Assessing Electronic Clinical Audit information Systems Using Activity Theory

Emergent Research Forum (ERF) Paper

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Abstract

Information systems are increasingly being implemented in many healthcare service provision areas including clinical, business service, administration and management. These systems are often introduced to hospitals with a view to supporting care delivery and improving care quality, safety, and efficiency. However, it is not always the case that the full benefits of these systems are realized. This paper reports on a research-in-progress that is designed to assess an electronic clinical audit information system in an Australian not-for-profit tertiary private healthcare system. Activity Theory is used to inform the study and thereby enable a deeper understanding around the key relationships between various stakeholders as well as the system itself.

Keywords

Activity Theory, Electronic Clinical Audit, Clinical Data, Healthcare, Information Systems, Health-computer Interaction

Introduction

New applications and information systems are increasingly being implemented in many healthcare service provision areas including clinical, business service, administration and management (Freedman et al. 2014; Nurek et al. 2015) to enhance various aspects of healthcare delivery, such as safety (Nuckols et al. 2014; Shekelle et al. 2011), efficiency (Waterson 2014; Wickramasinghe et al. 2016), and financial performance (McCoy et al. 2012; Unertl et al. 2012). This trend can also be seen from the figures of information systems/ information technology (IS/IT) investments (Haddad et al. 2015; OECD 2013). Most recently, Gartner (2015) has ranked the healthcare industry as the fifth biggest spender on IS/IT with about USD108 billion, behind banking, communications, education and government. These systems are often introduced to hospitals with a view to supporting care delivery and improving care quality, safety, and efficiency. However, it is not always the case that the full benefits of these systems are realized (Chaudhry et al. 2006). Hence, it is important for clinicians and healthcare providers to evaluate the level at which the new systems have been accepted and used as well as their impact on service provision and their alignment with strategy (Arvidsson et al. 2014). This study tackles this issue by assessing an electronic clinical audit information system in the context of the Australian healthcare system. In so doing, the study adopts a qualitative approach using a single case study to operationalize this exploratory research. The remainder of this paper is organized as follows: The next section presents the research questions and objectives, followed by a section to describe Activity Theory, the underpinning theory adopted for this study, and then the methodology is presented followed by an overview of the assessed system, and finally a conclusion which highlights the theoretical and practical implications of this study and next steps is presented.

Research Aim and Objectives

The overarching objective of this research is to assess the benefits and use of an electronic clinical audit information system in an Australian case study and identify the barriers and facilitators for receiving benefits from this system. Thus, the research question is:

"How can electronic clinical audit information systems help enhance key outcomes in healthcare?"

In so doing, this study uses the lens of Activity Theory to guide and inform the research. The next section serves to summarize Activity Theory and its appropriateness for this study.

Activity Theory

Activity Theory provides a powerful philosophical framework and descriptive tool that focuses on understanding the interactions between human activities and various work practices (Allert et al. 2007). According to this theory, various activities are the basic units of analysis (Kuutti 1996). Having said that, these units of analysis are always under constant, and sometimes unpredicted changes in the context in which they are embedded (Lockley 2016). Noting this, the traditional elements of the theory (tool, subject, and object) (Vygotsky 1980) are then expanded to include another main element; namely community (those who share the same object), which further results in two additional relationships in this context subject-community (rules) and community-object (division of labor) (Kuutti 1996). Figure 1 depicts the basic structure of an activity based on this conceptualization, and Table 1 briefly describes these elements.

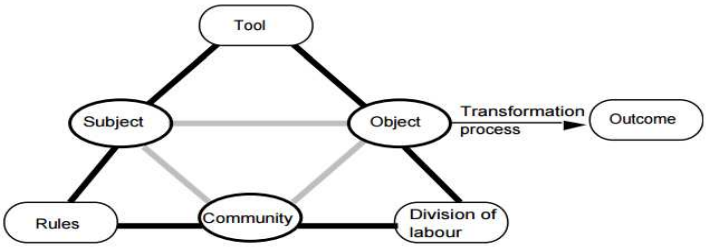

Figure 1: The basic Structure of an activity (Engeström 2014; Kuutti 1996)

Activity Theory elements	Description
Subject	Driven by their own goals and motivations, subjects attempt to achieve an outcome by transforming objects
Object	The element on which the transformation process is undertaken. Its characteristics are not necessarily static, rather they evolve based on the changes in the surrounding context i.e. the community.
Community	The context in which the subject is transforming the object.
Tools	A broad concept that covers any enablers or means for the transformation process. This varies from being materialistic (tangible) to an approach of thinking (intangible).
Rules	Cover both explicit and implicit norms, conventions and social relations within a community
Division of Labor	The explicit and implicit organization of a community as related to the transformation process of the object into the outcome
Outcome	The final product of the activity, which in other words can be seen as the modified object based on the needs of the subject and enabled by the selected tools.

Table 1: The basic elements of an activity based on the Activity Theory, adapted from (Kuutti 1996)

In the recent years, Activity Theory has been increasingly used as a powerful research paradigm by multidisciplinary research communities (Bakhurst 2009). It is widely used in fields like education (Holman et al. 1997; Lockley 2016), workplace practices (Engeström 2014; Engestrom et al. 2007; Williams et al. 2001), human-computer interaction (HCI) (Hekler et al. 2013; Kaptelinin et al. 2006; Nardi 1996), and recently healthcare (Coleman et al. 2013; Durst et al. 2017; Greig et al. 2012).

The use of Activity Theory in healthcare has become more popular during the last few years. For example, Korpela et al. (2002) used Activity Theory to investigate the development of new information system, and found that IS/IT development is an activity, while Coleman et al. (2013) used Activity Theory to examine the readiness to use eHealth tools in South Africa, and Durst et al. (2017) examined the use of a computerized physician order entry (CPOE) system used for chemotherapy in the context of an Australian healthcare not-for-profit tertiary private hospital. Thus, the literature shows that the use of Activity Theory to support research on health information systems is appropriate in the IS research community today. To the best of our knowledge, this theory has yet to be used to assess clinical audit information systems. Hence, this research-in-progress serves to address this void. This study uses Activity Theory to

comprehensively explore the influence of various actors on the outcome of the system i.e. better clinical auditing processes.

Methodology

This research is exploratory in nature, as it is planned to be a 'broad-ranging, purposive, systematic, and prearranged undertaking designed to maximize the discovery of generalisations leading to description and understanding of the area of research' (Stebbins 2001). In addition, as noted by Yin (2014), qualitative research enables carrying out deeper investigations about a diverse set of topics as is the case here.

In order to answer the research question, a case study is deemed appropriate for this research (Yin 2014). Single case study has been extensively used in the area of health information systems to evaluate various applications, see for example (Baskerville et al. 2016; Jones et al. 2014). The selected case is a multi-site not-for-profit tertiary private healthcare system in Australia. This healthcare provider has made a relatively significant investments during the last few years. In terms of data collection, the first phase included a series of 5 interviews to date. Three interviews were conducted with clinical informaticians who use the system and work with a wide spectrum of clinicians across the selected case to assure a 'smooth' transition towards adopting the system instead of paper based auditing. Other two interviews were conducted with actual clinicians who had dealt with both the conventional auditing method and the new system. During the interviews, the participants were asked questions on the interaction between the system and various stakeholders, as well as any problem and issues around the system. These question have helped to map the studied system onto Activity Theory. To subscribe to recommended practices to enhance the reliability of data (Flick 2009), interviews were transcribed by one researcher and checked by another. In addition, other sources of data including documents and site visits are being used for data triangulation purposes (Yin 2014).

The Assessed System: The electronic clinical audit (eCAT)

The assessed system is an electronic Clinical Audit Tool (eCAT). It aims at allowing doctors and other clinical users to create records for each operation or admission that occurs within each specialty. The record will include a structured data set, representing all of the information pertinent to clinical audit within that specialty. This system is seen to be at foundation of conducting various clinical process electronically, such as referrals, admissions, handovers, progress notes and discharge summaries.

The system is designed primarily for healthcare as a web-based platform that enables data collection, data analysis, and reporting online. The whole network from the user web browser to firewalls and the eCAT server is under the local network at the case study, which in turn is connected to the Internet. Upon inspecting the system, it was clear that the system enables both quick and present choices (multiple choices), such as admission category and admission site, as well as free text fields for descriptive items such as presenting problems, patient history, etc. To enable a quicker data entry process, the system categorizes tens of clinical procedures into a number of trees that match the number of clinical specialties the system is used for. Recently, eCAT for General Surgery and Spinal Surgery went live at the selected case. Both of these projects have extensive clinical content relevant to each specialty. They are also both integrated directly with the group's Patient Administration System (PAS) via HL7.

Results to Date

The initial analysis of the interviews has enabled a mapping of the eCAT system and the processes around it with Activity Theory. The process of conducting clinical audit electronically involves the following items as found in Phase 1 of the data collection:

- **Subject:** Human workforce for data entry and data analysis, and data reporting: the system users have a mix of clinical, research, and IT skills to navigate through the system.
- **Object:** Clinical data about each admission for the three aforementioned clinical specialties (general surgery and spinal surgery). Part of these data is generated automatically by the interface with the group's PAS system, while the other part is managed at the eCAT end.
- **Tool:** The assessed eCAT system.
- **Community:** The subject are supported throughout the process of conducting clinical audit by a group of clinicians (nurses and doctors) to help validate the results and set the areas of interest during the clinical audit process.

- **Rules:** the community is governed by a set on procedures and policies that guide the process as a whole and reflect the rules as per the terminology used by Activity Theory.
- **Division of Labor:** The community adheres to an organizational hierarchy that states the roles and responsibilities for each of the community members; which represents the division of labor in Activity Theory.

This preliminary analysis done in this research-in-progress study will provide key inputs for the next phase of the study, which will include extensive thematic analysis of gathered interview data.

Conclusion

This study explores the possibilities of Activity Theory to assess electronic clinical audit systems. Given the increasing recognition and need for clinical data to be of a higher quality and better validity, this study is expected to have both practical and theoretical impacts. Firstly, this project is expected to build a new conceptual framework for healthcare technology evaluation using Activity Theory. The secondary outcome is an evaluation of the new clinical audit tool in terms of its impacts and benefits in the staff work practice and healthcare outcome, and value propositions to healthcare providers. Practically, the study is expected to provide key lessons learnt as well as a set of recommendations to inform future projects and best practices to manage clinical information systems. This is key to enhancing the overall performance of the healthcare industry. Next steps include analyzing the data collected during Phase 1 of this study, and designing and conducting Phase 2 of data collection.

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