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# Challenges of Change: Technological Ease or Technological Upset?

*Full paper*

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## Introduction

New knowledge learning that involves errorless task performance has become a key objective for healthcare organizations [Rushmer & Davies, 2004]. As knowledge changes to incorporate the use of computer systems, service delivery using the Electronic Health Record (EHR) has created unforeseen challenges for service providers and the organizations they serve. This challenge appears mainly to involve a change in actions, behaviors and mental models by providers using the EHR [Senge, 2006]. This is necessary for healthcare organizations if they want to remain competitive, improve the quality of care, and reduce costs. The challenge is to develop and implement this new knowledge from individual current competencies [Becker, 2004]. One group that is critical in meeting these challenges is the physicians. Work practice documentation has changed to include a technological focus. As physicians interact with EHR technology, it is important they have the ability to unlearn needed knowledge while maintaining intellectual capital for organizations [McDonald, 1997].

Over the past 25 years, many medical records have been converted from a handwritten format to an EHR. Studies [Niazkhani, Pirnejad, Berg & Aarts, 2009; Greenhalgh, Potts, Wong, Bark & Swinglehurst, 2009; Fontaine, Ross, Zink, Schilling, 2010] indicate that the EHR is complicated and requires a serious, sustained commitment to human resources, process re-engineering, technology, and funding. Unfortunately, much of the healthcare system has been slow to take advantage of the EHR and realize the benefits of computerization, including improved access to, and records of, patient data, the enhanced ability to make better and more-timely decisions, with an improved quality of patient care and fewer medication errors.

Currently, a common assumption is that U.S. healthcare organizations are 10 years behind the information systems (IS) curve compared to organizations from other industries of comparable size and complexity [Kaplan & Duchon, 1988]. According to Institute of Medicine [IOM, 2001], "...healthcare delivery has been relatively untouched by the revolution in information technology that has been transforming nearly every other aspect of society" [Kaplan & Duschon, 1988, p. 15].

## Theoretical Background

Many organizations, healthcare organizations included, rely on speed and accuracy of service delivery. To maintain competency, service providers must remain current in their knowledge base. This involves the ability to update and change the knowledge base as a routine in scope of practice.

Reviews of (EHR) literature show existing challenges with the alignment of organizational design and the engineered artifact. Niazkhani et al. [p. 546] conclude, "When put in practice, the formal, predefined, stepwise, and role-based models of workflow underlying Computerized Physician Order Entry (CPOE) systems may show a fragile compatibility with the contingent, pragmatic, and co-constructive nature of workflow." Two of the findings of Greenhalgh et al., [p. 767] were "while secondary work (audit, research, billing) may be made more efficient by the EPR (Electronic Patient Record), primary clinical work is often made less efficient" and "the EPR may support, but will not drive, changes in the social order of the workplace."

In addition, Fontaine et al conclude, from a systematic literature review in primary care, that “The potential for HIE (Health Information Exchange) to reduce costs and improve the quality of health care in ambulatory primary care practices is well recognized but needs further empiric substantiation.” IOM [2001] claimed that the healthcare system needs to join the IT revolution, and improved information systems may be a critical factor for improving the healthcare system because of the pervasive need to access, record, and share information in order to provide high-quality medical care.

Unlearning is the process of replacement or disusing of knowledge, action, or procedure while substituting new knowledge when appropriate [Becker, 2007; Hammel & Pralahad, 1994]. Unlearning contributes to the learning process by allowing the change to occur. Change processes involving modification or replacement of new learning may indicate that unlearning is occurring [Hedberg, 1991]. Through unlearning, previously learned knowledge or procedures are modified by adding emerging skills with new knowledge thus completing the learning process [Wheatley, 2006]. Often, recently acquired knowledge has been untested by the individual [Starbuck, 1996]. The idea that an individual should “...eliminate preexisting knowledge or habits that would otherwise represent formidable barriers to new learning” has not been established [Nystrom & Starbuck, 1984, p. 36]. The problem is that researchers have not used the correct study design to characterize unlearning [Clark, 2010].

The unlearning process and the factors involved in new knowledge acquisition during knowledge change are not well understood [Nissen, 2006; Neal et al., 2011; Becker, 2010]. Some unintended consequences of the failure to unlearn include decreased productivity, reduced quality, and additional costs [Leibowitz & Beckman, 1998]. Additional time sinks, operating costs, and potential for errors are additional undesirables. Change of the knowledge base to maintain current employee skills during change is an open problem for healthcare organizations [Becker, 2004; Becker, 2007; Leibowitz & Beckman, 1998]. Ongoing technological advances, such as the Electronic Medical Record (EMR), require continual updating, increasing time constraints and altering work pace. This has become a major challenge to healthcare providers [Leape & Berwick, 2005]. Key to this is the realization by organizations of the importance of people and processes involved in knowledge change [Leibowitz & Beckman, 1998].

Hedberg [1981] suggests that, as new knowledge is available, old information is discarded, whereas, Starbuck [1996] views old knowledge as incorrect information that is no longer used following unlearning processes. Healthcare providers must acknowledge previous actions as unreliable and should stop using them to maintain competency [Hedberg, 1991; Starbuck, 1996].

The underlying assumptions or frames of reference of the practitioner may impact the success of unlearning. When knowledge is absorbed, it becomes part of the awareness of the individual. At the same time, it may not be necessarily used [Wheatley, 2006]. The focus of attention and alterations in the type or amount of unlearning needed may contribute to this [Mezirow, 1991].

The implications to knowledge change through unlearning are important. Because adults acquire, internalize knowledge competency, and use a variety of types of knowledge, change processes involving the use of technology are critical. Also, this knowledge change plays an important role in IT functions. Researchers have developed diffusion, adoption, and acceptance theories to explain how people adopt, accept, and use complex organizational technologies. Attewell [1992] defines complex organizational technologies as technologies that, when first introduced, impose a substantial burden on would-be users in terms of the knowledge needed to use these technologies effectively.

From an organizational learning perspective, Attewell defines technology assimilation as “a process of organizational learning in which individuals and an organization as a whole acquire the knowledge and skills necessary to effectively apply the technology” [Attewell, 1992, p. 1345]. The burden of learning creates a knowledge barrier that inhibits the diffusion of IT. In these cases, the use of IT can be inhibited as much by the ability to adopt IT systems as the desire to adopt these systems. Consequently, IT penetration into the market from which the stakeholders could benefit is seriously affected and the benefit undermined.

## Statement of the Problem

Healthcare organizations rely on speed and accuracy of service delivery. To stay competent, service providers must remain current and maintain their knowledge base. Modification and correction of their knowledge base needs to be a routine of practice.

The research question this study investigates is,

***How does technology inspired unlearning influence physician perceptions of the EHR in service provision?***

Investigation of the question used a qualitative study that examines how physicians interact with the EHR. Open coding was used to analyze the data and to develop concepts explaining these interactions in terms of the events, actions, and communications carried out among physician stakeholders. This enables concepts and relationships to be arrived at, and then assessed using the enfolding literature step from Eisenhardt and theoretical sensitivity from open coding. The combination of approaches strengthens the contributions of this study by enabling the results to be generalized to models and relationships. The research provides theoretical contributions by presenting the model of Physician Unlearning: Technological Upset and Technological Ease Processes. In addition, implications of this study for future research and practice are discussed.

## Research Methodology

The investigation of physician technology inspired unlearning related to technology interaction is complex, vague, and context-specific. We do not know why some physicians intuitively learn the EHR while others encounter various levels of difficulties. The qualitative methods used in this research can yield data about process relationships and richer explanations about how and why processes occur [Klein & Myers, 1999; Walsham, 1993]. Qualitative methods provide researchers with the ability to discover relationships from data that are systematically gathered and analyzed [Kaplan & Duchon, 1988]. The qualitative research allows the researcher to ‘interpret’ or unearth the meanings discovered in the research environment. The physician’s knowledge of reality is acquired through social constructions such as, language, consciousness, shared meanings, documents, tools, and other artifacts [Klein & Myers, 1999]. These methods of research in Information Systems (IS) are aimed “at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context” [Walsham, 1993, p. 389].

This study uses Eisenhardt’s case study approach, with interviews as the primary data collection, and open coding for data analysis [Eisenhardt, 1989]. The Eisenhardt method was chosen, as it: 1) Generates relationships or theory with constant comparison literature; 2) Emergent theory is likely to be testable with constructs that can be readily measured; 3) [produces] A high likelihood of valid relationships, models, or theory because the theory building process is tied to data and other evidence.

Case studies provide description [Kidder, 1982], generate, and test theory [Gersick, 1988; Pinfield, 1986]. The goal of this research is to gain a rich description of physicians’ interactions with the EHR, analyze the data, and generate relationships or a theory. The study uses the Eisenhardt method for building theories from case study research. It is well matched to the open coding analysis selected as the case study process is “highly iterative and tightly linked to the data” [Eisenhardt, 1989, p. 532]. Participants in the study are resident physicians selected from a medical center in the U.S. Midwest.

Open coding is used to analyze the data and develop concepts as they relate to physicians’ perceptions during unlearning with the EHR. The qualitative method and open coding analysis enable discovery of the relationships in a real world situation. Theoretical sensitivity allows the researcher to acquire insight into data, and to give meaning to the events and happenings of that data. “Insights do not just occur haphazardly; rather, they happen to prepared minds during interplay with the data [Strauss & Corbin, 1988, p. 47]”. Eisenhardt’s enfolding of the literature step complements the development of sensitivity. “An essential feature of theory building is the comparison of the emergent concepts, theory, or hypotheses with the extant literature [Eisenhardt, p. 544]”. This research uses theoretical sensitivity and enfolding

the literature to develop the lens for the effort: It allows the ability to see beneath the obvious to discover the new.

Physicians have demonstrated great variation in EHR use depending on specialization [Bates et al., 1994; Burt et al., 2005; Gans et al., 2005; Johnson et al., 2004; Khoury et al., 1998; Blumenthal, 2009; Tonneson et al., 1999] and type of practice ownership [Cutler et al., 2005; Gans et al., 2005]. Physicians have the ability to choose or avoid EHR use. In addition, by the nature of their position, they have the ability to have an impact on others in their organizations. For this reason, they were chosen as the target the sample.

The examination of the relationship between IT and organizations and people broadens the field of IT; however, this type of research produces additional complexity, greater imprecision, the possibility of different interpretations of the same phenomena, and the need to take these issues into account when considering an appropriate research approach [Gersick, 1988]. The use of a case study method to discover relationships or to generate theory minimizes these risks.

## Results and Analysis

The hospital selected for this study has successfully integrated all its internal units with various modules of a single EHR vendor. The data were collected over a three-month period in 2013 at an acute care count hospital in the Midwest. The hospital was chosen because of its central location and importance in providing health care for a county. Twenty-eight physicians were chosen because of their position as resident physicians. The entire resident population was interviewed, and the 28 interviews represent 21 pages of electronic transcripts.

Category	Description	#	%
Technology Ease	The perception of competence during the unlearning of EHR system use. This perception includes the feelings of comfort and competence during patient care.	76	23
Technology Upset	The perceptions of unbalancing skills, stress, and frustration occurring while working with an EHR system.	131	41
Comfort	Comfort appeared as the main positive perception involving the emotional ease about the unlearning process.	34	11
Frustration	Frustration appeared as the main negative perception involving an emotional upset about the unlearning process.	25	8
Negative Collaboration	The decreased collaboration perceptions involved unsupported instances of collaboration, lack of interfaces between various specialties, clinics, or organizations. The inability to work together to achieve shared goal of patient care.	34	10
Positive Collaboration	Perceptions of increased collaboration, increased interaction with patient support team, and improved collaboration emerged as positive perception. The ability to work together to achieve shared goal of patient care.	23	7
		<b>323</b>	<b>100</b>

Table 1: Data Categories

The data were tabulated according to concepts related to unlearning, technological ease, and technological upset [Hafner, 2015]. The remaining open-ended responses were analyzed through grounded theory open coding as they relate to physician interaction with the EHR. The result of this analysis is in Table 1.

Open coding was used to identify “labels of meaning” and was placed next to the relevant occurrence. Occurrences were events, happenings, actions, feelings, perspectives, actions, and interactions. Categorization of the coding was done in two phases by two coders. First, the data obtained from the interviews were labeled. Second, data were sorted into broad categories. Theoretical sensitivity allowed the researchers to have insight into, and to give meaning to, the events and happenings in the data. “Insights do not just occur haphazardly; rather, they happen to prepared minds during interplay with the data [Strauss & Corbin, p.47]”.

The research question was answered through the development of subcategories of perceptions that are present in physicians in the process of unlearning an EHR. Physician perceptions about how unlearning processes occurred were assessed during specific unlearning of EHR systems. Experiences were defined as how unlearning occurs in physicians who performed routine patient care functions with the information technology interface.

Technological upset is defined as the perceptions of unbalancing skills, stress, and frustration occurring while working with an EHR system. Frustration appeared as the main negative perception involving an emotional upset about the unlearning process. In addition, the participants also related a source of their upset as being related to the design of the system and its “non-intuitiveness in operation.” Participants discussed their concerns as a generalized upset unbalancing their competency and knowledge in the completion of job tasks [Hafner, 2015]. The decreased collaboration perceptions involved unsupported instances of collaboration, lack of interfaces between various specialties, clinics, or organizations.

Technological Ease is defined as the perception of competence during the unlearning of EHR system use. This perception includes the feelings of comfort and competence during patient care. Perceptions of increased collaboration, increased interaction with the patient support team, and improved collaboration emerged as positive perceptions. The participants were able to respond with a positive perception and appeared more at ease with the unlearning process. The understanding of their patient care tasks and the perceptions of competency during the process of unlearning were mentioned by the participants [Hafner, 2015].

### **Technology inspired unlearning process – incomplete**

The analysis suggests physicians’ inability to complete unlearning stems from their inability to adapt to the EHR interfaces and utilize the systems to support their work, and as collaboration opportunities appear to decrease, technological upset results. The following instances and components of the incomplete unlearning cycle demonstrate these observations:

*“Takes longer to do clinic notes. Not very intuitive, takes a while to learn the details and now to navigate the system.”*

*“Medication interactions pop up for everything. This happens so much that you get in a habit of ignoring them and may miss an important interaction.”*

*“Searching for labs and medications is cumbersome. You have to know exactly how it is entered into the system to find it.”*

*“Seems every time I learn to do something one way, it makes an update, and I have to relearn (usually by a mistake) how to do the same thing again.”*

#### **Non-intuitive EHR frustration:**

It appears that for some of the physicians, work processes were not supported by the EHR. They found the interface unintuitive and lacking in support for their work as indicated by the comments here:

*“Not a very user-friendly system.”*

*“Some things you are trying to order are nearly unfindable because of how they are entered in systems.”*

*“Non-intuitive interface. Slow system.”*

*“It makes entering orders much easier but can also take away from thinking critically about what the patient needs in that everything is check boxes.”*

### **Decreased collaboration:**

This research shows that some physicians were unable to utilize the EHR for successful collaboration. Rather, they have been challenged by the requirement to utilize the system to change their action, procedure or substitution of new knowledge required to successfully interact with the system. The following transcripts illustrate this:

*“System does not communicate well with nursing. Orders are sent to nursing that are not easily seen from their side, and orders are missed.”*

*“Two people cannot be in the same chart, and this causes time problems. I make an order and then have to get out of the chart for the nurse to see the order. If the nurse is in the chart, I cannot get back in to put in new orders.”*

*“It slows down clinic by taking too long to process orders. Not letting provider and nurses work in the same chart at the same time.”*

### **Technological upset:**

When physicians were unable to unlearn prior knowledge, actions and procedures and modify or replace their knowledge, the tools appear non-intuitive, and technological upset appears as indicated by these comments:

*“Med lists/dosages are either out- dated or don't make sense. I spend too much time clicking on multiple copies of the same med to find the one with correct dosage and form.”*

*“...there are lots of redundancy with ordering, documents are sometimes categorized in odd and inefficient places, and the use of a new screens for documents and ordering tends to jumble the computer work bar...”*

*“If system goes down, no work can be accomplished.”*

*“I think at times, it makes documentation take longer. Not every template lets you cross out pertinent negatives. Templates make you go into auto pilot and make documentation mistakes.”*

### **Technology inspired unlearning process – complete**

Physicians, however, indicate positive unlearning results in their ability to intuitively interact with the system, establish comfort with it, and increase collaboration to support work processes thus enabling them to establish technological ease.

### **Intuitive EHR comfort**

According to the physicians' perspective, the ability to intuitively interact with the technology system and have it support their work processes result in EHR Comfort as shown here:

*“Makes picking up services and call shifts much easier. I think the interface is clear. Once on the home page, you don't have to guess where 95% of the information is.”*

### **Positive collaboration**

This category illustrates the bundles of meaning relating to how physicians utilize the EHR to establish positive collaboration and increased value from the EHR as indicated below:

*"Appreciate the ease of coverage as far as being able to access concise, correct clinic lists by covering a certain attending."*

*"Lab comparison (easily found and together). Medications can now be accessed and adjusted by all providers involved."*

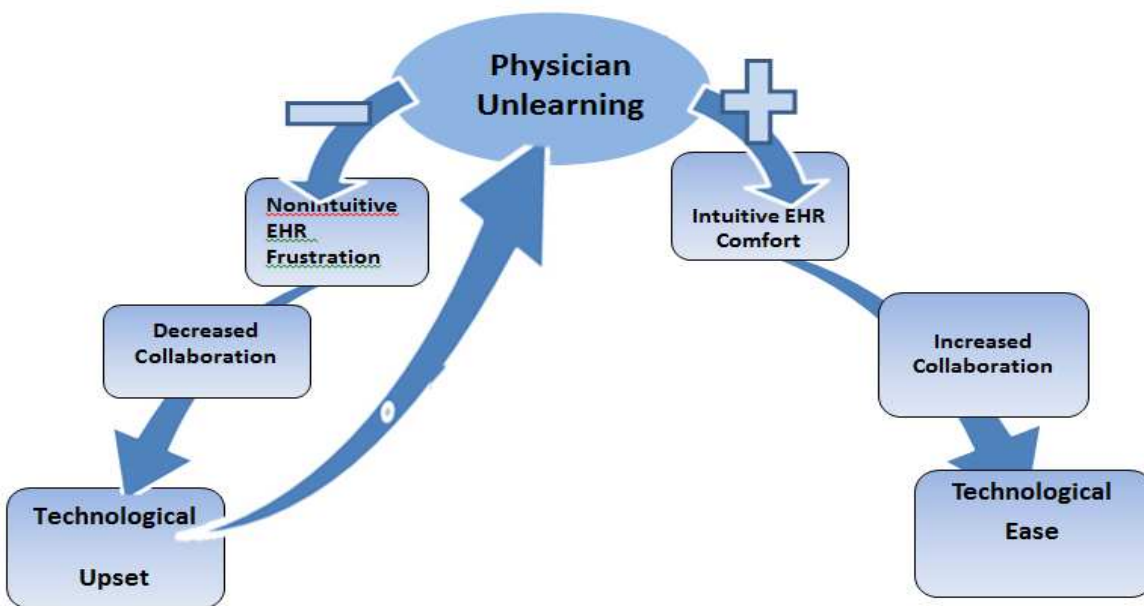
*"Access to imaging, labs, notes all from on interface. Makes a quick check of needed labs easy to find, nice being able to review films in the room with the patient."*

**Technological ease**

When physicians interact with the system in a fluid and natural way using the technology to enable them to interact with the system without additional cognitive effort, they have established technological ease as implied here:

*"I can click on a single lab, and it shows me the entire history of results for that specific lab. I can also quickly look back to see any trend in vitals. It will automatically pull the above information into the document for the past 24 hours. It is also now allowing us to pull all of the inpatient labs into the discharge summary."*

The analysis of this research suggests the ability to ‘unlearn’ processes related to incorporating new technological tools in the workplace results in positive and negative cycles of use. A positive cycle appears to exist, which could have a beneficial effect on physicians’ work practices. This positive cycle is related to the ability of physicians to ‘unlearn’ processes, establish comfort with the information technology, increase collaboration, and establish technological ease. When physicians are unable to unlearn and incorporate the information technology in their workflow, a negative cycle appears and can result in a negative spiral. Unlearning then results in frustration, decreased collaboration, and technological upset. The two processes are illustrated in Figure 1: Service Delivery Unlearning Paradigm.



**Figure 1: Service Delivery Unlearning Paradigm**



The model illustrates how the lack of unlearning, frustration, and decreased collaboration result in technological upset. At the same time, there is a positive cycle from successful technology required unlearning, which increases comfort that results in technological ease.

## **Summary & Conclusions**

This qualitative study adds to knowledge on the characteristics of unlearning in physician practitioners adapting to technology support systems facilitating their work processes. The case investigated the challenges related to changes required to service in the implementation of an EHR. It is apparent that unlearning of technological systems, as shown in EHR service delivery may involve moving in and out of cycles as the individual modifies their knowledge base. As the individual experiences frustration due to the realization that previous learning is no longer useful, there is a cycling into technological upset. As the EHR technology is better understood and the individual alters his knowledge base, cycling into technological ease occurs. The perception of competency and improved EHR use continues until the next change is presented. An individual may cycle in and out of technological ease and technological upset each time knowledge or competency level is altered. The individual experiencing these changes may not be aware of this cycling process. The result of these activities may create additional challenges for the organization.

The scope of this study is the formulation and identification of experiences, perceptions, and characteristics used in the unlearning process incurred when technology is introduced to the work process. The learning of a new knowledge base to perform tasks without errors has become an important focus for organizations [Rushmer & Davies, 2004]. As knowledge grows exponentially, the ability to maintain competitive advantage becomes difficult for organizations and individuals alike. Organizations must face the challenge to change rapidly, to alter actions, behaviors, and “mental models” in their professional [Senge, 2006] and maintain professional staff competencies [Becker, 2004].

## **Recommendations for future research**

The challenge to healthcare remains difficult when mental models of service delivery continue to change. This research provided a better understanding of the complex process of unlearning within physicians. The inherent complexities of unlearning are not well understood, requiring continued research. Technology inspired unlearning does play a role in knowledge change and may assist healthcare organizations to remain competitive. With improved use of EHRs, modification in knowledge base and competencies of healthcare providers can become more efficient. The EHR environment is complex requiring numerous system updates and additions in patient data requiring unlearning of functions in healthcare providers.

Future research should complete additional studies using the additional interview questions to add to the knowledge of the technology inspired unlearning of the EHR in several areas. Diverse specialties and experience levels of physicians could enrich the data. Healthcare participants may allow their knowledge base to have greater or lesser impact on the unlearning of the EHR.

The homogeneity of the study population may have had an impact. Additional study with diverse populations and a quantitative lens would substantiate this explorative study by adding to technology inspired unlearning characteristics. These challenges appear to have far-reaching implications to learning change in a variety of fields of study, especially impacting healthcare providers who need to update knowledge base to remain competent and embrace technology inspired change.

## **Recommendations for practice**

As organizations continue to utilize EHR technology to gain efficiency, effectiveness and consistency to best practices, it becomes a requirement to facilitate technology use with ease. As this research indicates, reactions to technology inspired unlearning can be technology ease or technology upset. The organizational goal is to determine methods to avoid technological upset, or at least offer support to break

out of the negative cycle. As service providers, our ability to influence the transition to technology ease provides increased technology benefits, increased technology use and ongoing professional staff competency.

We need to develop appropriate change management practices and consider unlearning processes to support transition to technology ease. Through best practices, the reduction of the potential for technology upset can be realized. The Service Delivery Unlearning Paradigm is a model to use for increased awareness and emphasizes requirements for intuitive interfaces, usability and support during transition to new technology innovations.

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