

# Streamlining Qualitative Research Methods for Medical Informatics – A Methodological Approach

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**Abstract.** Qualitative research methods developed in social sciences are more and more widespread in medical informatics. They are useful for the exploration, requirements analysis, usability engineering and the formative and summative evaluation of information technology in health care. The methodology of qualitative research is complex and the preparation and performance is time consuming. Computer scientists and IT experts ask for training in the practical, efficient and solid use of these methods, such as “semi-structured interviews”. We introduced this method to the work of researchers in medical informatics and developed a *Framework for the preparation and performance of semi-structured interviews in medical informatics*, which describes how to prepare, to conduct, to analyse and to report on semi-structured interviews. The evaluation showed that based on this framework the qualitative research method “semi-structured interviews” can be learned easily and adopted to new areas.

Keywords: Medical Informatics, Social Sciences, Qualitative Research, Subjective Research, Methodological Framework, Semi-structured Interviews, Guideline.

## 1. Introduction

The use of qualitative research methods (QRM) becomes more and more widespread in medical informatics. QRM are applied in order to learn about the users' needs, their work and the success or failure of information technology applications in health care [1, 2, 3, 4, 5].

Computer scientists and social scientists work on the exploration and evaluation of IT systems. The multi-disciplinary and multi-methodological approach offers the opportunity to gain fast and comprehensive insights. Computer scientists and IT experts need to discuss the setting and requirements on the system under construction with the future user. Hence there is a need for guidelines and frameworks to use QRM in an appropriate and scientific way [6].

At the Department for Medical Informatics of Aachen University students and postgraduates use the qualitative research method “semi-structured interviews” during their research projects e.g. for the requirements analysis and the formative evaluation. Although there exists a big amount of literature addressing the use of QRM, we learned that there is an urgent need for a practical, efficient and solid framework how to use a

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qualitative research method. Such a framework addresses a computer scientist who wants to use the method properly without being forced to become a social scientist. This paper presents a framework we developed so far for the application of semi-structured interviewing techniques by computer scientists in medical informatics.

## **2. Qualitative Research Methods (QRM) in Medical Informatics**

The sociotechnical approach facilitates the understanding of information technology in health care [2]. In social sciences QRM have been developed to explore social or human problems and to propose solutions [1, 7, 8].

Qualitative research is characterised by openness, explication, subjectivity, reflection and interpretation. It is an iterative process, which is maintained until saturation is reached [1, 7]. Qualitative studies are performed incrementally. The researcher goes into the field to learn about the user, his work, his needs and his ideas. The data collection is for example performed as an observation or an interview and relies on textual formats. The selection of an appropriate qualitative research method is crucial for the high quality of the scientific work. The researcher reflects on the selection and the research process including the intermediate results with colleagues and supervisors (“neutral experts”). One of the neutral experts, for instance a social scientist, should be adept in QRM and their scope. Furthermore the high quality is assured by the use of different methods (“triangulation”) [9]. At least two methods should be applied, either both qualitative or one qualitative and the other one quantitative.

A qualitative study starts with an introducing question that covers the problem the researcher works on, for example “How can medical informatics support the knowledge management in a human resources department of a hospital?”. It is important that the researcher explicates his mental model [10] and his personal experience before he performs the data collection in order to be aware of his own bias and knowledge gaps later on. The researcher must reflect his work during the whole process. He discusses the study design, the results of the literature reviews, the data collection and analysis and interpretation with colleagues and externs. He must iterate the steps and change the research route if new insights occur.

Semi-structured interviews are interviews with representatives of the inquired field. The so-called “interview guideline” contains the topics and questions. The term “semi-structured” signifies two complementary aspects: (a) the interviewer is aware of the topics, and (b) the interviewee has the opportunity to talk freely on a certain point.

In the following we present the main building blocks of our approach to an efficient and effective preparation and performance of semi-structured interviews. The “Framework for the preparation and performance of semi-structured interviews in medical informatics” consists of three modules: (1) the template for an interview guideline for semi-structured interviews, (2) the process-schema for performing the interview, and (3) the supervision and feedback concept. The framework aims to empower computer scientists to apply QRM in a more easy and reliable way. The results obtained by QRM can serve as base of the researchers' future work for instance on exploration, requirements analysis, formative and summative evaluation and usability engineering [11, 12].

### 3. A Framework for the Preparation and Performance of Semi-structured Interviews in Medical Informatics

#### 3.1. Module 1: The Template for an Interview Guideline for Semi-structured Interviews

After the researcher designed the study and identified representatives as interviewees, he prepares the interviews by creating the interview guideline. The interview guideline deals with the more detailed questions that evolve from the introducing question. An interview follows a certain dramaturgy and can be divided into four periods: the warming up, the exploration of present and of future aspects and the finish. The first step (warming up) serves as a means to make the interviewee comfortable. Present aspects deal with the current situation and problems. Future aspects address the identification of needs and ideas. The finish ensures that nothing is left out.

The interview guideline shall assure that no relevant point is left out and serves as a checklist for the interviewer during the interview. Table 1 shows periods and aspects to exemplify an interview guideline for semi-structured interviews in medical informatics. It should be considered, that the creation of an interview guideline is up to the researcher, and Table 1 is to be seen as an extensible template.

Table 1: Template for an Interview Guideline for Semi-structured Interviews

Period	Aspects
Warming up	<ul style="list-style-type: none"> <li>- The organization (vision, goal, structure, business activities)</li> <li>- The interviewee (professional background, tasks, work)</li> <li>- Terminological clarification</li> </ul>
Exploration of present aspects	<ul style="list-style-type: none"> <li>- Relevance</li> <li>- IT and other tools</li> <li>- Context of work (colleagues)</li> <li>- Preconditions, limitations, problems</li> </ul>
Exploration of future aspects	<ul style="list-style-type: none"> <li>- Expectations and needs</li> <li>- Wishes on new tools and instruments</li> <li>- Additional ideas</li> </ul>
Finish	<ul style="list-style-type: none"> <li>- Summarization (by the interviewer)</li> <li>- Feedback on completeness</li> <li>- Benefit for the interviewee</li> <li>- Acknowledgement and leave-taking</li> </ul>

#### 3.2. Module 2: Process-schema for Performing the Interview

The process-schema includes the scheduling, the preparation, the interview, the field notes and the documentation (see Table 2, next page). The interview should by all means be taped. During the parting, after the recorder is cut off, the interviewee often adds relevant additional information. The field notes serve to document this information and the course of the interview and impressions. We strongly recommend that the interviewer retires immediately after the interview to an undisturbed place for ten or fifteen minutes to write down the field notes. The documentation is the transcription of both the recorded texts and the field notes.

### 3.3. Module 3: Supervision and Feedback Concept

We introduce computer scientists, who are novices in qualitative research to the text analysis, in a problem-based way. First one of their supervisors gives them an introduction to computer software for text analysis, and some introductory literature on qualitative text analysis. The researcher performs the analysis and interpretation to identify problems, needs and ideas. Especially new insights are of interest for the further work of the researcher. He uses all collected data: the interview guideline, the explicated researcher's mental model and personal experience, the transcribed interview texts and the transcribed field notes. The identification of categories and concepts that lead to propositions is an iterative process. This work can be performed supported by software-applications<sup>2</sup>. In a second meeting the researcher and the supervisor discuss the researcher's results on his analysis of the collected data and identify open tasks and next steps.

The researcher starts the report on the study with a sketch of the field and the problem. He describes the study design and motivates it. He describes the results of the analysis and interpretation in prose and illustrates them by anonymous citations taken from the transcript. The report ends with the conclusion and some suggestions. In medical informatics this can proceed for instance as a project design or a requirements analysis.

Table 2: Process-schema for Performing the Interview

Steps	Parts	To consider
Scheduling	- (Email and) telephone call	- Purpose - Appointment - Time - Place - Confidentiality
Preparation	- Creation of the interview guideline	- See "the template for an interview guideline for semi-structured interviews"
	- Assembling the materials	- Printed interview guideline - Notepad - Wristwatch - Recorder
Interview	- Introduction	- Reception and introduction to each other - Thanks for the participation - Explanation of the purpose - Explanation of the benefit and feedback - Explanation of the confidentiality - Explanation of the interview course - Grant of the permission to record the interview
	- Performance	- <b>Recording</b> - Trigger notes
	- Parting	- Thanks for the participation - <b>Mention of the next steps and the feedback and benefit</b>
Field notes	- Course of the interview - Additional information - Impressions - New ideas and insights	- Immediate documentation (handwritten notes) - Undisturbed environment
Documentation	- Transcription of the interview text	- By a typist
	- Transcription of the trigger and field notes	- By the interviewer: not later than 24 hours after the interview - Attachment to the interview text

<sup>2</sup> For a survey on methods and approaches how to analyze and interpret texts see [7].

#### **4. Evaluation**

So far (January 2006) thirteen graduates and postgraduates in medical informatics (short: researchers) used semi-structured interviews for the exploration, requirements analysis and both the formative and summative evaluation. The studies covered areas like knowledge management in medical research, hospital management, web-based information platforms and web-based learning. They were performed in different contexts, for instance in research projects, diploma theses and PhD projects. The evaluation of the introduction of the framework was performed by means of QRM. We performed and analysed individual semi-structured interviews with each of the researchers and natural-group interviews with groups of researchers at the end of training sessions. All thirteen researchers took part in the interviews.

All researchers initially were sceptical whether qualitative methods in computer science could be easily learned and used with a reasonable effort. The feedback in the beginning showed that a ninety-minutes-lesson on qualitative research with focus on semi-structured interviews and some literature from social scientists did not meet the needs to learn about the practical performance. The researchers requested a tailor-made introduction for computer scientists. Hence we developed the framework for semi-structured interviews. Furthermore we intensified the face-to-face training on the software-supported analysis.

The researchers appreciated that it was easier than expected to learn how to do qualitative research. The effort to use qualitative methods was estimated as an appropriate means, as they could use the results of the analysis directly for further project designs and requirements analyses. Using QRM was considered a structured and comprehensible approach. Some remarks from the researchers may serve as examples: "By doing semi-structured interviews it is easy for me to get a whole picture with many details in a short time." - "The materials facilitate the profound discussion with colleagues and supervisors." - "The first step of the requirements analysis - to know the user, his situation his needs and his ideas - is now more structured." - "The perspective of the computer scientist changes from IT-centred to user-centred." (Not verbatim but analogous translation from German to English.)

An expert (social scientist) supervised the process of the implementation of QRM. During the supervision the effect of the framework on the interview skills was evaluated formatively. The supervisor analysed and gave feedback on the researchers' interview-guidelines, their interviews (tapes and transcripts) and their findings. The researchers were required to revise their interview guideline, to iterate their text analysis and to reconsider their conclusions once or twice. The formative evaluation facilitated the continuous improvement of the researchers' skills in the use of this qualitative research method.

#### **5. Conclusion and Outlook**

QRM in medical informatics gained more and more attention during the last decades [1, 3, 4, 2]. Social sciences offer the methods and the tools to perform qualitative research [7, 8]. The results of such qualitative studies can be applied to exploration, requirements analysis, both formative and summative evaluation and usability engineering [11, 12]. Computer scientists ask for appropriate training and clear and comprehensible guidance in using these methods [6]. We introduced semi-structured

interviews to the work of students, graduates and post-graduates in the context of their research projects. The development of the framework for semi-structured interviews in medical informatics supported an effective and efficient adoption of QRM. A comparative assessment of the researcher's skills before and after the training will be an effort of the future development of our framework.

To assure a high quality of scientific work the researcher has to select an appropriate QRM and to use at least two different methods (“triangulation”) [9]. He can apply either several qualitative or a combination of qualitative and quantitative research methods. One of the colleagues or one of the supervisors (“neutral experts”) should be adept in QRM and the scope of the methodology in order to be able to give useful feedback during the whole research. We are extending the use of QRM in medical informatics to other interview techniques such as panel groups, focus-group interviews and natural groups [8] and observations. We will further investigate how training and frameworks on qualitative research can support the introduction of qualitative methods in the context of larger research and development projects in medical informatics for computer scientists and in multi-disciplinary teams. Furthermore we will work on methodological and technological approaches to bridge the gap between the text-based documentation of the results of qualitative analyses and more formal representations (such as use-cases), which can play an important role in the analysis, design, implementation and evaluation of information technology in health care.

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