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How do technical improvements change radiographers' practice — A practice theory perspective

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ABSTRACT

Introduction: The two plane imaging techniques are gradually being replaced by multidimensional imaging. How it affects radiographers' professional practice has not been investigated.
Aim: To explore how technical development affects the relations between different actors and their actions in the practice of Computer Tomography.
Method: A qualitative design with data collection by open interviews ($n = 8$) and open observations ($n = 10$) of radiographers during their work with Computer Tomography. Data was first analyzed inductively resulting in seven codes. Secondly abduction was carried out by interpreting the content in the codes with a practice theory. This resulted in four themes.
Result: **First theme**: *Changed materiality makes the practical action easier.* The actual image production has become practically easier. **Second theme**: *Changed machines cause conflict between the arrangements of the work and the patients' needs.* The time for the machine to carry out image production is easy to foresee, but information about the patient's individual status and needs is missing and this leads to difficulties in giving individual planned care. **Third theme**: *Changing materiality prefigure learning.* The different apparatus in use and the continuously changing methods of image production is co-constitutive of the practitioners' activities and learning. **Fourth theme**: Radiography is arranged for patient safety in relation to radiation doses and medical security risks. But the radiographers, who meet the patients, have to check the accuracy of the planned examination in relation to the clinical observed information about patient safety risks with the examination.

Introduction

This article is about how the technical improvements in medical imaging affect radiographers' professional practice. The two-plane imaging techniques are gradually being replaced by multidimensional imaging, especially in neurological-, gastro- and urological-radiology. This development has led to improved diagnostic quality, which benefits the patients and the medical practice.[1] Less is known about how this technological development influences radiographers' professional practice.

Radiographers' practice has been studied from different perspectives. A focus on defining competence has been used in order to facilitate improvements in the education and mobility of radiographers across the European Union.[2,3] Descriptions of both general and specific competences of radiographers are seen as necessary to achieve this objective.[2,3] In Sweden, the competence perspective has been adopted in a national initiative to define the required competences of radiographers.[4–6]

Other studies of radiographers' practice have focused on professional identity,[7] role extension[8–12] and general aspects of radiographers' work process.[13] A common theme in these studies is that both care and use of technology are seen as important and part of the required competences for radiographers. Some studies have also reported that medical aspects are seen as a third important element of the radiographers' knowledge base.[2,8,13]

Competence descriptions do not show how generic and specific competencies are used together in practical work. Lundvall et al.[13] gives a general description of the radiographer's working process in regard to image production. The study describes how general tasks and responsibilities are linked in a process. The process covers three different phases; planning the examination, producing the

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images and evaluation of image quality. Producing the image is experienced as radiographers' autonomous professional area. Even if the study by Lundvall et al.[13] shows how the professional work of radiographers is carried out, it does not take into account how rapid technical development affects the professional actions of radiographers.

In order to understand how the education of radiographers across the EU should be improved, research is needed that takes into account the interaction between humans and technology in this practice. In this study, we wanted to take a broader perspective and study both the human and non-human actions, viewing material objects and technology as entities that can act on practice. A practice theory perspective was found useful because it takes into account both social and material aspects.[14–19]

According to Kemmis' theoretical framework, professional practices consist of external structural arrangements formed by traditions, material-economic conditions, social structures and actions in the practice.[14] The structural arrangements are bunched together in a characteristic way and relate to that specific practice in which the actions take place. The actions are held together of the practitioners' practical and general understanding, rules and habits.[15] There are also teleo-affective structures i.e. the common purpose of the actions, accepted end-results, projects and beliefs about that specific work. The common purpose of the practice influences how the practitioners reason about their practice. If the common purpose is production, there will also be technical reasoning in the practice. The intended goal of knowledge production leads to theoretical reasoning and practical reasoning, which may lead to wise judgments. The actions are shown in verbal and written language (sayings), practical doings and relations between people as well as relations between people and physical matters. What a specific practitioner does with a specific client at a certain moment represents the orchestration of the practice and depends on the structural arrangements, the practice, and the competencies and capacities of the practitioners.[15]

A practice theory perspective gives insights into the relations between structural arrangements and actions in the practice. Schatzki[20] explains that the arrangements together with the practice form social sites. In these sites the arrangements and practice can relate in different ways. The material arrangements often prefigure what it makes sense to do; a certain course of action makes the practice easier or seems more logical. Some material arrangements can have a causal relationship to practice and lead to specific actions, while others can be more co-constitutive. Actions in a practice can be linked to or be a part of another practice. Practices connect to each other and build up nets of practices.[15]

Practices are transformative; changes of the structural arrangements generate new actions which lead to learning processes for the practitioners. If a change is needed, it is not enough to alter the knowledge and intentions of the practitioners. The external structures also have to be modified because they have an impact on the actions.[14–19]

To attain a deeper understanding of how technology improvement affect this practice, the paper was restricted to the practice of computed tomography (CT), mainly focusing on radiographers' professional actions. The study was conducted in Sweden. The research questions are: 1) how does the technical development of CT affect the radiographers' professional actions, compared to conventional techniques? 2) How are technology and human aspects related in this practice? 3) How do different professional practices connect to each other in CT practice?

Increased knowledge about this topic would be useful for developing this practice for the patients and the practitioners themselves. It would also be useful for educational purposes.

Aim

To explore how technical development affects the relations between different actors and their actions in the practice of computed tomography.

Method

A qualitative design was used. Data was collected by means of open interviews with eight radiographers and open observations of radiographers during their work with CT. This data was collected for two studies with different aims, whereof one is published.[13] All data was collected by the first author.

An experienced supervisor at a department of radiology at a university hospital in Sweden was asked if she knew of radiographers who would be suitable for interviewing in a study of professional experiences. Five persons were nominated, and four agreed to participate. Two of these interviewees were asked by email, after the interview, if they knew of other radiographers who might be suitable for interviewing. This led to four additional interviewees being found. All informants, three men and five women, worked full time as radiographers. Four informants spent 50% or more of their working time in a specialized field like computed tomography, magnetic resonance imaging, skeletal radiography and interventional radiography. All of them worked with computed tomography, especially during evening and night duty.

An interview guide with four open-ended questions was tested in two pilot interviews. These two interviews were included in the study. The interview guide was constructed to collect data for the two different studies. The interview items were: 1) Describe an ordinary situation that you have experienced when your knowledge as a radiographer was important. 2) Describe a situation when you learned new technology. 3) Describe an ordinary situation when your professional knowledge was important for taking care of patients. 4) What do you know, as a radiographer, that other professionals at your place of work (both in your ward but also other professionals you meet during work) do not know? For this study, mainly data from item number two has been used. All interviews were recorded with a voice recorder and transcribed verbatim by the interviewer. The interviews varied between 25 min and 71 min, with a total length of 375 min.

After a preliminary analysis of the interviews, data collection continued with open observation of the radiographers' work with CT at a middle-sized radiological department in Sweden. The observations were open in character, and varied in length between two and four hours on each occasion during one week. There were ten observations in total. Field notes were made directly after each observation, and these generated 13 pages of transcripts. The field notes were structured according to three steps, 1) description of the observation, 2) theoretical memos, and 3) reflections on the focus of the next observation. The first author conducted the observations dressed as an employee, but did not take part in the work. The employees had been informed in advance and the purpose of the study was known.

Ethical considerations

The study was approved by the research ethics committee of the medical faculty in Linkoping University (Dnr 2010/74-31) and the study was conducted in accordance with the Helsinki declaration.

Data analysis

The data for analysis consisted of the transcripts from the eight interviews and the field notes from the observations. The data