of achieving shared understanding, and is embedded in cultural systems, likely to depend strongly on language and hence to be clearly socially constructed and open to negotiations. Embedded knowledge resides in systematic routines, it relies on the interplay of relationships and material resources, and may be embedded in technology, practices, or explicit routines and procedures. Encoded knowledge is recorded in signs and symbols, such as books, manuals, codes of practice, and
electronic records, encoding requires abstraction from other richer forms of knowledge. Blackler talks about the change of emphasis in interests away from knowledge that is embodied and embedded towards knowledge that is embrained, encultured and encoded. He suggests a way to rethink knowledge and organizations, in stead of seeing knowledge as something that people have, knowing is better regarded as something that they do. The unit of analyses should be the socially distributed activity system.

Activity theory, in particularly in Engestrom's interpretation, is a way of studying knowing and analyzing the dynamics of the systems through which knowing is accomplished. Knowing is analyzed as a phenomenon which is manifest in systems of language, technology, collaboration and control (it is mediated), located in time and space and specific to particular contexts (it is situated), constructed and constantly developing (it is provisional), purposive and object-oriented (it is pragmatic) and finally contested (Blackler, 1995). Blackler’s question is how systems of knowing and doing are changing and what responses would be appropriate, rather then asking what sorts of knowledge are needed and how may organizations acquire them.

3.2 Knowledge in organizations

As mentioned in the previous section, knowledge society, knowledge intensive economy, knowledge intensive organizations and knowledge workers are buzzwords today. I will narrow down this chapter to describe the specific type of organizations that hospitals in Norway are, characterized by providing public services, by its highly professionalized occupations, and by intense performance pressure from both outside and inside.

Hospitals are professional bureaucracies according to Mintzberg’s (1983) organizational configurations framework. He describes this kind of organization as institutions where the key part of the organization is the operating core (doctors, nurses etc) and where these have some amount of autonomy and freedom in their job performance. Most of the coordination between the operating professionals is handled by the standardization of professional skills and knowledge rather than standardized output. Another distinguishing feature is that the standards of the professional bureaucracy originate mainly outside the organizational structure, e.g., from the professional associations, emphasizing the power of expertise. As such, important issues are in reality outsourced. Professionals resist regulation by the
technostructure, because it threatens their professional basis of autonomy, but also because their work is challenging to describe in sufficient detail. Change in the professional bureaucracy is difficult to manage, it takes time, for example by changing what they learn in their professional schools, both knowledge, skills and norms.

Blackler (1995) developed a useful 2x2 matrix of knowledge organization types, which adds to Mintzberg structural approach, and provides a framework for considering what type of knowledge is most important to various organization types. The figure below shows how organizations can be classified based on the different types of knowledge. In particular, four kinds of organizations are identified: expert dependent, knowledge routinized, analyst dependent, and communication intensive. Each of these depends on different degrees of embodied knowledge, embedded knowledge, embrained knowledge and encultured knowledge respectively (see previous section about knowledge images).

<table>
<thead>
<tr>
<th><strong>Emphasis on collective behavior</strong></th>
<th><strong>Knowledge Routinized Organizations</strong></th>
<th><strong>Communication Intensive Organizations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Emphasis on knowledge embedded in rules, processes &amp; technologies</td>
<td>1. Emphasis on knowledge ingrained into culture &amp; collective understanding</td>
<td></td>
</tr>
<tr>
<td>2. Typically capital, technology or labor intensive company</td>
<td>2. Communication &amp; collaboration are key processes</td>
<td></td>
</tr>
<tr>
<td>3. Hierarchical division of labor and control</td>
<td>3. Empowerment trough integration</td>
<td></td>
</tr>
<tr>
<td>4. Low skill requirements</td>
<td>4. Expertise is pensive</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Emphasis on contributions of individuals</strong></th>
<th><strong>Expert Dependent Organizations</strong></th>
<th><strong>Analyst-Dependent Organizations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Emphasis on embodied competencies of individual members</td>
<td>1. Emphasis on internalized skills of key members (embrained knowledge)</td>
<td></td>
</tr>
<tr>
<td>2. Status &amp; power from professional reputation</td>
<td>2. Entrepreneurial problem solving</td>
<td></td>
</tr>
<tr>
<td>3. Heavy emphasis on training &amp; qualifications</td>
<td>3. Status and power from creative achievements</td>
<td></td>
</tr>
</tbody>
</table>

Figur 1 Knowledge character in organizations (Blackler, 1995)

Blacklers’ typology is based on the organizations focus on familiar or novel problems, combined with emphasis on collective or individual contributions. According to this framework, hospitals as organizations can be described as a combination of several of these characteristics. Physicians’ work is traditionally contributions of individuals, with focus on familiar problems, status and power from professional reputation, and emphasis on training and qualifications - so the organization would be expert dependent. But even if physicians work is more and more specialized, split into subspecialties (Adler et al, 2008), it is also more
and more interdependent with other professions and therefore more communication and collaboration intensive. Likewise, nursing is also dependent of both individual expert skills and collective, communicative contributions. Hospitals are in addition so complex as institutions, that pressure for hierarchical division of labor and control, and thereby knowledge routinization, is considerable.

Adler & Kwon (2008) studies the evolving organization of professional work in medicine, framed by three contrasting organizing principles and their corresponding mechanisms. These are the hierarchy principle, which relies on the authority mechanism, the market principle, which relies on price and the community principle, which relies on trust. Professional work relies primarily on community, meaning trust relations between professional peers and professionals and clients, but in the structure of real institutions all three principles are present in varying proportions. Adler & Kwon (2008) argues that the community form is particularly effective at knowledge generation and diffusion, while its weakness is the risk of closure. Market principals affords more flexibility, but does not handle well the public goods aspects of codified knowledge. Hierarchy principle affords more control, but does not handle well tacit knowledge’s embeddedness in practice. Adler & Kwon (2008) shows in their article that market and hierarchical pressure reshapes medicine and other professions, as specialization and task interdependency, need for new expertise (technical, administrative and legal) creates pressure to strengthen coordination mechanisms. Clients become also more educated, professional knowledge is more accessible to the public, so the narrowing competence gap means that clients/patients take a more active role in managing their medical conditions. In health care a growing market competition can be observed, as public government demands cost reduction and control, and as a result of recent political-ideological changes, allowing some extent of private financing in health care. On the other hand, growing knowledge-intensity in medicine and even in the broad sense of capitalist development, is a powerful force working to give community continuing, indeed growing influence (Adler & Kwon, 2008). Knowledge workers need community within which to learn skills and norms, and within which they can continually advance theoretical and practical knowledge (ibid). The conclusion of the analysis below is that there is need for new combinations of market, hierarchy and community principles in knowledge intensive organizations and also need for new forms of community, rooted in the quality of their organized collaboration. Adler & Kwon (2008) states that new forms of professional community seems to be moving away
from insular, elitist model and towards greater interdependence with a broader range of stakeholders.

In relation to this master thesis, the idea of new forms of professional community might be useful when analyzing the nursing community at the hospital. Organizational principals at the new Ahus are pointing towards need for more flexibility and more collaboration both inside and outside of the community.

### 3.3 Nurses’ knowledge work

In this chapter I will describe nurses’ work and their relation to knowledge, by looking at nursing practice shown in a process model, the need and demand for documenting the practice, and the growing use of evidence-based practice.

#### 3.3.1 Nursing practice and documentation

Patients are entitled to quality and continuity in health-care. Nurses are the largest group of knowledge workers in health care. A superior task for nursing is that quality of care and nursing for each individual should be the best possible considering available resources. Nursing practice should be justifiable and verifiable. A central and widely accepted concept model, which describes nursing practice is a structured, problem solving approach from 1967, by Yura and Walsh (referred in Björvell, 1999). This process contains assessment, diagnosis, planning, implementation and evaluation.

Assessment

Diagnosis and goal

Planned interventions

Implementation

Evaluation

**Figur 2 The nursing process model (in Björvell, 1999)**
The nursing process model is based on the scientific approach of investigation and goal oriented action. The primary purpose of the model is to relate individualized nursing care to the individual, rather than generalized care based on routines (Björvell, 1999). This model serve as information model in most information system approaches, including DIPS.

Drucker (1993) defined knowledge work as nonrepetitive, nonroutine work that consumes considerable levels of cognitive activity, and knowledge workers as those who are able to critically reflect upon the explicit knowledge of the organization by adding personal, theoretical and tacit knowledge acquired from their own experience. Considering nurses’ work, for example described by the nurses’ process model, consisting of assessment, diagnosis, planning, implementation and evaluation, nurses’ work can be characterized as the combination of scientific or intellectual knowledge and situated, reflective and experiential knowledge to deliver quality care (Brooks & Scott, 2005; Curran, 2004). Literature is pointing out the experiential, problem solving elements of tacit knowledge that become developed and refined through the process of engagement with others as a challenge (Brooks & Scott, 2005). Communication of such experiential, problem-solving knowledge is essential if the tacit knowledge held by individuals is to become actionable and operational within their larger community and organization. Knowledge is not only held by individuals, but is both produced and held collectively by groups of people working together in a community of practice, to achieve a shared understanding (Brown and Duguid, 1991; Brooks & Scott, 2005).

A research project called Professional Learning in a Changing Society (ProLearn) at the University of Oslo, describes how professional nurses in Norway are handling the challenges of a growing amount, new form and complexity of knowledge-rush. In a five-year perspective, nurses see changes in knowledge base and learning requirements related to both new organizational forms in health care and the emergence of new patient groups. They describe their working day as filled with rich possibilities for learning and that relating to updated knowledge is a part of their professional identity. Nurses report on frequent use of paper based and electronical works of reference, when meeting with practical problems (ProLearn, 2007). Through development of local working procedures, which are validated to up to date research in the field, they link to larger knowledge networks and by that made professional update to an integrated and regulating part of the profession. Procedures are used to quality assurance, update and change routines in the everyday patient care. This means the
existence of a knowledge supply which reflects the growing complexity of nurses’ work and which offers relevant resources for learning processes in the practice (ProLearn 2007).

Traditionally, nurses documented on paper their performance of the medical interventions, or observations ordered by the physician. The rationale behind this was to show that the instructions had been adhered to and to inform other nurses or physicians (Björvell et al, 2000). Recently, the nursing profession has moved towards a more independent practice with a clear recognition of nursing contributions. From the year 1999, it is also founded in the Health Personnel Act (1999) (Lov om helsepersonell) the demand of how authorized healthcare personnel are to document healthcare. The act defines documentation as recording, classification, and presentation of patient data. In recommendations drawn from the law, (The Norwegian Patient Record Regulation [Forskrift om pasientjournal], 2000, § 8) the following elements be made explicit in documentation: patient’s status with underlying observations, assessments and decisions, patient problems, planned interventions, and outcomes. The act also provides instructions about the information form. These instructions include that records must be useable for other healthcare workers and must be made available to the patient. Consequently, nurses have to document planned and performed nursing. A qualitative good documentation in nursing is one of the conditions for safety and quality in clinical nursing. It also contributes to more individualized care and patient involvement. With increasing recognition of the nursing components, the documentation of nursing care must include not only timely and accurate recording of the performed interventions, but also the decision process, explaining and evaluating why a specific nursing action was chosen (Björvell et al, 2000, Moen et al, 2008). Assessment or planning the health care is documented in the care plan. Although Ellingsen et al (2007) presents an alternative approach to care plans: they emphasize the process of planning as a collective, ongoing and heterogeneous achievement, more of a network and not the plan as a single artifact. The development in computer technology has led to a goal which requires that the documentation is done electronic. This development means that nurses are now educated in using technology which is necessary to attend to their responsibility in documentation.

Taking a closer look at what kind of IT-artifact or information system the electronic patient record is, I lean on Berg (1999), who states that the tool, in relation with the reading and writing activities of nurses, doctors, laboratory systems, can be seen to perform two roles in
work practices. They *accumulate* inscriptions and *coordinate* activities of other entities in the work practice, and in that way afford the handling of more complex work tasks.

### 3.3.2 The concept of evidence based nursing

Health care institutions in general and New Ahus in particular is under pressure to provide safe and high quality services, which implies a measurement of performance and development of systems to improve quality of care, and at the same time higher efficiency and cost control. To meet these demands, one of the means for higher quality care is evidence-based practice.

According to Sackett et al (1996), evidence-based practice is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. Their article points out that the evidence-based means integrating individual clinical expertise with the best available external clinical evidence from systematic research, and neither alone is enough. Although the authors are explicit in stressing that evidence-based medicine is not "cookbook" medicine, and that external clinical evidence can inform, but can never replace, individual clinical expertise, several authors have problems translating this to evidence-based nursing practice. Ingersoll (2000) mentions some of the concerns in nursing's acceptance and adoption of the principles of evidence-based medicine. The most important is the absolute dominance of positivist thinking and that randomized clinical trials as the only studies worth considering in literature. These are always identified as the most important and most appropriate for use in clinical practice, and also means the absence of qualitative research. Others note the absence of discussions about theory in evidence-derived decision making, both the interpretation phase and the application phase of the evidence-based practice process. Another concern is the possibility of negative ethical consequences because of the loss of individual patient input into decision making. To eliminate these concerns and incorporate the missing dimensions, Ingersoll (2000) proposes a revised definition of evidence-based practice for nursing:

> Evidence based nursing practice is the conscientious, explicit and judicious use of theory-derived, research-based information in making decisions about care delivery to individuals or groups of patients and in consideration of individual needs and preferences. – Ingersoll, 2000; p. XXX

Evidence-based nursing provides practical clinical guidelines that are proven to produce positive patient outcomes. The majority of patient care organizations are required to adhere to
these best practices in nursing to meet today's stringent industry practice standards. Therefore, health care organizations try to build knowledge infrastructures, in order to meet the demand of evidence-base, to streamline knowledge development, distribution and consolidation.

### 3.4 Knowledge infrastructures

In this chapter I will elaborate on what knowledge infrastructure is, and what kind of properties can be worked on to make the infrastructure coherent and functional.

Infrastructure in everyday language is the basic physical and organizational structural elements (e.g. buildings, roads, power supplies) that provide the framework supporting an entire structure needed for the operation of a society or enterprise. The term has diverse meanings in different fields, and it has been applied with increasing generality to suggest the basic internal framework in any technology system or business organization that is built and maintained.

In their article Steps Towards an Ecology of Infrastructure, Star & Ruhleder (1996) offers several properties and dimensions of infrastructure:

<table>
<thead>
<tr>
<th><strong>Embeddedness</strong></th>
<th>infrastructure is “sunk” into, inside of, other structures, social arrangements and technologies.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transparency</strong></td>
<td>infrastructure is transparent to use, in the sense that it does not have to be reinvented each time or assembled for each task, but invisibly supports those tasks.</td>
</tr>
<tr>
<td><strong>Reach or scope</strong></td>
<td>this may be either spatial or temporal – infrastructure has reach beyond a single event or one-site practice.</td>
</tr>
<tr>
<td><strong>Learned as part of membership</strong></td>
<td>the taken-for-grantedness of artifacts and organizational arrangements is a sine qua non of membership in a community of practice. Strangers and outsiders encounter infrastructure as a target object to be learned about. New participants acquire a naturalized familiarity with its objects as they become members.</td>
</tr>
<tr>
<td><strong>Links with conventions of practice</strong></td>
<td>infrastructure both shapes and is shaped by the conventions of a community of practice, e.g. the ways that cycles of day night work are affected by and affect the electrical power rates and needs.</td>
</tr>
</tbody>
</table>
Embodiment of standards modified by scope and often by conflicting conventions, infrastructure takes on transparency by plugging into other infrastructures and tools in a standardized fashion.

Built on an installed base infrastructure does not grow from nothing, it rather inherits strengths and limitations from the already existing base.

Becomes visible upon breakdown the normally invisible quality of working infrastructure becomes visible when it breaks.

**Figur 3 Characteristics of infrastructure (Star & Ruhrleder, 1996)**

The configuration of these dimensions forms an infrastructure, which is without absolute boundary or a priori definition (Star & Ruhrleder, 1996). With this understanding, infrastructure is seen as an ecology of tools, action and built environment. It is not simply ‘a technology’, but is interweaved with and inseparable from social and other non-technical elements. As such, an infrastructure is part of the technological, material and social conditions of practices. Star & Ruhleder (1996) also holds that infrastructure is layered and relational. What is the core resource for one participant, may be infrastructure for other participants. This implies that infrastructure can be transparent, and easy to use at one moment, and the very topic of an activity in another moment (Star & Ruhrleder, 1996). This is central in the authors understanding of what an infrastructure is, or rather when something becomes an infrastructure. Therefore the infrastructure can only be identified in relation to working conditions and arrangements.

Researchers use the concept of knowledge infrastructures in a lot of different ways. In some extent it is used on global and national large-scale knowledge bases such as research networks. But in this thesis I refer to the meaning of knowledge infrastructures, e.g. knowledge tools and social elements, within the organization.

Davenport and Prusak (1998: 114) refers to knowledge infrastructures as including the firm’s libraries, knowledge bases, human and computer knowledge networks, research centers, and knowledge oriented organizational structure. They also use an example from a well-known, global consultant company (Ernst & Young, engaged in assurance, tax, transaction and advisory services) to underline that the technology component is substantial in building knowledge infrastructures, but the human resources issues – setting up human networks, roles and responsibilities – are much more difficult to create and manage.
Sivan’s (2001) agenda is to place knowledge infrastructure in a strategic perspective in the organization. He defines knowledge infrastructures as the set of all successfully implemented interventions, measures, institutions and facilities that represent a supportive knowledge environment for knowledge workers who execute knowledge intensive tasks. These knowledge infrastructures consist of three main dimensions: people, organizational- and technological systems. Practicing knowledge management in organizations can be achieved through the development and implementation of knowledge infrastructures (Sivan, 2001), see figure below:

His related working definition of Knowledge Management is: KM is the art of performing knowledge actions such as organizing, blocking, filtering, storing, gathering, sharing, disseminating, and using knowledge objects such as data, information, experiences, evaluations, insights, wisdom, and initiatives—all of which, though not identical, are, from the point of view of KM, simply items to be managed. In general terms, KM is the performance of knowledge actions on knowledge objects (Sivan, 2001).

In a deliverable (Moen & Toiviainen, et.al. 2008) to the Knowledge Practices Laboratory on knowledge management approaches in workplaces, the authors suggest an expanded notion of knowledge- or socio-material infrastructures. The socio-material infrastructure refers to the social organization of work, like individual and expertise fields, and the material elements of the work, like ICT-systems, documents, as intertwined entities which presuppose each other.
This concept should give an additional useful framework to analyze and design system supporting efforts of evolving knowledge practices (Moen & Toiviainen, et. al. 2008).

### 3.4.1 IT as enabler in the knowledge infrastructure

Information technology is perhaps the most important intervention in managing knowledge in organizations over the last decades (Davenport, 2007). Knowledge workers can create, share and use knowledge almost anywhere and at any time. But according to Davenport (2007) it is still unknown how the new technologies are used and how jobs are affected. Sveiby (2001) tells the story of the IT perspective of knowledge management, which has been going through three rapid phases in the years leading up to 2000: The first phase was inward-looking, focusing on productivity issues - "How can we use IT systems to prevent reinventing-the-wheel?" This phase created a multitude of project databases, best practices databases, Lotus Notes installations etc. The second phase was similar but now with a customer focus - "How can we leverage what we know about our customers to serve them better?" - Data warehousing was the theme of the day. The trouble with the early installations is that all they did was to create massive data and text archives of dubious value, passive and with no interaction. The third phase is from 1999, and now interaction has reached the surface: systems we talk about are Interactive IT web pages, e-business, e-commerce, on-line transactions etc (Sveiby, 2001). On the one hand we can find semantic technologies for representation, search and information retrieval, and on the other Web 2.0 applications for sharing and collaborative creation (e.g. Facebook, MySpace, blogs and wikis). The latter applications have created a new generation of knowledge management tools and application domains, reaching far beyond the original application into workplace settings. This is seen as more promising because the focus of attention leads towards how to maximize the ability of an organization’s people to create new knowledge and how to build environments conducive to sharing of knowledge (Sveiby, 2001).

Davenport (2007) too presents the history of technologies for knowledge work, specifically pointing to knowledge repositories (or databases of knowledge) as first largely successful solutions for managing knowledge. Organizations can store procedures, best practices, observations about the customers, learning from experience, and so forth. The problem with such repositories is that time and attention quickly becomes a constraint. Knowledge workers are too busy to search and consult, and even more to contribute to repositories, which often
grow too large and unpractical. However, repositories are sometimes the probably only possible approach to support knowledge: if the work process is unstructured and collaborative, if it is difficult to determine in advance what knowledge is needed, and if it is no technological application that can mediate the work (Davenport, 2000). One alternative to repositories is *embedding knowledge into the work flow*. Knowledge workers will then not have to seek for knowledge, instead it is delivered to them at the time of need. Davenport (2007) suggests that “when knowledge supports the primary technology-enabled transactions used in day-to-day work, it is no longer a separate activity requiring slack time and the motivation to seek knowledge”.

Looking at the two information systems in this thesis, it is convenient to describe them with Davenports’ classification. The collection of practical nursing procedures, PPS, is a knowledge repository. The electronic patient record (DIPS), and the nursing care plan within, is a system supporting nurses’ work flow itself.

### 3.4.2 Integration of information systems

Integration in general can be viewed as a process of bringing together things such as services, people, data collection tools, data sets, institutions, information systems etc. The traditional definition of information systems integration emphasize on interoperability and interconnection between systems in terms of programs reading and writing on the same file and the use of standards such as protocols for communication (Aanestad et al. 2005). Current literature conceptualize integration as consisting of both technical and non-technical issues contributing to the challenges of integrating information systems and Aanestad et al. (2005) therefore presents a continuum of integration approaches and technologies as varying from tight to loose integration. These challenges are ranging from tension between standards and local adaptation, asymmetric inter-organizational power relations, divergent agenda and interests of multiple actors to intra-organizational conditions, including a blend of institutional, technological, social-economic and cultural factors (ibid).

Integration of information systems in health care has been a justified need, as it is important to share information between systems and across organizations of the health system. Integration should enable better coordination and control of organizational processes and health care delivery. But this fact does not mean that integration is always an achievable goal. As argued
by researchers, “tighter couplings of information systems increase the complexity of the systems and with it the likelihood for unintended effects of any action taken. As a result of these unintended effects, the wished-for integration may not emerge, and the attempt to increase control over fragmented systems may be more or less unsuccessful” (Sahay et al. 2006).

The issue of integration of information systems in the IS literature gives some additional perspectives to this master thesis. It points out that even in the case of very loose technological interoperability and interconnection between systems (as the PPS –DIPS), there are challenges to be considered, in order to achieve a more comprehensive and consistent infrastructure for health care in the hospital.
4. Research methods

To find out how knowledge infrastructures evolve in professional organizations I have been studying the Akershus University Hospital and their implementation of the PPS (practical procedures for the nursing service) integrated with the DIPS (the hospitals electronic patient record system). In this chapter I will describe the research methods I have used, and argue why these have been appropriate for this thesis. I will also describe how I carried out the research in practice, strategy for analysis of collected data, before I point out some limitations and constraints, and reflect on my role as a researcher.

4.1 Research Design

Research design means the choice of methods for what kind of data the researcher collects and in what way, and will also effect how data will be evaluated. In the case of a master thesis, it is common to try to align the research with previous classic studies on the topic, but the main criteria for choosing methods has to be the research problem. Silverman (2005:6) describes however that research problems are not neutral. Already by framing the problem, the researcher will explicitly or implicitly commit to a particular model of how the world works (ibid). The research focus of this thesis is about how the integration of the PPS and DIPS is contributing to the hospitals knowledge infrastructure. A typical what and how question is leading to qualitative research.

Knowledge and knowledge infrastructure are complex concepts, discussed from philosophical, educational, psychological and sociological perspectives. In addition, information technology is more and more deeply integrated in knowledge practices. As a researcher I tried to understand the phenomenon from the point of view of the actors and their particular social and institutional context, more explicit - nurses’ adaptation and perceptions of this integration as part of the knowledge infrastructure. Study of such phenomena calls for qualitative research methods, as this is based on the underlying assumptions about the need of detailed understandings of the socially constructed nature of reality.

To describe this particular unit where data was collected, the specific ward at Ahus, and to investigate the actors and organizational issues, case study research is deemed appropriate.
Yin (2002) defines the scope of a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. These unclear boundaries were very relevant for the research focus in the thesis, since use and meanings in this particular setting were to be studied.

In case study research, common sources of data collection include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher’s impressions and reactions (Yin, 2002). When planning this research, the obvious choice of method for data collection was interviewing nurses. I combined interviews with observations of how they used the available functionality to use PPS –DIPS interface in their documentation.

Interview as data collection method gives the possibility to gain deep insights in the topic you want to know about. The researcher is in face-to-face contact with the informant and has the possibility to ask clarifying or follow up questions to prevent misunderstandings and to catch non-verbal communication. It is especially useful to hear about the informants’ explanation of how, when and why they use the PPS-DIPS, the systems as separate tools as well as integrated by the hyperlink, and do things in a particular way.

Critics though state that it could be a disadvantage that interviews are not naturally occurring data, but represent an intervention or artificial research environments (Silverman, 2005:120). Accordingly, they will prefer observations, which produce more naturally occurring data, without the intervention of the researcher. This would show more of what people actually do, and not what they say they do. In my case this would be observation at the ward, and I did that to better understand the available infrastructure. I also reviewed documents. Techniques to collect data trough observations are to follow the situations, document, then present, analyze and interpret the collected material. This would be a preferable method for finding out about how work actually is done. Of course, the actual process is not as simple as that. The researcher has to be aware of her presence and the influence it means at the ‘site’. Apart from the difficulties with time constraints and gaining access to observe nurses extensively in their natural working environment, I would like to refer to Silverman’s (2005:120) argument, that no research is really unaffected by the researcher (e.g. recording equipment, note taking). It is also important to consider that there is interpretation in both documenting, presenting and of
course analyzing data. Instead of choosing one before the other, it might be useful to keep in mind the difference between ‘natural’ and ‘not-natural’ data when analyzing. In my case study I focused on the interview data as socially constructed in time, place and context, and tried to ‘map’ it with data from observation and document analysis as background information.

In the following chapter I will describe the way I carried out the data collection in practice.

4.2 Data collection

As stated before, when designing this investigation, I put the emphasis on interviewing nurses. But I soon discovered that to be able to ask the relevant questions, I had to know much more about the context. So I studied documents and carried out observations before interviewing nurses. Afterwards, information from these different data collection methods were intertwined, as I was inspired by interviews to observe and consult documents, and also the other way around.

As a start, I studied documents found at the hospitals Intranet, regarding the PPS-project, the organization, the building of new Ahus, the affiliated organizational development projects to re-organize their workflow, how this knowledge infrastructure could support and so on. These documents were not directly used to describe how the organization actually works or how nurses use the information systems in their day-by-day work. But they showed how the organizations focus on some important topics in the processes of planning the new hospital, and re-organizing their work processes. For example, these documents gave insights to the importance of organizing with the patient in focus, of flexibility at work implying more mobility of staff, of standards and evidence-based practice, of new technology and of management by quality.

I also carried out observations to gain a practical understanding of what is going on. The first opportunity to observe was attendance at a training session for nurses in the use of PPS, in September 2007. It was a two hour long session led by the PPS project manager, at the hospitals training center. It was a pretty tight time schedule, obviously nurses where attending in busy working hours. The training was an introduction, demonstration and then trying out the functionalities of the PPS, and nurses seemed to handle it without difficulties. I was a passive observer, with no possibility for asking questions, but I could try the system myself
and could take notes. I was also allowed to visit the competency department at the hospital and explored the project manager’s review of the challenges in the implementation process. He was very helpful, demonstrated and answered a lot of my questions. I also had the opportunity to observe the nurses station at the ward for about 3 hours. One could argue that I could have been observing more extensively, by following nurses in every step of their work. But my main focus was nurses’ documentation and care planning work – e.g. sitting in front of and interacting with the computers, and it seemed like less efficient data collection strategy to follow them around or shadow every step of the way. Nevertheless, it was a useful experience to see the nurses’ station, the practical working conditions and the atmosphere. It was fascinating to observe that even when sitting at the computers, nurses have to keep ears and eyes open and always the patients need in focus.

Therefore, the main data source in this thesis are semi-structured interviews with five nurses. I was recommended by the PPS project manager to establish contact with the urology ward N7 because they started early with the implementation of the PPS, in fact already from October 2007. I gained access as participant in the ongoing, collaborative InterMedia-Ahus project, which was well-known at the hospital for some time. The Professional Development -nurse at the ward was an active participant of the PPS project, so she was an obvious choice as informant. Then she asked for volunteers, willing to talk about their experiences, and recruited two nurses with a long working experience, and two others who were newly employed.

Key information about the informants is presented in the table below:

<table>
<thead>
<tr>
<th>Nurse</th>
<th>Experience</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Long experience – 16 years</td>
<td>male</td>
</tr>
<tr>
<td>#2</td>
<td>Long experience – 8 years</td>
<td>female</td>
</tr>
<tr>
<td>#3</td>
<td>Newly graduated &lt; 1 year</td>
<td>female</td>
</tr>
<tr>
<td>#4</td>
<td>Newly graduated &lt; 1 year</td>
<td>female</td>
</tr>
<tr>
<td>pd-nurse</td>
<td>Long experience – 18 years</td>
<td>female</td>
</tr>
</tbody>
</table>

I had a preliminary idea about noticeable differences in use and perception of the information systems, due to the fact that nursing students know and have used PPS during their education, and that they probably have more need to consult procedure descriptions in practice (the theory-practice gap described in literature).
When interviewing, I used some time to present my master project as part of the InterMedia-Ahus collaboration, and I handed out written information about both projects. The informants signed informed consent form about to participate in the study, and to tape record the interview. It seemed unproblematic for all the informants, after assuring that I would not be concerned with sensitive information or patient data. Most of the interviews lasted about 45 minutes to one hour. I used a semi-structured interview guide, which was prepared in advance (see appendix). This was helpful for structuring my own thoughts about the research question, for thinking about the language I used and as an aid to remember the topics I wanted to discuss. But I had to adjust the open questions during the interviews because the answers I got were about either the PPS as an application or the care plans in DIPS, or the integration PPS-DIPS in practice, and very few perceptions of the content in PPS. Therefore, I found myself talking too much, on some occasions trying to explain what I was particularly interested in, and rephrase my questions over and over again. This situation meant some loss of flexibility and did not allow the respondents to lead the conversation (as in the ideal situation).

4.3 Data analysis

Seidler (1998) describes qualitative data analyses as a process of Noticing, Collecting, and Thinking about interesting things in the material.

![Diagram of Qualitative data analysis process](image)

Figur 6 Qualitative data analysis process (Seidler, 1998)

But this process is not linear. It can rather be described as iterative, because it is a cycle that keeps repeating. For example, when you are thinking about things you also start noticing new things in the data. You then collect and think about these new things. In principle the process is an infinite spiral. The process is also recursive because one part can call you back to a
previous part. For example, while you are busy collecting things you might simultaneously start noticing new things to collect. Finally the process is holistic, in that each step in the process contains the entire process. For example, when you first notice things, you are already mentally collecting and thinking about those things (Seidler, 1998).

My interviews were recorded and transcribed in Norwegian. Citations in the text are my translations. Analyzing the data meant reading it all several times, then labeling paragraphs as topics emerged. Coding was made according to common themes, in over- and subordinated groups related to the topics, changed several times, in a flexible way. This means that labels were changing during the analysis. It was a time consuming process, but it gave me a useful overview on the data material. Codes or labels help the researcher to reorganize the data and give different views of the data (Seidler, 1998). My labels or codes can be characterized as heuristics (as opposed to objectivist), as their role was just to help to collect the things noticed. Heuristic codes helps to reorganize the data and to give different views of the data (Seidler 1998). They facilitate the discovery of things, and they help to open up the data to further intensive analysis and inspection. The heuristic approach does say that coding the data is never enough. It is the beginning of a process that requires working deeper and deeper into the data (ibid).

4.4 Validity, reliability and generalization

Any kind of research should address questions about reliability and validity. Reliability and validity in a broad sense are issues about the quality of the data, appropriateness of the methods used in carrying out the research and the steps towards the abstracted findings. In qualitative research these questions are closely related to the discussion of the meaning of interpretation. Thagaard (1998) suggests the concepts of credibility, confirmativity and transferability to replace the quantitatively biased concepts of reliability, validity, and generalization.

Credibility is about how trustworthy the research is carried out. Combining document analysis, together with non-participant observation and interviews provided different angles of the same research area, and consequently supports the idea that the use of multiple methods
increases the credibility of the research. Confirmativity addresses whether the research explains or measures what the research question said should be measured or explained. The researcher’s way to ensure confirmativity must be a constant justification of the interpretation and an internal evaluation of the motives for interpreting in a particular way.

Transferability is about the understanding gained in the actual case study that can be relevant in other situations. An important goal in qualitative research is that the researcher should argue for relevance of her analysis to other contexts. In qualitative research the interpretation gives the grounding for transferability and not the description of data (ibid). Therefore I seek a recontextualisation at the end of this thesis, in the sense that I try to put my theoretical understanding into a broader relation.

In the next chapter I will elaborate on some of the evaluation of my motives and beliefs.

4.5 Constraints and limitations

Time and timing was a problematic constraint in this study. On one hand I was recommended to wait for some time (January 2008), so that nurses got familiar with and could talk about their use of PPS-DIPS. On the other hand, in January it was suddenly difficult to get access to interviews during working hours. Nurses made loose appointments, telling me to come between 13:00 and 15:30, and then we can talk when they have the time. 4 times I had to postpone interviews, it was just too busy at the ward.

I was reflecting a lot on the limitations of both time constraints and being an outside observer. With a more involved approach I would probably have been able to observe more informal and semi-formal verbal communication about the content and at the same time tangible data about the use of PPS-DIPS. But within the constraints of this master thesis that was not a real option.

During design process, during the data collection and analysis, I had to keep in mind my experience and prior knowledge on working with information technology in hospital. I had to remind myself of considerable changes in the past few years and do not think of nurses as
generally opponents to new technology. My goal was to keep an open mind and understand as much as possible during observations and in-depth interviews.
5. Findings and discussions - Use of the integrated PPS-DIPS

In this chapter I will present findings from the data I have gained through observations and interviews at one of the piloting wards. At the same time I will also discuss the empirical material in light of theories and concepts presented in chapter 3.

5.1 Practical use

The main challenge when introducing the PPS as a knowledge repository is the actual utilization of the resource. Gourlay (2000) emphasizes the distinction between knowledge representation, e.g. repository like the PPS, and the knowing process, that is the use. He argues that knowledge itself cannot be managed, only the conditions of its use-in-action, which necessarily includes dealing with the organization, system and people. In the following chapters I will try to analyze this use-in-action. First I sum up the story of how the implementation was carried out, I elaborate on findings illustrating two different ways to use the PPS, then I look at experiences and use of the offered infrastructure, and finally I discuss validity of the version of the best practice procedures.

5.1.1 Implementation of the integrated PPS

Nurses at the N7 ward had received a lot of information about the ongoing project work, mostly because the nurse responsible for professional development (hereafter pd-nurse) was an active member of a working group to consolidate versions of clinical procedures, and the reference group in the PPS project. The consolidation of the PPS was a long-lasting, complex project. Two of the informants, the two experienced nurses, mentioned discussions at the ward related to the consolidation work. This was a confirmation of the pd-nurses’ efforts, as she was trying to involve the staff and trying to consider knowledge and experiences directly from their practice, both her own individual experience and the ward’s collective expertise. During September / October 2007 all staff participated in a 2-hours training session in practical use of the PPS, and the integration PPS-DIPS. This training was about the functionality of the systems (PPS and DIPS), carried out by the project manager from the competency department, as mentioned before (chapter 2). I noticed that both teaching and
participant questions were quite instrumental, that is about how the technical use is to be carried out. Even more exactly, it was about how to find the right procedures in the PPS and how to link it into the care plan in DIPS. Nobody was asking about when to read procedures or how strict one should treat the procedures. The why dimension of the use was not emphasized, as I expected, as these could have given me logical connections and explanations about what nurses were thinking of the evolving structure. Of course, it is possible that these questions were asked (locally at the ward, or nurses’ professional development meetings) and answered in advance or later in follow-up conversations. I also wondered if these questions and answers might be so obvious for nurses, encultured in their community of practice, that they were unnecessary to ask. Still, it became an issue to investigate further.

On the other hand, the newly graduated nurses (two of the informants) had extensive knowledge of the PPS, since the system had been used as introduction to practical skills during their student-training activities. At the skills lab or training environment at the school of nursing and before practicing clinical procedures, as giving injections or catheter, they usually studied and consulted the procedure in the system. They had available computers at these skills lab, and used the system actively, in particular the description of ‘how to do’ the procedure and the ‘tool-list’ attached. Therefore, the newly graduated nurses felt comfortable with the PPS, and stated that they continued to use it, now as part of their regular work.

5.1.2 Access from/through the Electronic Quality System

For ease of use, nurses could access the procedures either as part of their knowledge management structure - Eqs (Electronic Quality System) from the hospital Intranet, or directly from the Electronic Patient Record system – DIPS – where the procedures could easily be integrated in the charting of planned or ordered care.

The PPS is part of the hospitals Electronic Quality System, and as such, accessible to the staff from the Ahus Intranet, and the screen shot below illustrates what it looks like to the clinicians.
Making the procedures accessible through the EQS acknowledges the fact that the PPS is selected as procedures valid for and guiding clinical work for the entire hospital. The PPS descriptions give directions for how the specific work should be carried out in the institution performed by, but not restricted to, the nursing staff.

In the interviews, the informants reported to be generally satisfied with easy access from the Intranet to the PPS procedure. Every informant felt that it is very easy, very straightforward use, both to access and to search inside the PPS application. Nevertheless, one can argue that this kind of entry from the Intranet might be a limited utilization of the knowledge repository, because it is expected that nurses, or other knowledge workers at the hospital, would consult these repositories to find knowledge when they have the time. Time and attention is certainly a constraint for knowledge workers (Davenport 2007), and nurses’ everyday work, with the patient in focus, means that they have to balance their priorities between actual ‘patient care’ and additional activities. On the other hand, procedures on the Intranet were considered as improvement from paper based handbooks. Those meant an even bigger interruption of core activities.
Informants had different perspectives regarding accessing the procedures from EQS or from DIPS. For example, one of the nurses (#1) found that the access from the intranet was unnecessary complicated, because he has to go from the patient record, open a new window from the Intranet, and begin to search from the start. Others (#4, #3) considered it as a simple and straight forward activity. But in an everyday work context, it is not considered as given that nurses would log on, access the PPS from the intranet, search for the right procedure, and read the extensive text before making decisions or taking action, before doing for example a catheter change. One experienced nurse said that the only realistic opportunity to consult the procedure you are not familiar with, has to be before the shift.

“… if I didn’t manage to do that, then I will not do it [the procedure]. then I leave it to someone else to do... I won’t do it if I am uncertain…” (#2)

So these experiences and expressions illustrate a previously reported problem, according to for example Davenport (2008), that knowledge workers, in this case nurses, rarely have spare time to supply the knowledge needed from the repositories, regardless of how correct or appropriate the content is. He suggested that the organization will have to free up employee time to enable seeking knowledge in repositories. To my knowledge, this is not a considered practical solution in everyday work for nurses at Ahus.

5.1.3 Access through the Electronic Patient Record system - DIPS

An alternative approach to increase or stimulate to use repositories actively and integrated in the work, is to build the knowledge into the work process (Davenport, 2008). The integration of the PPS with DIPS’ nursing documentation and the nurses care plan can be seen as an attempt to do this. The care plan template is an important tool for nurses’ representation of their practice, as described in chapter 3. It gives an overview of probable nurse-related diagnoses/problems, goals, patient resources related to the particular problem/diagnosis, combined with relevant interventions to alleviate the diagnosis/problem. The intention is to individualize the documentation by adding appropriate observations, conversations with the patient, by choosing elements from the template and adding free text. Use of the care plan templates can be seen as decision support for nurses in their documentation activity. Rather than reporting every detail in the procedure, when the procedure is a standard integrated in the care plan, and in addition to the decision support, it can be referred to as valid best practice. When the nurse’s offered care deviates from the procedure, it is necessary to document that fact in more detail.
It was the pd-nurse who facilitated for such integrated use, as she customized/implemented the care plan templates at the ward, and included the linking from the template to the right procedures in the PPS. In fact, in collaboration with other experienced nurses, the pd-nurse created 16 care plan templates, each contained one or several PPS-links. The example below illustrates what it looks like for the nurses using the available functionality from the DIPS/EPR.

![Image of care plan template with link to PPS procedure](image)

Figur 8 Link to PPS procedure from DIPS care plan (Størseth, 2007)

This link made the electronic procedures embedded into the everyday work practice, as looking up the procedure is no longer a separate activity requiring use of already scarce time and attention to seek knowledge. Or is it? As nurses use a care plan template, they don’t actually have to read the procedure, even if it is fully available. To make the content visible, they have to click on the link to open the PPS and then reed.
The question is to what extent they read, or just do it in a procedural/’mechanical’ or instrumental way. The care plan for each patient and the documentation afterwards are one of the core processes in demonstrating quality in nursing practice. Because planning the care is when nurses make their decisions about patient care, it is the process when the ability to add knowledge is most valuable (Davenport, 2007). Still, the integration gives only the possibility to link or refer to a procedure as it is, and the system around does not enforce nor offer opportunity to add knowledge or customize according to understanding of patients’ care requirements. Taking a step back and considering the concept of knowledge- or socio-material infrastructure (Moen & Toiviainen et al, 2008) as a whole, the integration of the PPS into the care plan is just adjusting a material element in the infrastructure and might be lacking the social organization of work.
5.1.4 Experiences and use of the offered infrastructure

The pd-nurse stated clearly her goal and expectation of much more strict guidelines about the use. According to her, it should be instructions and clear expectations to every step: to make care plans, to add PPS-procedures and to consult or check out procedures before the interventions.

“Yes I would like that [more strict regulation] very much, yes. But I am sure that it will come... It was the goal, that we will have to integrate procedures in the care plan...and counting the use... yes, it is clear that it should go to the VP of professional services [fagdirektør] for example...”(# pd-nurse)

On the other hand, another informant (nurse #3) appreciated and felt comfortable about the freedom and flexibility experienced by the fact that the use is voluntary and at their discretion. From the nursing profession’s point of view, instructions regarding the use of the tool could in fact threaten the professional autonomy, the status and power of nurses in the hospital hierarchy. Such kind of instructions might be considered as regulation by the techno structure and standardization of skills (Mintzberg, 1983) and nurses will resist such attempts. On the other hand, Timmermanns (2005) argues that the incentives to create guidelines or practical procedures helps confirm the scope of a professions jurisdiction, to safeguard against competitors and to avoid outside evaluation of there work. This can be considered a useful argument in the case of nursing, as the profession tries to make itself visible and to position their status between physicians and licensed practical nurses (hjelpepleier).

Adler & Kwon (2008) observes the growing influence of market and hierarchy principles in organizations, visible in initiatives and demands on standardization, formalization and accountability. They argue for the key role of the community, witch relies on trust and mutual adjustments between professional peers and trust between professionals and their clients. On the other hand, I remember a story about expert pilots, who’s safety critical work is done under a completely different regime. They have mechanisms for professional accountability build in the system – they have to carefully go through and check out the same lists and procedures when flying for the 200th time. Accountability pressure from outside the professional community is just as considerable for health care professionals, but physicians and nurses traditionally don’t have implemented similar mechanisms in their community practice. An explanation might be the pilots work with machines operating in predictable and
standardized ways, contra health professionals work with humans, where each patient is likely to present variations of sign and symptoms, and therefore have to be treated as an individual, also considering her/his total well being and preferences. But this fact is clearly opposed to the requirements for standardization, and creates tensions in claims for accountability of nursing practice. Therefore, there is a risk that means like procedures for best practice become the objectives in themselves. An other explanation might be that pilots share fate with their clients / passengers, contra health professionals who don’t. In that case, requirements, attention and focus on quality is becoming an ethical issue too.

There is currently no available statistical reports or monitoring system to automatically check the actual use of the integrated systems in terms of number of looks ups in the system, use of integrated procedures in DIPS etc. However, the PPS project manager made some sample counting at the ward, which shows the use of care plans and care plans with PPS-procedures at the particular unit. In the table below, snapshots to actual use of the available tools in the infrastructure is shown.

<table>
<thead>
<tr>
<th>Date</th>
<th>Patients</th>
<th>Care plans</th>
<th>Care plans with PPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.09.07</td>
<td>22</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>12.12.07</td>
<td>32</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>18.03.08</td>
<td>35</td>
<td>24</td>
<td>19</td>
</tr>
</tbody>
</table>

*Figur 10 Snapshots of use of care plans and PPS procedures at the ward*

The table shows that over time, the 3 snapshots, 82 % (n=22), 66 % (n=32) and 68 % (n=35) of the patients at the ward actually have care plans. The number of in-patients at time of counting differed / increased, but when number of patients increased the number of care plans did not increase accordingly. The counting also shows that although the number of in-patients increased, 61 % (n=18), 86 % (n=21) and 79 % (n=19) respectively of the care plans included PPS-procedures. These numbers give some indications about the use of available tools, but the numbers should be interpreted with great caution, since they are snapshots and just sample counting, and there is for example no information or registration of time of day to control for natural variation in workflow and charting practice. According to pd-nurse the time of registration is important, and most extensive right after 3 a clock in the afternoon, when the day-shift is finished with their documentation work. For example, patients admitted according to the waiting lists are registered in the morning, but their care plans are usually written between 14:00-15:00 – that is towards the end of the day shift. The pd-nurses also explained
that if the discretion template with PPS-procedures in care plans does not fit to patients’ care
needs, then it is much variation and individual preference of the responsible nurse how care
plans are created. Her observation (pd-nurse), based on experience, was that care plans
structured or written as free text instead of templates rarely contain PPS-procedures (as well
as standardized nursing languages like NANDA, NIC). It seems that independently creating
care plans integrating PPS-procedures, when no template with PPS procedures is available,
represents barriers for nurses, and need further attention.

To sum up, all informants stated that the PPS-DIPS is in use. Everybody mentioned that the
integration as functionality was working well. It is considered very easy to just click on the
link, and the right procedure pops up. It is also appreciated that the link is visible, marked as
link and marked with PPS (see figure 8). Nevertheless, my understanding of the data material
leans towards that the use of the integrated PPS - DIPS is to a great extent limited to the
purpose of accountability, it is mechanical/ instrumental, and not typically for adding
knowledge to the work process, as the social infrastructure around is not designed to enforce
this kind of use (Davenport, 2007). Although the pd-nurse expressed her hope for more
regulation and control of the PPS-DIPS use, it seems that measures for enforcement are not
likely to be taken in near future.

5.1.5 Validity – access to updated best practice

All informants stated that it is a great improvement that they do have a valid, reliable, updated
version of the clinical procedure. They appreciate that the appropriate procedure is available
from the care plan, it is no need to turn pages in different paper folders to get to the
description you are looking for.

“.. and now, when I have been on leave for a while [seven month], I could look up in
the PPS and I feel that I find a procedure which is not outdated, and that is really
useful, like a freshen up... ... like before, when I found something from 2000 and
wondered.. is it valid? haven’t we changed that one?.... It means safety. Yes, I believe
that. ...”(#2)

It is a stabilizing factor to have one valid, ‘authoritative’ version of nursing procedures. It
gives nurses a possibility and tool to balance the emerging expectations of more and more
flexibility and mobility. In fact the pd-nurse was stressing the importance of having one
common, valid repository of procedures, especially thinking of the new organizing principles
in the new building.
“...there [in the new building] we will have to be very flexible. Patients will be placed all around, you will never know whom you will find on the morning shift and you might be ordered to other wards also... So yes, it’s clear that it will be ok to have something common to hold on to. I think it will be one of the safest things, to have the procedures to hold on to... so at least that is common... at least that we know...” (#pd-nurse)

An important question to the informants, related to this issue is how the practice around new versions of the PPS will be followed up. The PPS vendor (Akribe) will update the procedure repository annually, based on handling the suggestions and requests of change. The competency department at Ahus, by the PPS-project manager, has the responsibility to manage implementation of new versions, and pd-nurses at the ward will have to make it visible in the practice. Since they are still in year one and have not had any updates yet, it is an open question for the informants how introduction of new version of the procedures will be carried out. This can be a challenge to handle, if nurses are used to just click in the PPS-procedures, and rarely read them, like my observations indicate. How could they be aware of changes, new details? A summary of changes will probably be a first logical step, but such knowledge will take time to ‘settle’ in the practice, and it may be a resource demanding task.

5.2 Nurses perceptions about the content

Regarding the perceptions of how the two systems fit in content, my overall understanding was that the informants typically did not reflect much on the challenges.

5.2.1 Formality

In the interviews I asked nurses to reflect on what they think of their use of the PPS. I was trying to find out if they felt the need for searching for knowledge or is the use more like a formality to just make the executed procedure visible.

It was a clear difference between experienced and novice nurses stories and thoughts about when, how and why they use the PPS. Experienced nurses have a more laid back attitude and consider the procedures in the care plan as a formality.

“Yes, we put it in the care plan, we do, but that doesn’t mean that it is active use, does it? It’s more like a formality, it’s on the right place. And you do what you are used to do anyway...” (#1)
This nurse emphasizes that due to his extensive experience, he is likely to depend and act on his situated, reflective and experiential knowledge (Brooks & Scott, 2005; Curran, 2004) in meeting familiar activities.

PPS is more used as a source of knowledge when they are facing procedures they do not perform regularly, or they need to freshen up some. In these cases it is need for scientific or intellectual knowledge (ibid), even if it is seen more as options then strict standards (Timmermanns 2005).

“But of course, it is a great help for example when you have to change dressings of the central vein catheter, something we don’t usually do. Then it is great to take a look, because it depends on what you did have training in.. and where…it can be different.” (#1)

“..., for example I have been on leave for a longer period, and then I just looked up some procedures in the PPS, and I find a description which is not out of date, then I feel I am updated, and it is very useful, like a brush up on my knowledge...” ( #2)

Novice nurses access the PPS more on the regularly basis before doing procedures. They read the short text-version of how to carry out the procedure, they consult the tool list, but they also appreciate the evidence-based knowledge available in the learning module (#4), and find it reassuring. These nurses can not rely so much on their experiential knowledge (Brooks & Scott, 2005) yet, therefore they may try to compensate with the available scientific standards – and are willing to consult the PPS. In this aspect it is mentioned by several as a problem that texts are long, it takes too much time to read everything. On the other hand, if nurses don’t have the time to reed and study the procedure they need to do, then they will just not do it. Then it will be passed on to somebody else, and they will not do procedures they are uncertain about (#2).

5.2.2 Access to computers and the PPS tool

Time is an issue also because nurses feel that they have limited access to computers. The particular ward has 5 computers at the nurses’ station, and they feel they often have to sit and wait for a free computer to do the necessary documentation. One nurse (#1) explained that it feels wrong that access to the system and necessity to document is guiding nurses working day, in stead it should always be the patients need. They look forward to moving to the new
building, where they expect better computer access to alleviate the problem. It was also mentioned that computers by each bed will make a substantial improvement in the process of informing the patient, explaining procedures. It will be possible to show illustrations to explain the procedures and print out relevant material for the patients (#1).

The PPS is still considered as already leading to better quality in performing nursing work, mainly due to the fact that new and stand in nurses have an easy access to check things, to control how procedures should be done. On the other hand, one nurse (#1) mentioned that use of the electronic care plan and procedure repository might be an obstacle for nurses with lot of experience, but lacking computer and informatics competence. This lack of competency may disturb the work flow, because available knowledge support is dependent on technology use.

5.2.3 Best practice

In my interviews I was trying to find out how nurses think about the procedures presenting and recommending best practice. I asked then to what extent or how strict nurses follow the procedures.

It was again a difference between experienced and novice/ less experienced nurses’ answers. Experienced nurses acknowledge the content as evidence based best practice, but do not follow too strictly the written guidelines.

“I absolutely feel that it is legitimate knowledge.. the reason I don’t follow it strictly, it is more of a habit.. when you have worked here for so long it feels unpractical... To insert a catheter is sterile, isn’t it.. so I do it based on my experience.. and if you take a look at the doctors, he-he... that is far away from any procedure what so ever... "(#1)

This nurse compares practice with the physicians, who evidently take little notice of written guidelines when intervening in tricky situations. He explains that doctor’s expertise is needed when nurses don’t manage, in special situations. As he is a very experienced and skilled nurse, he justifies this ‘rule-bending’ when naming the procedure unpractical for someone with such long experience. He legitimates his actions by calling on his professional autonomy.
Since the implementation is in the piloting phase, it is too early to draw conclusions, but it might be some challenges in implementing the vision of the PPS being valid for the entire hospital. To enforce the procedure guidelines on other medical staff, especially on physicians, will challenge professional power and autonomy, and will add up to an ongoing doctor-nurse relationship discussion, as seen in the statement above. On the other hand, any successful model of health care delivery depends on effective collaboration between these two professional groups. A repository of common, standardized procedures guiding the work in the entire institution, if successfully implemented, will contribute to break down boundaries, facilitate communication and create the conditions for a seamless delivery of care.

Another point made was that it can be some differences between the general standard, and what they actually do at that particular ward. It might be situations where local circumstances required adjustments. The pd-nurse, who has an overview of the PPS-procedures, pointed out that as professionals they accept that use of ‘stellefrakk’; a plastic apron and long arms is best practice in theory, but it is just not possible to follow in practice, since the hospital doesn’t have these items available.

“.. we have discussed it…. with the project manager too… and everybody has agreed on.. that this will have to come from upstairs… CEO or somebody up there must tell us that these procedures cannot be followed. Yes, somebody has to say no, that these with long arms are too expensive to purchase, then it is ok..”

The pd-nurse calls for managers to take explicit responsibility for the fact that recommendations in best-practice procedures cannot be followed. She places the outside economical-administrative accountability (Timmermanns, 2005) in the vertical hierarchy of the institution.

Less experienced/novice nurses reported that they try to follow the procedures as strict as possible. If the practice or own experience differs, then they try to change what they do and not change the procedure (#3). They feel that it is reassuring that the hospital finally has a valid and clear repository of procedures. It means that they can trust the source they use. One nurse (#3) explained that she didn’t want to describe the procedures as strict, but rather specific or concrete. She was referring to that even if there is no implemented set of regulations for how strict to follow procedures, it is appreciated that they exist in this form. On the other hand it is still other sources for knowledge retrieval that are considered just as, or even more valuable as consulting the PPS.
“Like the procedures I learned here at the ward, those I don’t look up in PPS, so I really don’t know how they are described... but I would guess that they are pretty much alike what I have learned here at the ward, because here has people been working for many, many years...”

This nurse clearly prefers and trusts knowledge from the experts at the ward, to the extent that she doesn’t need to/want to check the ‘best practice’ description in the PPS.

5.2.4 Documentation of practice

Documenting the planned and provided care is an important part of nurses’ work. I was trying to find out what nurses think about the normative, general information or knowledge from the PPS integrated in the patient record. As the project manager explained, the idea is that the nursing documentation can refer to the valid procedures and only chart by exception, or document discrepancy from the standard. It is a request that the patient record should be able to handle the integration of this kind of normative, general content, and handle different versions at all time. This can simplify documentation and increase the quality of nursing. The project manager was conscious about that even if the PPS can handle versions in the system, the organization does not yet have the routines to follow it up. From March 2008, a working group is established to set the guidelines for practice in nursing documentation.

Nurses’ perception of the quality of the documentation was different. One nurse (#1) was uncertain, as the procedure name and link in the document is just indicating what was done, but it is not a ‘statement’ that it was actually done according to the procedure. Also it is up to the nurses when and what they consider interventions so different from the standard procedure that it is worth mentioning in the free text part of the documentation.

Another nurse (#3) was satisfied with the fact that the text of the documentation is finally to the point, you could skip unnecessarities. She also compared the current electronic nurse documentation to the paper based at the other institution she worked at. She felt that it was much easier and clearer now. The practice of silent report represented some challenge, as they often had to wait for available computers. But she was positive:

“we try as much as we can.. and it will be better eventually. But sometimes we have to give verbal information at the spot, we cannot stay over so long just because we don’t have computers.. So sometimes it has to be emergency solutions...”(#3)
Much of the perceptions about the care plan, practical procedures and documentation look ahead in time. It seems that nurses are aware of the fact that the full potential of the systems is not realized and implemented. They are in a floating situation, preparing for a new building, new organization and a complex infrastructure of new tools and technologies.

5.2.5 Evaluating the practice

Evaluation of practice is also part of nursing work process. The use of PPS-DIPS should be a helpful tool for evaluating. The technology, in the sense of inserting standard links in the care plan, makes it possible to quantify the use of procedures. One can argue that this does not mean that nurses evaluate their actual practice of patient care, they can only evaluate how clever they are in documenting the practice. But the pd-nurse felt it necessary and useful to count, even if the technological possibility is not yet implemented. In addition, she points to her own perceptions as an evaluation of possible positive effects of the PPS-DIPS on practice at the ward:

“Yes, I imagine that the times we have patients from other wards, with need for “cvk”-care for example, then the care will be better because we follow the same procedures. It will not be different because each had different training in school or other practices.. therefore I think it will be more continuity and more quality care..”

My understanding is that the implementation and use of PPS-DIPS is still new, and there is not prepared to use it in a process of evaluating the practice. But since both the project manager at the competence department and the pd-nurse at the word, were conscious about the affordances in the technology, it is hope for a future addition to the use.

5.3 Infrastructure for learning?

The core analytical framework of this thesis has been the knowledge infrastructure, and how the integration of the PPS – DIPS folds into it. I am also interested to take an other complementary view of this framework, as I investigate and analyze the learning aspects of the PPS-DIPS integration. In this section I will first look at the learning module in the PPS, then at the learning outcome of using evidence-based procedures, and finally at the learning outcome of the possibility to change and adapt the evidence-based procedures.
As mentioned in the case-description, the PPS has a learning module, built in as part of the knowledge system, as a possibility to get additional background and scientific knowledge. It was not a focus of this research to investigate in depth how this learning module is designed and how it works, but I wanted to find out if and why nurses use it, as part of the PPS-DIPS integration.

In his doctoral dissertation Gurible (2005) uses the analytical notion of *infrastructures for learning* to analyze learning practices where computing infrastructure is an integral part of the infrastructure for learning. He states that infrastructures for learning can, for analytical purposes, be seen as having the same characteristics as infrastructures in general, but they are at the same time designed to and/or assigned to support practices aimed at learning. It seems that infrastructures for learning are intermeshed with and hook into other infrastructural arrangements (Guribe, 2005), in this case the knowledge infrastructure. Likewise, resources that support working arrangements can also be used to support learning practices.

Newly educated nurses reported that they have used the learning module in the PPS, but mostly in school and under training.

“yes, I have been there [in the learning module]... well, I cannot say that I am using it on daily basis... no, I don’t... because I don’t have the time for it... But if there is something, then I look it up... I am familiar with it from school though...”(#4)

It looks like the learning module is even more distant in the everyday work of nurses. But several (pd-nurse, #1) mentioned that it is great to have it available for nurses working as temporary help, for example on night-shift, when it is more difficult to ask for information and help. I argue that the learning module can be seen as part of the infrastructure for learning at the Ahus, in the sense that it is *embedded*, ‘sunk into’ (Star & Ruhrlede, 1995) other structures and technologies, and the absence of it would really make it *visible* (Star & Ruhrlede, 1995).

Using the PPS, and consulting best-practice procedures with the purpose of learning is not a straightforward practice at the ward. As the data material shows, experienced nurses rarely look up or follow procedures like a ‘cookbook’, or for learning purposes. But as Timmermanns (2005) argues, there is an appropriation of guidelines which implies an indirect learning aspect: the individual practitioner’s ability to evaluate whether the evidence and the procedure apply to the situation at hand. Instead of a radical change in behavior, the effect of clinical practice procedures might be a more nuanced learning of when to ignore, adapt, or
implement procedures (Timmermanns, 2005). Of course, such learning would be more explicit and focused if it was supported by a system for evaluation.

Best-practice procedures are to be updated annually. The procedures are set out to integrate research based knowledge and new evidence, and adhere to legal regulations and recommendations as well as professional guidelines and national standards if identified and available. They are also considered legitimate and accepted by nurses. Nevertheless, this update of research and new evidence seems to be a one-way communication. It is the pd-nurse who has the responsibility to forward suggestions and ask for changes, but for the nurse practitioner it might seem like a great distance in time (new version once a year) and space (pd-nurse, then coordinated within the organization, and further preparation by the vendor) to manage to contribute with personal experience. It is too soon to draw conclusions, but it might be important to build up a communication line, so that nurses have an easy possibility to contribute to the procedure repository.
6. Conclusions

This thesis is about studying evolving knowledge infrastructures, through a case study at Ahus. The hospital implemented the integration of a knowledge repository, PPS (Practical Procedures for the nursing service) and the core information system for nurses work, the Electronic Patient Record (EPR). I studied how the integration was implemented and tried to explore nurses’ understanding and perceptions about when, how, why they use the integrated information systems. The empirical material and the analyzes pointed out some insights which I will sum up in this final chapter.

In this case, the arrangements made to support the different knowledge practices at the hospital can be considered the previously established knowledge infrastructure. It consisted of the different elements of the Electronic Quality System (EQS), the paper based procedure handbooks, the network of practitioners using these, the routines for quality assurance, and the established guidelines for how to upgrade the knowledge resources. These elements underlied and transparently supported the health care work.

Trying to integrate the electronic repository of practical procedures for nurses (PPS) with the electronic patient record (DIPS), implied making changes at different levels. On one level the paper based procedure handbooks were consolidated and made accessible from computers, as part of the existing knowledge infrastructure. From a technical and usability perspective this was a successful change. On an other level, the integration with the care plan was adapted. Technically and functionally this integration too was a success. Still, as it has been shown in the analysis, the implementation of this integration has not yet fulfilled its vision and potential. From a knowledge management perspective, this integration can be seen as an alternative to knowledge repositories, in the sense that the technology is embedding knowledge into the work flow (Davenport, 2007). Nurses’ day-to-day knowledge work is dependent on use of the electronic patient record. Now the possibility is present for reaching knowledge resources at the time of need.

The analysis points out that there is a lot of difference between experienced and newly graduated nurses use and perception of the integrated systems. Experienced nurses insert the procedures into the care plan in a mechanical way, without reading it, mainly to document the
executed procedure. They treat it as a formality. But at the same time they see the advantage and flexibility of having it available, for training, for stand-in- or visiting nurses. Novice nurses are more likely to seek knowledge and consult the procedures. But that doesn’t mean that they prefer or trust it more than local expert knowledge at the ward. This difference might be interpreted as similar to the analysis of nurses’ use and perceptions of evidence based knowledge.

The analysis also shows that integration of the two systems and into the evolving infrastructure is not just a technical matter. It has to be also a process of negotiating organizational arrangements, as responsibilities, accountabilities and resources. Nurses are made accountable in a more visible way by the possibility of using PPS procedures in the care plan. Responsibility has to be taken from the hierarchy, when best practice evidence is decided to be rejected. Resources will have to be negotiated when appointing nurses for system administration. Finally, a lot of organizational arrangements will have to be renegotiated when the organization moves to the new building. This moment really outlines the ‘when’ dimension of this infrastructure, as it will be a new one after moving.

The main purpose of introducing the integrated PPS-DIPS was to improve quality of the given health care by promoting and facilitating evidence-based practice, staff development and use the clinical procedures. To my understanding it is possible to reach these goals, if the organization, managers in charge and users reflect on the existing affordances in the knowledge infrastructure and build further on social organizing of work processes. More specifically, I refer to focusing on every step of nurses’ knowledge work (planning, documenting, evaluating, learning) and make the best possible use of the tool.

The findings, as well as the analysis in this thesis, suggests some interesting further possibilities for research on the topic. The obvious is to follow in time the development of the use of the integrated PPS-DIPS and find out how the use changes nurses working practice. It might also be interesting to investigate what kind of knowledge infrastructure will be evolving when moving in to the new building, with new technologies, new organizational principals and new work flow.
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Appendix

Intervju-guide:

Research questions:
In what way is the integration of the PPS and DIPS contributing to a consistent and coherent knowledge infrastructure?

Innledende spørsmål:

• Hvor/hvordan ble du kjent med pps?

• Hvorfor, når, i hvilke situasjoner bruker du pps /eventuelt ikke bruker? Hvem har mest bruk for en PPS prosedyre ??

• Hva syns du om PPS ?

Hovedspørsmål:

• Hva ser du som fordelene/ulempene ved at pps er integrert i sykepleierdokumentasjon?

• Hvorfor ser du på PPS prosedyrene - er de rådgivende, for læring, som forskrift for praksis eller annet? Hva betyr de i praktisk utøvelse ?

• ..og er det forenlig med at dokumentasjonen sier at ”slik er det gjort”? ( motsetning mellom standard prosedyre og individuell behandling)

• I forhold til før hvordan dokumenteres praksis nå?

• Hva legger du mest vekt på av PPS prosedyrer, i forhold til avdelingsspesifikk (faglig spesifikk)? Forklar litt om hva du ser som forskjell mellom de to?

• På hvilken måte kan du tenke deg mer fleksibel/ situasjonstilpasset prosedyrebeskrivelser, eventuelt at du kan legge til egne kommentarer, som representerer mer nøyaktig dine erfaringer, vurderinger og det du gjør? …i stedet for de standardprosedyrene som ligger fast i pps?

Avslutningsvis:

• Betyr PPS noe for din praksis - Kommer det pasientene til gode? Sikkerhet, kvalitet, erfaringbasert praksis, eventuelt ulemper – mindre tid til pasienter??

• Kan det tenkes mer integrasjon / flere it-systemer i EQS? Kvalitetshåndbok…