Supporting the Design of Health Information Systems: Action Research as Knowledge Translation

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Abstract
In this paper we show how action research contributes to the design of health information systems by constructing knowledge addressing users’ concerns in a timely manner. Our aim conducting action research is to understand the work practices of the expected users and to bring this understanding to the design, ensuring that we are enabling users rather than constraining their work. We view this process as a knowledge translation process where researchers and users exchange and create new knowledge about technology and use practices. We argue that action research can be viewed as a knowledge translation process, where researchers and users co-construct a common context for design and use of technology. By providing insights from our two years of action research focusing on the design and use of emergency department information systems within a Canadian hospital, we identify four main activities essential for creating the research context as a knowledge translation context.

1. Introduction

The Human-Computer Interaction (HCI) research field is concerned with basic questions of human perception and interaction techniques [1]. These questions are essential when designing new technology and include investigations of how practitioners think and work in practice. Previous HCI researchers have investigated how usability practitioners develop their own practices and how they experience the potential of self-reflection when interacting with researchers [2]. They suggest the ‘design collaboratorium’ as one way to address the inherent problem of usability labs: “the lack of cooperation between designers, usability professionals and users, and the weak impact on design caused by the analysis/evaluation bias of usability” [3]. Design collaboratorium conceptualize design activities, which takes the practical circumstances of practitioners seriously by applying action research methodologies. Action research places equal attention on solving practical problems while extending scientific disciplines [4, 5]. Since its inception, action research has been incorporated and modified into many different research disciplines [6, 7], and in recent years, action research has become more common within the area of Information Systems (IS) as well as HCI [3, 8]. Action research is unique because it allows researchers, through actions in practical situations, to gain access to study complex social phenomena [9]. Action research is a way for the researcher to step out of the ivory tower and to support practical needs. Research needs to be rigorous, and hence there is a need to systematically articulate techniques for action research data collection and analysis [10]. However, evaluating academic work, especially action research, should take into account the practical accomplishment achieved [11]. Action research seeks to bridge the gap between theory and practice, so evaluation should include examinations of the practical accomplishments, which might take various forms, such as new designs, networks, technical reports, or improved software processes [12-14].

In this paper we view the practical accomplishment as a knowledge translation process, where new knowledge is created and used to enable the design and reconfiguration of new technology. The nature of knowledge is social. “Knowledge is always embedded in some social collectivity and is subject to the cultural assumptions, practices, and power relations operating within the collectivity” [15, p. 3]. Knowledge translation is facilitated when producers (both researchers and expected users) of knowledge are known to one another and are thus familiar with each other’s needs, preferences, objectives, and circumstances [16]. Knowledge translation involves a complex system of interactions between researchers and practitioners exchanging an ethically-sound application of knowledge with the aim of accelerating the benefits of research for practice [17]. To conduct action research enacting knowledge translation, we need practice to open their doors, and that comes at the price of hard, time consuming work, which disappears from the final publications and as such is often not credited within the academic system. However, when we, as researchers, succeed in developing a strong practitioner relationship, the action research approach supports knowledge translation, prompting new
findings relevant for research as well as for the practical circumstances.

We begin by briefly presenting our empirical case, and then we highlight important aspects of action research addressed in IS literature. This is followed by sections explaining how the collaboration was initiated and how we as researchers contributed to the design activities, as well as a section articulating the challenges of such engagements. Finally, we reflect on the process of co-authoring with practitioners as a process of knowledge translation supporting user-centered design. We conclude the paper by identifying four main activities essential to turn a research project into a knowledge translation context where researchers and users co-construct knowledge in the process of applying action research.

2. The empirical case

The action research project is a two-year engagement with an emergency department (ED) at a pediatric hospital in Canada. The ED sees approximately 38,000 children yearly and employs approximately 20 physicians and 75 registered nurses. Our involvement with the ED began with a problem: A computerized triage system that was introduced caused significant work flow problems and presented numerous other challenges. We began our action research process with the ED as they were removing that first system, and our engagement with the ED has continued as the ED returned to a paper based system, and subsequently designed, re-configured, and implemented new electronic Emergency Department Information System (EDIS) for triage and patient tracking.

The goal for the project was two-fold. The goal for practice was to design and re-configure the EDIS to support the current work practices within the ED. The goal for research was to investigate the challenges in configuring EDIS from a theoretical perspective. The project was immediately problematic in that multiple EDs that operated with different work practices—some of which had implemented the system in advance of the others—were to negotiate a common configuration of a shared EDIS.

Using action research as the methodology in this partnership was ideal. We had the opportunity to be actively involved with the configuration of the design while collecting data for research. Moreover, the knowledge obtained was immediately applied to practice through the iterative, cyclic processes linking theoretical conceptualizations to practical issues (see Figure 1).

The research activities included extensive participant observation of the ED work practices and design workshops. The first author participated in 22 design workshops, lasting between four to eight hours over a seven-month period. Each design workshop focused on articulating existing work practices and re-configuring the EDIS. In total, the first author spent approximately 132 hours participating in design workshops. In addition, 15 observation sessions (in total 66 hours) of ED work practices were conducted over an 18-month period. During all observations, informal interviews were conducted with 34 different ED staff members. Some staff members were observed more than once. In addition, four formal interviews were conducted, two with the clinical nurse educator and two with the emergency program manager. Three of the formal interviews were recorded and transcribed. Moreover, a large number of informal conversations (with the emergency department manager, the clinical nurse educator, nurses, clerks, and physicians) took place over a nine-month period, where the first author was present at the hospital for an average of two and a half full days each month.

3. Action research

Originally action research comprised two stages: a diagnostic and a therapeutic stage. The diagnostic stage involves activities aimed at identifying and diagnosing the problem situations, whereas the therapeutic stage comprises actions directed toward solving the problematic situation [8]. Action research in information system design has been applied in different ways, such as collaborative practice research [13, 14], canonical action research [10], and dialogical action research [18]. Different types of action research stipulate different stages, even though they are similar in nature. The stages of action research typically comprise diagnosing, action planning, action taken, evaluation, and specifying learning [19].

Action research is cyclic in nature, which means that the various stages are performed in a repeated and iterative process, supporting both the practical problematic situations as well as the scientific goals. In most applications of action research, the cyclical processes are seen as one coherent process; however, McKay and Marshall [20] suggest that action research should be viewed as two single, but interlinked, cycles: one related to the problem solving interest and responsibility; the other related to the research interest and responsibility. Action researchers easily risk becoming highly engaged with the practical problem and loosing the theoretical perspective. Thinking about action research as two interlinked, equally important processes helps to keep the focus on both action and research. The theoretical perspective is crucial because this is one of the main aspects that differentiate action
research from consulting [10, 21]. In our work, ongoing interaction with our research partners gave us a good understanding of the practical problems they faced. As researchers, we then had both to articulate how we could contribute to the solution of the problems, and to identify and define the researchable questions.

It is important to explicitly articulate the dual goal of action research projects [4]. This explicit articulation has been referred to as the researcher/client agreement (RCA) [19]. If the expectations in practice differ dramatically from the researchers’ expectations, it will create tensions, which makes it critical to negotiate these initially [9]. The RCA articulates the research project aim, project structure, responsibility, team structure, and consideration of the theoretical approach [13]. Having a clear RCA has also been framed as a criterion for evaluating action research projects [10].

We operate in an environment where, prior to undertaking any fieldwork, our research proposal must be vetted through both hospital and university ethics review boards. The ethical review process functions as an RCA agreement at a high level. The application for ethical review of projects includes information about roles of team members, and it sets out general rules of conduct to be followed during the project. Before an application has been made to the ethics review boards, we also discuss the empirical partner’s expectations about deliverables (e.g., frequency of reports, report style, sharing of results with staff), and intellectual property issues (such as who will have the right to publish findings from the study, etc.). Finally, the research aim and benefits of the project are negotiated during these early planning meetings, and are continuously renegotiated throughout the project.

An action researcher can take on several different roles, such as participant observer, facilitator, reflective partner, observer, consultant, and sometimes the roles interchange in ways that cannot be anticipated [13]. The action researcher acts while observing herself acting. In some particular applications of action research (e.g. dialogical action research) the researcher does not act herself, but instead participates in reflective conversations about practice with practitioners, and it is through these dialogues that the action researchers act [18]. During our ongoing relationship with the hospital, we enacted multiple roles dependent on particular situations. This included networking to build and sustain our relationships with the field and co-constructing the research context [22] by responding to practical needs, as they change over time.

4. Narrative of the study

4.1 Initiating practice collaboration

Action research projects can be researcher driven, or they can be driven by the need to solve a problem [21]. Our engagement with the hospital was a combination of the two and was initiated by coincidence.

A brief conversation which occurred on a ski lift led to the longstanding relationship with the hospital. It turned out that the person on the ski lift was the emergency department manager at a hospital and had inherited the implementation of an electronic triage system, which staff found difficult to use. Since our research interest concerned how computerization influences medical work practices, we saw an opportunity for collaboration. Conducting this initial study required ethical approval from two universities and the hospital. This took time, and by the time the ethics approval was in place, the problematic information system had been removed from the ED. The original action research project involved two dual goals: 1) to help the ED understand why their existing electronic triage system was problematic, while 2) informing research about electronic systems in health care settings in general. However, the new situation in practice (the problematic triage system was removed from use) meant that the original project evolved into a study of the current work practices within the highly complex collaborative setting of the ED [23, 24]. As our data collection progressed, we did not know whether the observations and interviews we conducted
At the hospital. At these workshops, people from the
started to participate in a number of design workshops
reconfiguration and implementation of the EDIS, we
suggested by Rapoport [4].

Renegotiation includes redefining the dual goal of the
project. Typically driven by both formal and informal
mechanisms. Here we negotiated our common
project, as well as EDIS application specialists
representing the two involved health authorities
(agencies governing the delivery of health services),
participated. EDIS application specialists are
individuals who have experience in designing and
implementing EDIS in other Canadian hospitals.

Initially the first author had to create and build her
role as academic researchers participating in the design
workshop through reflection and commitment. It took
approximately two months for the researcher to be
integrated as a part of the core group of the design
workshops. In this period the researcher spent one or
two days a week at the hospital, being there and being
seen.

The design workshops were typically planned
around a particular aspect of the EDIS application,
such as the design and user interface of the electronic
triage template or the security settings of the system.
The topics were selected by the EDIS application
specialist, and the relevant practitioners were invited to
debate this issue. For instance, the ED manager would
be present in some sessions, whereas only the nurses
would be present in others. Moreover, in some
situations, representatives for other involved EDs in
the province would be present if the topic would affect
multiple EDs. These representatives would then either
fly to the pediatric hospital or be present via
conference call. The researcher’s contributions to the
design workshops were in the form of bringing
attention to issues of current work practices essential
for the reconfiguring and design of the EDIS. For
instance, in the workshops where the use of icons on
the electronic whiteboard (an issue closely related to
the work processes and flow) were debated, the
researcher would bring attention to how the embedded
model for use of the icons was conflicting with the
current practices within the ED. One example of design
issues brought up by the researcher was an issue
concerning the management of consultant visits
(medical specialists) in the ED.

Consultants are physicians specializing in, for
example, neurosurgery or orthopedics. Consultants are
employed by departments in the hospital other than the
ED. The ED physicians sometimes request that
consultants come to the ED to offer their specialized
knowledge to particular cases. Handling and
coordinating consultant visits in the ED is managed
through the use of whiteboards. The new EDIS
included electronic whiteboards, which would replace
the existing whiteboards, and thus would affect the
management of consultant visits. The electronic
whiteboard was designed for one consultant per
patient; however, many of the patients in the ED
needed to be seen by multiple consultants. During an
early workshop in July 2007 there was a debate about

4.2 Changing circumstances

The circumstances for research changed in late
spring 2007. The hospital got extensive capital funding
for implementing a new electronic triage and patient
tracking system (the EDIS). This meant that our
presence in the ED collecting ethnographic data about
work practices gained relevance. The ED perceived
that our ethnographic work could be helpful for the
design and re-configuration of their new electronic
system.

Seeing both an excellent new research opportunity
and the possibility of assisting the practice
environment, we began renegotiating the goal of the
project. Because the conditions had changed, we
needed to renegotiate the collaborative commitment
between the hospital and the research group.
Renegotiation activities in action research have also
been identified in previous literature as an important
part of controlling action research projects [21].
Renegotiation includes redefining the dual goal of the
project, typically driven by both formal and informal
mechanisms. Here we negotiated our common
interests, as well as the role of the researchers within
the project. We explicitly articulated the revised dual
goals of our work (of research and practice), as
suggested by Rapoport [4].

4.3 Contributing to design of health
information systems

After our collaboration changed to focus on the
reconfiguration and implementation of the EDIS, we
started to participate in a number of design workshops
at the hospital. At these workshops, people from the

would be useful in relation to the practical situation of
the ED or whether our work would contribute
ultimately to only the research goal. To give
‘something back’ at that time, we agreed to conduct a
series of structured telephone interviews with ten
Canadian EDs about their use of electronic triage
systems [25]. The interviews functioned as a means
through which we were able to keep the collaborative
partnership with the hospital active at a time where it
could easily have died.

While some of the work done in this period related
to the hospital did not prove essential to future research
questions (e.g., the phone interviews), other research
activities (e.g., ethnographic study of complex
collaborative work practices) was important for the
research cycle. The ethnographic study undertaken at
that time did not appear to be relevant for practice.
However, that soon changed, and the fact that we had
undertaken that study proved quite important.

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current practices within the ED. One example of design
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how to reconfigure the system so it would support the work practices of managing multiple consulting visits. During this debate, the researcher brought to attention how the current work practices highly conflicted with the design of the consultant icon, which only allowed one consultant per patient. In this case, the knowledge that was translated comprised the researcher’s articulation of the nurses’ otherwise tacit knowledge.

Another example of knowledge translation during the workshops concerned the order of vital signs as they appeared on the electronic triage form. Vital signs are essential when assessing patients’ conditions and sorting them according to urgency. Since the system was built to support adult EDs, the order of the vital signs presented on the electronic form listed heart rate and pulse first, because that’s the most common urgent condition in adults. However, in the pediatric patient population, the most common urgent conditions are related to airway and breathing problems. Time is a major issue in emergency work; thus, the order in which the vital signs are assessed is essential. In an adult population, this means the heart rate and pulse should be listed first, whereas in pediatrics, airway and breathing should be listed first. Noticing this conflict in work practices was crucial to the design and re-configuration of the EDIS. In this case, the researcher’s role was to support the pediatric nurses in their interpretation of how the electronic form should be designed by suggesting theoretical explanations (e.g., the distinction between boundary factors and contextual contingencies [26]) for why the differences in work practices between pediatric and adult ED work were important design considerations.

This special form of knowledge translation, which took place during the design workshops, can be conceptualized as transforming the empirical observations of current work practices and representing them through articulation. As time went by, the researcher emerged in a role at the workshops as advocate for the ED personnel by pointing toward important HCI issues about the design that might affect crucial work practices in the ED. These issues concerned the order of data entry fields in the user interface, differences between current patients and paper flows, and the flows embedded in the generic design of the EDIS. It was not the researcher’s role to make decisions about the design, but rather to portray possible conflicts between the system design and the existing work practices. Subsequently, the practitioners (nurses and application specialists) would decide whether they wanted to change their existing work practices, reconfigure the application, or define a workaround to accommodate the conflict.

The design workshops became a knowledge translation context, where the researcher prompted negotiations while volunteering theoretical explanations of concrete issues pertaining to the design while the practitioners articulated their responses. This knowledge translation context prompted a very productive design environment where users’ perspectives were negotiated as a part of the design. In this way, the theoretical findings were co-constructed together with the practitioners, making the knowledge translation happen in a timely manner and directly impacting the design.

5. Challenges of close relations

When you, as a researcher, work closely with practitioners in practice for a long time, it also creates particular challenges. It is difficult to detach yourself as a researcher from the practical process. The focus of the collaboration easily becomes the focus of practice. You as a researcher become ‘one of them,’ and the borders become opaque. Dealing with this close relationship is, at times, quite challenging.

One challenge is that confusion about roles and tasks can create inappropriate expectations. The researcher volunteered to facilitate three design workshops focusing on process and work flows in the ED in November-December 2007. These workshops were aimed at articulating the existing work processes in the ED before and after the implementation of the new system. The facilitation consisted of preparing diagrams concerning different flows (various patient flows and paper flows) based on the ethnographic observations. These diagrams were then used to prompt questions and revise diagrams outlining the various work processes within the ED according to the new electronic systems. During the three dedicated workshops for processes, all diagrams were revised and evaluated, moreover many important issues related to the current work practices and the design were discussed and negotiated. The researcher constructed and revised the diagrams as well as writing up the observation notes from the workshops. However, facilitating these workshops made the distinction between being a researcher and a practitioner unclear. In all workshops throughout the project there was a minute-taker present to take notes. The minute-taker’s task was to document all decisions. However, the discussions about the work processes and how the new system should be used were very complex and difficult to follow if you did not have in-depth knowledge about what goes on in the ED. After the first of the three process workshop, the minute-taker asked the researcher whether he could get her notes. The rationale for the request was that it had been too difficult for him to follow the discussions and document the decisions. This was quite disturbing...
because there had been a lot of decisions made during the workshop that were not in the researchers notes because she had been busy facilitating the workshop, revising the diagrams, and making research notes. There is a distinct difference between research notes and minute notes. While minute notes can be seen as recording decisions, research notes include interpretation and selection of what is experienced [27]. Giving her notes to the minute-taker was not simply a matter of making an extra copy, but included creating the documentation of decisions retrospectively. The researcher had already agreed to construct and revise the work flow diagrams (there were approximately 10 highly complex diagrams), and even though the minute-taker could get these, he was also told he needed to create his own notes. This incident meant that the minute-taker, in the following workshop, was granted half a day’s time for clarifying issues that were not clear to him as a result of viewing just the diagrams.

This incident illustrates one of the challenges we, as action researchers, are confronted with when we are deeply engaged with practice. However, the close relationship was crucial to create the environment where we, with the practitioners, co-constructed new knowledge that was both relevant for practice and theoretically anchored. Theoretically anchored here refers to the notion that, throughout the iterative action cycles, problematic issues were challenged with various theoretical concepts (such as the theoretical concepts of situated actions, invisible work, tacit knowledge, contextual contingencies) in the process of reaching an in-depth understanding of the particular issues and then interventions were planned based upon this reflection.

6. Co-authoring as knowledge translation

Thinking about action research as dual processes of research and practice [20] makes it easier for the researcher to reflect upon activities and to solve the challenges of close practice collaboration. However, the two cycles of practice and research also overlap and interlink, and it is, in particular, during these incidents that we argue that knowledge is transformed by both parties.

The link in processes became pertinent when we began to co-author research papers with the practitioners. The hospital is a teaching and research hospital. Many staff members hold academic appointments, and there is an awareness of the educational environment and the value of academic publication. For those with clinical appointments, academic publication is a metric through which staff members are evaluated. For academic research, publication is an important element to continued success; thus, action researchers and hospital staff shared a common interest in publishing.

There are certainly differences between what kind of knowledge medical practitioners find immediately interesting and what kind of knowledge academics are inclined to publish within academic papers. One of the differences we observed here was that, since the medical field, as such, is highly impacted by and related to research on medical practices, there seemed to be expectations that all other research fields would use the same procedures and methodologies when enacting research. This meant that clear explanations of the differences in research design we had applying action research was needed. Moreover, the practitioners were very interested in improving their practices through the design of the EDIS and expected that we, as researchers, would be able to ‘prove,’ in scientific positivist terms, whether the design was good or bad. However, our research aim was not to approve or disapprove of a particular application. Instead, we had an interest in developing theoretical concepts useful for explaining our empirical observations in a more general manner. These differences made co-authoring with practitioners a challenge. However, we managed to turn the challenge into a constructive process of knowledge translation.

7. Writing with practitioners as knowledge translation

One of the explicit purposes of action research is to effect changes in the research environment as well as in practice. Publishing academic papers can have an impact on both if the academic researchers invite the practitioners to co-author papers. Mårtensson and Lee argue that becoming a scientist is a process where the person is socialized and assimilated into the socially constructed reality enacted by people who call themselves ‘scientists.’ Scientists are socialized into the academic discourse of scientific reasoning and become a part of the peer-review processes of journals and academic departments at universities [18, p. 514]. Thinking like a scientist is different than thinking like a practitioner, and different aspects of the research become pertinent as audiences change.

When writing with practitioners, one of the main challenges is to articulate and translate theoretical concepts to the practitioners during the writing process. The translation of theoretical concepts, especially, changes the writing process with practitioners. One example is that the first ‘draft’ tends to contain more pages dedicated to in-depth descriptions of the theoretical concepts and landscape than necessary for building the argument [26]. The draft served both as a
medium for translating the theoretical concepts from existing theory on health information systems to the practitioners, as well as a first draft for the co-authored paper.

When we first began the co-authoring process with the practitioners, there were different possibilities for topics. We could focus on the political process (this was of interest for the ED program manager), on the teaching process (this was of interest to the clinical nurse educator), or on the design processes (immediate interest for the researcher). The discussion about the topic was ongoing for a couple of months, and it was the researcher who was the driving force coming up with new ideas and identifying various theoretical possibilities, while seeing whether they would work or not by creating small outlines. The final topic chosen gave the paper two related functions. First, it was an academic paper presenting an argument, and second, the paper served to support the nurses’ perspective on re-configuring shared electronic templates. In this way, the academic paper produced the theoretical argument for why it was important to re-configure two different versions of one generic electronic template when used in different EDs [26].

Viewing co-authoring as a knowledge translation process, it was quite rewarding overhearing the nurses explaining to others why it was important to re-configure the electronic templates, referring to the theoretical argument developed in the paper a couple of months after it was submitted.

8. Discussion

8.1. Renegotiating access

The first area of action research essential for creating the close relationships necessary to turn the research context into a knowledge translation context consists of the negotiation and renegotiations of the dual goals of action research. Previous research has argued for the importance of negotiating the goals of action research initially [9]. While we agree with Baskerville and Wood-Harper, we would take this statement a step further and argue not only that negotiating the goals initially is important, but also that continuous negotiating and re-negotiating the dual goals are crucial. Other studies have also pointed to the importance of renegotiation [21]. Practice is dynamic, and the context for research is continuously changing. Enacting action research, it is important to follow this flow of change, thus re-formulating the research question, aim, and expectations at different stages. We would seriously question that the researcher/client agreement should ideally be produced in advance [10].

Even though Davison et al. [10] acknowledge that the RCA, in reality, is of a more emergent nature, we would actually argue that it unproductive to view the RCA as a static initial document. Instead, we argue that continuous renegotiation of the dynamic relationship with the practitioners is essential.

8.2. Managing data and cyclic processes

The second area supporting the maintenance of close practical relations, while preserving the research goal, involves the management of the action cycles. Action researchers generally agree that clearly defined cyclic processes are essential for structured data collection [e.g. 13, 19]. We agree that the cyclic process, as well as structured data collection, is essential. However, we would argue that the borders of the cyclical processes are emergent and changing. This means that determining when one phase (such as problem diagnosis) is finished and when the next phase (such as planning intervention) begins is fluid and up for negotiation. If the action research project truly takes the continuously changing practice into account, it makes it impossible to initially plan the whole project, including all the cycles and phases (see Figure 1).

Instead, we would propose that one of the areas essential to creating the engagement necessary for the knowledge translation context is to manage the cyclic perspective on the research. This includes continuously evaluating the practical problems as well as identifying the theoretical research approach. We believe that allowing the theoretical approach to change and move together with the context increases the chances of producing theoretically anchored findings immediately relevant for practice. However, managing this process requires that the data collection techniques are continuously re-evaluated. Without clear borders between activities, the risk of getting lost in the practical problems increases. Therefore, we argue that it is essential work of action researchers to distinguish themselves from the practical cycles, stepping back and reflecting upon the practical problems in light of the research cycles. In this process, the action researcher needs to continuously construct and reconstruct the borders of the project. While constructing and reconstructing borders, we found it beneficial to view the dual cycles of action research (practice and research) [20] as detached from each other.

8.3. Managing the network

The action researcher’s role depends on the changing context, and effort is required to sustain the relationship with practice both at the organizational
and collaborative level. Here the networker role is essential, however often missing from the literature on action research. The problematic issue of putting in extra work to keep the access to the field has been mentioned in previous research [4]. Through our experience, we argue that putting in the time for networking is not a choice but a condition for action research. The extra time is not necessarily well used producing products to meet short term practical goals, (e.g., such as producing technical reports requiring quick turnaround). Instead, we believe the extra time is best used building up engagement and networking as well as keeping the door open and noticing new opportunities. The small, quick products are sometimes important (such as the phone interview report in our case); however, as a general strategy, we would argue that producing these short term products requires too much time to justify their usefulness when viewed only as in relation to the research cycle. In some situations, producing objects (e.g., reports) that do not have demonstrable use as research products might have demonstrable long term consequences as networking and trust-building tools, thus contributing to the knowledge translation process, linking theory and practice.

### 8.4 Translating theoretical concepts

The process of co-authoring with practitioners across disciplinary lines involved translation of theoretical concepts to the practitioners. And although it was clear that they were interested in writing, the hospital staff had very little time, if any, available during their normal work hours. Therefore, the time for research was constrained, and writing was mostly done outside regular working hours. In this situation it is not possible to overload your co-authors with a lot of reading material. Instead, you need, as a part of the co-authorship, to present the theoretical perspective as well as the theoretical argument in the actual writing. You describe much more about the theoretical framework than you do normally. However, these more detailed descriptions of the theoretical framework do not end up in the final submitted papers. In this way, there is a lot of extra effort required when writing with practitioners. There is much more articulation work [28, 29] involved in the cooperative work of co-authoring papers with practitioners.

Moreover, since the context is changing, the theoretical foundation for research also needs to be reconstructed. This means that when allowing the practical situation to guide the direction of research, it calls for a malleable theoretical perspective. Therefore, we would argue that stability in theory is an idealized vision [13], and an important part of action research as knowledge translation is to balance the theoretical approach with the actual practical work.

We would argue that even though it is challenging to co-author with practitioners, this process adds to the data collection and interpretation techniques, since you get the practitioners’ perspective on the actual theoretical findings, which helps ensure that the theoretical contributions are relevant for practical situations. Finally, we believe that co-authoring can be seen as a knowledge translation activity supporting the design of information systems that is unique to action research.

### 9. Conclusion

We set out to investigate IS action research as a knowledge translation process that enables the development of new theoretical knowledge together with practitioners and ensures findings have practical relevance for the design of health information systems. We found that establishing a research context as a knowledge translation context required a strong relationship with practice. This strong relationship supported our engagement with the actual design activity of the health information system, spurring a process of crucial negotiations for the reconfiguring of the generic EDIS.

Creating the research context as a context of knowledge translation requires four important activities: 1) negotiating and renegotiating the dual goals, 2) managing the interlinked action cycles, 3) managing the network, and 4) creating and translating the continuously changing theoretical conceptual framework.

By identifying these activities embedded in action research, we, at the same time, question some of the taken-for-granted descriptions of action research as they appear in the information system community [8]. *Negotiating and renegotiating the dual goals* raises questions about whether or not it makes sense at all to have, as an ideal approach, the researcher/client agreement negotiated initially [10, 13], because it will change over time.

Naming *managing the action cycles* as a crucial part of action research causes us to question the whole approach presented in many descriptions of action research—that the research project is a straightforward, clearly phased process [9, 13, 19].

Pointing to the essential element of *managing the network* as a part of action research makes visible an absent issue of action research, which has not been addressed within literature. We found that network was essential for creating the close relationship with practice, establishing a context for knowledge
translation where the creation of knowledge directly impacted the design of health information systems.

Finally, we argue that creating and translating the continuously changing theoretical conceptual framework is an important part of action research when viewing it as a knowledge translation process. Here we challenge the notion that action research is based upon a clearly defined theoretical foundation upfront [6, 13, 14] by stating that the theoretical approach is a moving target following the forever-changing context.

Action research contributes to the design of health information systems by engaging us, as health IT researchers, in the processes of designing and computerizing hospitals. We become committed to producing timely and accessible findings that can be used in practice. By noticing issues of the design, we make possible conflicts visible and available for negotiations in the actual process of design and reconfiguration. When we then engage in discussions and negotiations with the practitioners, volunteering theoretical conceptualizations of the experienced issues, we, together with the practitioners, co-construct the context of research and knowledge translation. Knowledge translation does not go only one way, since both researchers and practitioners construct and create new meaning essential for new knowledge.

Action research in HCI knowledge translation comprises the dual process of transforming and aligning practitioners’ practical experiences into empirical observations, as well as developing, transforming, and aligning theoretical concepts relevant to explain, interpret, and understand the empirical observations.

We do not claim to have produced a conclusive list of the work required to establish action research as a knowledge translation context. Instead, this is the beginning of articulating an important benefit of action research in a user-centered design perspective, which has been neglected in previous HCI papers [1]. We support the work of Bødker and Buur [3] in that enacting research on user-centered design together with practitioners engaged in real life practices and contexts, such as in hospitals, will benefit from applying action research approaches. We do hope others also will take up the challenge to engage in action research projects by participating in design processes, since this will bring new venues for HCI research in general.

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