

Using Inductive Approach as Research Strategy in Requirements Engineering

Issam Jebreen

SERL, School of Computing & Mathematical Sciences

Auckland University of Technology

Auckland 1142, New Zealand

issam.jebreen@aut.ac.nz

ABSTRACT— This paper is primarily targeted at doctoral students and other researchers considering using inductive approach as a research strategy. We present interpretive research designed to explore the interaction strategies between analysts and clients/users during requirements determination process and the factors that may be at work in such interaction. Using inductive approach can be treated as both an underlying philosophy and a specific mode of analysis. As a philosophical approach to human understanding, it provides the philosophical grounding for interpretivism. As a mode of analysis, it suggests a way of understanding textual data. Within the philosophy underpinning inductive approach, researchers need to design a research strategy that flows directly from the research questions and goals of the research project. This paper explores such a strategy.

Keywords: *Software engineering education; interpretive research.*

I. INTRODUCTION

This paper explores the value of inductive approach as a credible and rigorous research approach to explore the interaction strategies between analysts and clients/users during requirements determination process in software development practice. The research was part of Issam's doctoral research. We have primarily targeted the paper at doctoral students and others considering inductive approach as a research strategy. In this paper we present the design of a research approach that encompasses a research paradigm and its philosophical assumptions and framework, the methodology, and the strategies used to gather data and derive meaning from these data. In addition, attention is given to the ethical conduct of the research. Research findings are presented to enable readers to contextualize the research approach and to understand the connection between research design and outcome.

The organization of this paper follows the same structure as that of Myers and Avison [1]. The structure provides a systematic way of describing and defining the research approach. The structure is as follows: Part II gives a general overview of the research phenomenon and questions; Part III gives a general overview of the research from philosophical point of view; Part IV discusses the research method of this research; Part V gives an overview of how data collection

methods were useful for this research and how they were applied; Part VI provides description and utilization of modes of analyzing and interpreting the data of this research.

II. THE RESEARCH PHENOMENON AND QUESTIONS

The purpose of the present study is to understand the phenomenon of developing a shared understanding of software requirements through exploration of the themes and communication strategies used by software analysts and users. In addition, many researchers in the field of software engineering/information system seek the best ways to interpret participants' communication strategies and experience, in order to explore how to develop a shared understanding of software requirements. Urquhart [2] suggests that "shared understanding" is the way people assign meaning to what they hear and see, and also how they make sense of the information they receive. "Software Requirements" were defined as user-related needs and objectives. Two groups of participants in information system projects are analysts and users, who might understand and agree among themselves upon the requirements.

The principal question of this research was: How does a shared understanding of requirements occur? This study focused on both the structure and the process of developing a shared understanding of requirements. The study explored what questions require explicit attention in order to understand and interpret the main research phenomenon, and how these questions can be answered. Therefore, this study investigated the following research questions: "How analysts and users developing a shared understanding of software requirements? What are analysts' strategies for developing a shared understanding of software requirements with users, via various communication channels?" In order to answer these questions we have used an interpretation of the interaction and other data sources to explore the themes and strategies of analysts via various communication channels.

III. RESEARCH PHILOSOPHY

The research questions "How analysts and users are developing a shared understanding of software requirements? And what are analysts' strategies for developing a shared understanding of software requirements with users, via various communication channels?" come from the analysts' interaction with users. This is a major aspect of the research problem, given that requirement determination is an essential interaction

activity. An interpretive philosophy seems to be a highly appropriate approach to use here, in order to give an account to the study that captures the views of the participants, and in order to learn how the participants communicate and interact during the requirement determination phase [3].

In choosing a particular research philosophy, certain assumptions and perspectives are accepted, and certain strategies and interpretations should be involved. Revealing what is hidden behind the “facts” shared by the stakeholders in the requirement determination process can be done by applying an interpretive approach to their interaction process. This creates a more in-depth look at the context of the interaction. An Interpretive approach also reveals what participants shared and why sharing it was done in this particular way. The fact that this approach allows researchers to study the context of interactions and the influences on those interactions means that interpretive philosophy has become more developed in recent years and, increasingly, is applied to information system studies.

For the purposes of this study, we decided that interpretive philosophy is the most suitable approach to use for this case due to the fact that it generates new understandings of the complex human phenomena that influence how analysts and users develop a shared understanding of software requirements. Therefore, the data acquired will be investigated via the interpretive paradigm.

IV. RESEARCH METHOD

A research method is a strategy of inquiry which includes research design and data collection (Myers & Avison, 2002). The choice of research methodology influences the way a researcher collects data (ibid). Specific research methods also imply different skills, assumptions and research practices. Several research methods in the information system area include action research, case study, grounded theory and ethnographic research [1].

Ethnography is a research method well acknowledged and widely used in sociology. The main purpose of ethnographic research is to describe people collectively, drawing attention to social and communal ways of life, to behaviour and customs. It is an appropriate method for studying social interactions, behaviours, beliefs, and perceptions that occur within groups and organizations but are not yet clearly understood. Information about the social life of a group can be studied through ethnographer’s immersion into the life of people from that organization [4]. The central aim of the research is to provide insights into people’s views and actions by collecting information through interviews and observations. This research method can incorporate multiple perspectives into the research phenomenon [5]. Therefore, ethnographic research seems to be perhaps the most suitable research method for this study. Furthermore, the aim of ethnographic research is based on two main propositions:

- The reflexive nature of human interaction, where people share the same interpretation of such cues as words, body language, gestures, etc.;

- Information is indexed and is applied in a particular context, based on the previous experience and interactions.

In its core ethnographic approach relies not only on observation of social life in natural settings (“fieldwork”), but mostly on close-up experience and the participation of the observer in the personalized settings of an organization or community. Such research requires long-term participation in order to obtain a portrait of the group under study. The “unstructured data” (data that is not coded at the time of data collection) allows the researcher to carry out inductive research, rather than test hypotheses. Researchers who use ethnographic methods must pay careful attention to the process of field research in order to identify patterns from observations and interviews. The data is normally supplemented by interviews, observation, and documents [6]. At the end of the research, the researcher will have a wide range of qualitative and quantitative data obtained through learning and testing different problems from different perspectives. Hypotheses can then be made from these different sets of data. The collected data can be compiled in charts, tables, and graphs, but the ethnographic report is always presented in narrative form, with an introduction, settings of the scene, analysis and the conclusion.

V. DATA COLLECTION

The four data collection methods, namely, interviews, participants’ observation, focus group and documents analysis, were used on account of their suitability for qualitative research.

Myers and Avison [1] found that many qualitative researchers prefer the term “empirical materials” to the word “data” since most qualitative data is non-numeric. In other words, data in qualitative research comes in the form of “words”, “phrases”, “sentences” and “narrations” which can provide a more complete portrayal of this subject under study than “numbers.” Blumer [7] describes “words” and similar data as being capable of providing the “rich”, “full” and “real” story, rather than the thin abstraction produced by “numbers.” Indeed, these are the data considered appropriate in explaining human and social aspects which cannot be quantified in a universal manner. According to Miles and Huberman [8], the strength of qualitative data is that it is rich and holistic with strong potential for revealing complexity nested in a real context. The following sections are given the description for the three methods for data collection and then give the justification for the chosen data collection methods.

Ethnographic research was conducted within 7 months from December 2011 to June 2012. Data was collected throughout the research during field work. We have used Participant Observation, Focus Group, Interviews and Document Collection. We have been in 130 meetings between the clients and analysts. There were also 23 focus group meetings with the analysts, which took total of 118 hours. Both formal and informal types of interviews were conducted with the developers, which lasted for the total of 71 hours. We collected 90 documents which included meeting minutes and meeting agenda.

The Figure 1 presents percentage of the data collection methods used in the study. While the Participants Observation method was used most of the time (34% of the research), Document Collection was the least used method (20%). The second most used method was Focus Groups (31%), which together with Participant Observation constitute over half of all data collection methods (65%). Interviews stayed at the top of the second quintile at 25%.

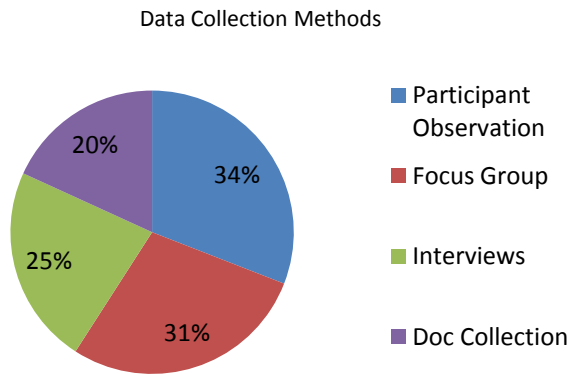


Figure 1. Pcentage of the data collection methods

Figure 2 indicates the period of time from December 2011 to June 2012 when the study was conducted. The graph states the number of interviews (I), focus groups (FG) and participants observations (PO) collected during the period of the study. The most fluctuating methods were interviews and participant observations. At the beginning of the research in December 2011, the most used method to collect data was interview (I = 6). The reason being is that focus groups need more time to arrange, and participants observation needs time to get into the field in order to understand the way the organization works and identify the main participants. In January we concentrated on organizing focus groups and focusing on participant observation, and the number of those data collection methods increased (FG = 2, PO = 7). The number of interviews meanwhile dropped down to 4 (I =4). In February the data collection sped up and the number of all data collection methods rose to nearly its maximum for interviews and focus groups (I = 15, FG = 5). In March the data collection slowed down and the number of all data collection methods dropped down (I = 12, FG = 2, PO = 21). In April 2012, the number of data collection methods dropped down due to the fact that the data collection period came to the end (I = 3, FG = 2, PO = 10).

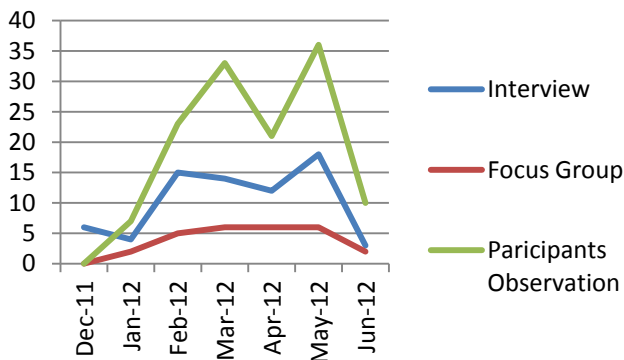


Figure 2. Period of time

The number of participants observation also increased (PO = 23), and climbed up throughout March 2012 when it almost came to the maximum (PO = 33). The number of focus groups also reached its climax in March 2012 and stayed consistent till May included (FG = 6). Both the number of interviews and participant observation ducked down in April 2012 (I = 12, PO = 21), but rose to the climax in May 2012 (I = 18, PO = 36). The month of May 2012 was at its peak for all data collection methods used with participant observation being the highest (PO = 36), followed by the number of interviews (I = 18), and number of focus groups being the lowest (FG = 6). In June 2012, the number of data collection methods dropped down due to the fact that the data collection period came to the end (I = 3, FG = 2, PO = 10).

A. Participants

Yin [6] warned of the disadvantage associated with qualitative research: fewer people are studied and as a less easy to draw generalizations or, especially, solid conclusions from. However, any disadvantage caused by having fewer respondents in this study was overcome by utilising a population rather than a sample. In this research, the population was the analysts and users who communicate together in order to determine the software requirements. This in turn overcame the issue of generalization. In addition, according to Simon & Burstein [9] the value of conclusions drawn from sampled data depends on two aspects: (1) the sampling frame; and (2) the representativeness of the sample within the sample frame. The sampling frame for this study includes analysts who: (1) have had experience with the information requirement determination process; (2) have varied backgrounds and skill levels; (3) come from varied industries and functional areas; (4) have had experience with different information requirements determination techniques; and (5) have had experience with different types of information systems, and the users who should interact with the system.

A purposeful selection method was chosen, as recommended by several researchers who have previously conducted this type of research, in order to select information-rich cases for detailed study [10]; these were participants who could illuminate the phenomenon of shared understanding of requirements. This method of sampling is consistent with interpretive paradigm research [11].

Two software development companies participate in this research, Org1 and Org2. Org1 was established in 1997, and it is a leading software company in the Middle East, presenting its clients with cutting-edge technology solutions. The company consists of 40 employees that include people working in marketing, sales, analyst developers, and management teams. The company has two branches in the Middle East: in Jordan and Saudi Arabia. The services they offer include software development, systems integration, and software localization. The company's strategy is client-oriented, giving the clients access to real-time business intelligence so they can make better decisions. The company's software products deal with accounting, inventories, purchasing, retail, school management, freight management systems, and human resource management systems. The products are divided into 3 different levels: 1. Basic solution that are used by small

companies and don't have many requirements; 2. Specific solutions, those are used by companies of various sizes and kinds, and should be built depending on clients' needs; and 3. ERP solutions those are used by medium companies and large size companies, and should be customized to fit with the client's business and needs. Org2 is a professional IT company established in 1998. The company is dedicated to providing solutions for the business sector in the areas of Agricultural industries and corporations, Finance and Banking, Education, Insurance, and Health. Org2 deals with four main aspects of information technology: IT Hardware Supply, Data Communication Installations, IT Services, and IT Solutions. The company is experienced in developing software solutions (e.g. Human Resources Management System, Accounting), mobile application (e.g. Asset Management System, VAN Sales, Warehouse Management System) and logistics technology solutions (e.g. UPS Road Net Solution, Courier Management System Turnkey Barcode Solution).

B. Participant Observation

Participant observation is a qualitative method that comes from ethnographic research. The objective of such observation is to gain multiple perspectives of the population being studied and the relationship between different views held within one community. The data is collected during the field work, when the researcher makes careful detailed field notes of the events, and of informal conversations and interactions with the participants. Taking accurate notes is an important part of participant observation, since it eliminates the researcher's bias and records participants' subjective reports about their actions and opinions. Most field notes will consist of textual data, however, the researcher can also note down such things as Figures, maps, and charts. Although a large majority of the data will be qualitative, it might also include some of the quantitative information related to the number of participants involved in a particular activity during a specific project.

Participant observation is useful in identifying the physical, social, cultural, and economic contexts of the members of the study, interdependency between people, various ideas and norms held by the members of the study, as well as people's behaviors. This method can assist in understanding the factors that will resolve the research problem, provided that the researcher designs the right questions to ask the participants in order to understand the phenomenon under study.

One of the main drawbacks of ethnographic research is that it is time-consuming. In most cases, a researcher needs at least a year to collect data through the participant observation method. Another shortcoming is the difficulty of documenting the data, since the researcher has to rely on the field notes, which are hard to compile, since it is difficult to participate and observe at the same time.

During the initial stages of the research, we established positive relationships with the stakeholders and gatekeepers, whose approval for setting up the study was of vital importance. The participant observation and the approval of the appropriate officials directed me to the right group of the study participants. Participant observation also ensured me that the interviews we conducted were culturally appropriate and the

focus group discussions I conducted were relevant to the issues at hand and appropriate for this research method.

After gaining access to the clients and analysts' meetings, which was accepted by the participants, we became part of the field work. This allowed me to observe the way analysts interact with the client to collect software requirements. During participant observation notes of the discussions were taken. In cases when the clients agreed to be recorded, the meetings were audio recorded. The data collected during those meetings allowed me to design the right questions for further interviews and focus group discussions, which would reveal the participants' opinions and beliefs about the interactions with the clients.

The data collected during participant observation provided the context for understanding the data, which helped us to understand the main chunk of data. In this case participant observation was done prior to other data collection methods; however, it can also be carried out simultaneously with other methods or even during the data analysis stage.

The participant observation was the main resource for data collection. As mentioned before we have been in 130 meetings with the clients and analysts. The type of meeting depended on the project of the software development, as well as the requirements determination phase. The meetings were divided into 3 different types: initial requirements, requirements gathering, and requirements validation. The first type of meeting involved identification of the initial requirements from the customer. Requirement gathering meetings were to collect requirements in details, which included understanding of the clients' business process, collecting documents, and discussion of the process in details. The last type of meeting was to validate requirements which included representation of the requirements through prototype and presenting the client with some functions of the software that they were able to try out. The products for development were Human Resource (HR) software, Enterprise Resource Planning (ERP) software, Special Solution software, such as school management system, Restaurant Management (H2O) software, and Point of Sale (PoS) software. Figure 3 below visually represents the number of meetings, meeting types and requirements determination process throughout the 5 projects I have been a part of.

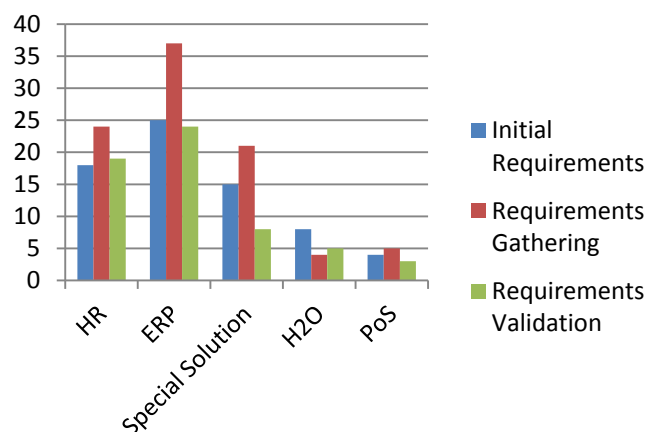


Figure 3. Numbers of meetings

During participant observations, we were a part of 5 different projects: HR, ERP, Special Solution, H2O, and PoS. Each project consisted of 3 different types of client meetings: Initial Requirements (IR), Requirements Gathering (RG), and Requirements Validation (RV). In most of the projects the most important and numerous arranged meetings were meetings for Requirements Gathering (RG = 24, 37, 21, 4, 5 respectively) with the exception of H2O project, where visits for Initial Requirements (IR = 8) were the main reason. For the projects HR, ERP, and PoS, the number of client meetings for both Initial Requirements and Requirements Validation was quite similar, ranging by one, where the former prevailed in ERP (IR = 25, RV = 24) and PoS (IR = 4, RV = 3) projects and the latter prevailed in HR project (IR = 18, RV = 19). H2O project involved 8 visits for establishing Initial Requirements and 5 meetings for Requirements Validation. The biggest range between Initial Requirements and Requirements Validation visits was for Special Solution project (IR = 15, RV = 8).

C. Focus Group

In the last decade focus group interviews have become a commonly used technique to collect qualitative data by asking the participants about their perception, belief, opinion, or attitude towards a concept, idea, service, or product. While social research adopts direct observation, focus groups are more appropriate for studies of attitudes and experiences. The free communication between participants in the focus group allows the researcher to gain access to various areas for studies, sampling, and raises unexpected issues for exploration. Focus groups are used as a self-contained method as well as in addition to other research methods, like in-depth interviews.

Although there are some disadvantages of conducting an interview in a group, the advantages can be maximized through attention to research design issues and the project and group level. Focus interviews may encourage people to be involved in the discussion even though they might feel reluctant or unwilling to be interviewed one-on-one.

It is of vital importance for the research that these focus group discussions incorporate natural communication skills by including day to day interactions such as joking, teasing, arguing, and so on. These help to introduce more data, including data that might have been untapped otherwise. Common language allows the participants to cascade, link ideas, and thus extend the preceding topic. When data is collected in such a friendly atmosphere, the researcher analyzing the data is better able to pinpoint the shared common knowledge. To avoid cultural variables, it is better to conduct focus groups via same cultural research.

One of the disadvantages of group interviews involves the social desirability bias - the fact that some participants may remain silent, or that minority opinions might be misheard, or drowned out by the majority opinion. The discussions of the employees regarding management might be interrupted and they might be prevented from expressing criticism, even though their discussions are highlighting certain aspects of people's experience. Such dynamics might limit the usefulness of the data for certain purposes since the method does not allow for anonymity.

On the other hand, group work might facilitate the discussion of taboo topics, reveal the opinions common to the group, and encourage people whose experiences are similar to discuss these experiences, when they might have been unwilling to discuss them otherwise. Some research has shown that group discussions generate more criticism than individual interviews.

Before conducting a focus group, we identify the major objectives of a meeting and develop main questions relevant to my study. The discussion session normally lasts an hour or an hour and a half, during which we might address 5-6 questions at most. To plan the session, we need to schedule a time when all the participants can attend. The participants' company conference room was used. This was beneficial, because all of the participants could see each other. The main ground rules we followed during a focus group are to keep focused on the research topic while the discussion flows and evolves, to maintain momentum, and to achieve closure of questions. The focus group meeting agenda included: welcome the participants review the agenda and goals of the meeting, explain the means of recording the session, introduction, question and answer period, and wrap up. During the main part of the session, we might sit back and listen to the discussion. Later on, we might encourage them to conduct a discussion in more of a debate style, and to encourage different opinions to be voiced. We facilitated equal participation of all the members, giving each person time to answer the question and to voice their opinion on the matter. To avoid having one or two people dominate the discussion, a round-table rule should be introduced as one of the ground rules at the beginning of a session. When using this method, the researcher should not rely only on his/her memory, but should prepare an audio-video recorder for the session period, or involve a co-researcher who may take notes of the discussion and observation/field notes.

Although many researchers recommend homogeneous groups to capitalize on the shared experience or knowledge, it can be also advantageous to compile a diverse group to get data relating to different perspectives of the participants. This will allow the researcher to avoid running into a hierarchy affect. In the case of people who work together, the groups can be "naturally occurring". An advantage of such a group is that friends and colleagues can relate to each other's shared knowledge or experience. They may also challenge each other if they perceive contradictions.

Data collection through focus groups was conducted on Saturdays and Thursday in both companies. We had 23 meetings with analysts, some of those meetings were audio recorded but some were not. The main point of the focus groups was to discuss the analysts' perspective about the software requirements or about requirements determination process with the client (see table 2). The analysts also discussed the clients' understanding, behavior, and interaction strategies during the requirement determination process. Some of these focus groups were conducted to discuss the initial findings for this study in order to clarify the analysis result of the study.

The Figure 4 presents the total number of Focus Groups in each of the companies: Org1 and Org2. The highest number of Focus Groups was conducted in Org1 (Thurs=28, Sat = 46). The number of group discussions held in Org2 on Thursdays was more than twice less than in Org1 on the same day (Thurs = 12), while reaching just over Org1’s Thursday maximum on Saturdays (Sat = 30).

Focus Group discussions held in Org1 and Org2 companies included 13 main discussion topics presented in the table 1 below. The total amount of hours spent in group discussions are 76 in Org1 and nearly twice less in Org2 – 42 hours. The two main foci for discussions in Org1 were Requirements Gathering and Software and Business Process and took 12 hours in total each. The second two important discussion held were regarding Requirements Gathering Techniques and Communication channels and took 8 hours in total each. 6 hours took to discuss Requirements Validation, Communication Skills and Management Process. Org1 spent 4 hours to discuss Client’s Background and Representation of Requirements for each topic, and 3 hours to focus on Requirements Management and Prototype Techniques. Only 2 hours went on Writing and Change of the requirements for each topic.

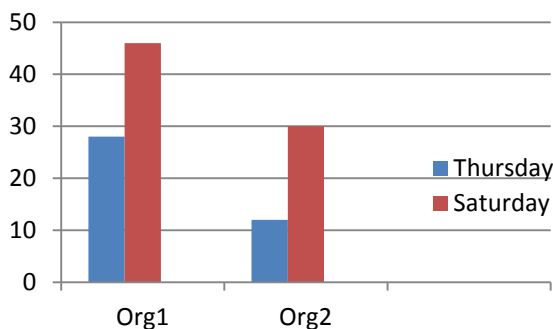


Figure 4. Total numbers of Focus Groups

Focus Groups in Org2 took only 42 hours in total throughout the study. The 2 main topics discussed during Focus Groups on Thursdays and Saturdays were Communication Channels (7 hours) and Change of requirements (6 hours). 5 Hours went on discussion both Clients Background, and Software and Business Process; 4 hours was spent on each of the topic of Requirements Validation and Gathering; Requirements Gathering Techniques and Communication Skills took 3 hours each. Only 2 hours were used to write the Requirements. Org2 did not discuss such points as Requirements Management, Prototype Techniques or Management Process.

In general more work and discussion time was held for each topic in Org1, however Org2 had more time to discuss Clients Background and Change of Requirements in comparison with the time spent for these discussion topics in Org1.

TABLE 1. DISCUSSION TOPICS

Topic	Org1	Org2
Writing Requirements	2 Hrs	2 Hrs
Requirements Validation	6 Hrs	4 Hrs
Requirements Gathering	12 Hrs	4 Hrs
Requirements Gathering Techniques	8 Hrs	3 Hrs

Clients Background	4 Hrs	5 Hrs
Change Requirements	2 Hrs	6 Hrs
Represent Requirements	4 Hrs	3 Hrs
Requirements Managements	3 Hrs	0 Hrs
Prototype Technique	3 Hrs	0 Hrs
Communication Skills	6 Hrs	3 Hrs
Communication Channels	8 Hrs	7 Hrs
Management Process	6 Hrs	0 Hrs
Software and Business Process	12 Hrs	5 Hrs
TOTAL	76 Hrs	42 Hrs

D. Interviews

Interviews are a widely used tool to access people’s experiences and their inner perceptions, attitudes, and feelings of reality [12]. The option for conducting interviews opened a vast avenue of various types of interviews. There are three types of interviews: structured interviews, semi-structured interviews and unstructured interviews [10]. This study had choice of unstructured interview as one of data collection methods.

The choice of unstructured interview as a data collection method was based on both researchers’ epistemology and research objectives. My reasons for selecting the unstructured interview is supported by Denzin [13] who argue that unstructured interview help to make sense of a subject’s world through the subject’s own perspective and in their own terms. Moreover, an unstructured interview does not have a set of questions or answers, according to Denzin & Lincoln [12]; it rather relies on social interaction.

Unstructured interview was born in anthropology and sociology in order to obtain people’s vision of reality. Different authors give different term for unstructured interview, such as “informal conversational interview”, “in-depth interview”, “nonstandardized interview”, and “ethnographic interview”. The definitions are also numerous, Denzin [13] described it as a way to understand people’s complex behavior without categorizing it beforehand, thus enlarging the field of enquiry. Patton [10] believed that unstructured interview is a natural way of interaction based on spontaneous questions, which normally is a continuation of the observation fieldwork. Disregarding various names and definitions of an unstructured interview, it is a best fit with the study based on the researcher’s epistemology and research objectives. Researchers doing unstructured interviews are open to the reality and its changes and have interpretive approach of the events. They approach the reality from participants’ perspective, interpreting it in participants’ terms [13]. Moreover, unstructured interview allows the research to use inductive approach, when the researcher comes to the interview without a set of predetermined questions or hypotheses about social reality, but rather act spontaneously during the interview, when the questions are generated in response to the interviewee’s anecdotes in a natural way. Based on the nature of the interview, the data can create different structures and patterns, which will allow to better understand the interviewee’s reality from their perspective, even though some of the themes would be unanticipated by the researcher.

Unstructured interview is entirely informal and is not controlled by a predetermined set of questions. It is rather based on a set of issues that the researcher would like to

highlight during the interview. In other words, the researcher directs the interview based on a set of issues that he is interested in Denzin [13], which allows greater exploration of the topics. This freedom, however, creates some downfalls for the research. The researcher’s control over the conversation will encourage the interviewees to relate experiences that are only relevant to the problem investigated in the research [11]. The researcher will try to keep his control to the minimum by asking spontaneous questions that will be generated based on the interviewee’s narration and the researcher’s reflection on it. The fear of entering multiple discussions can be controlled by an agenda – a broad guide to topic issues created by the researcher beforehand, which will create a certain degree of consistency across the whole interview, achieving balance between flexibility and consistency.

My choice of unstructured interview is supported by Malbon [14], who argues that it helps in collecting detailed data about people’s perspective to information and its usage. It is useful for finding specific patterns, which define models. For example, Alvarez and Urla (2002) in their study used unstructured interviews to examine information requirements during the implementation of an ERP. In my study, this approach help to note down all the topic areas covered during each interview. Unstructured interview also unfolded some extra related areas, which I was not aware of, which was a benefit. Ultimately, it generated detailed data which provide in-depth understanding of a phenomenon.

E. Utilization of Interviews

Analysts/Developers were interviewed according to the schedule discussed and agreed on with the participants as well as without schedule discussed and agreed. In fact, skilled ethnographers often gather most of their data through participant observation and many casual, friendly conversations. They may interview people without their awareness, merely carrying on a friendly conversation while introducing a few ethnographic questions [16]. The Figure 5 below shows the number of interview with analysts.

While taking part in the 5 projects (HR, ERP, Special Slution, H2O, PoS), I held two types of interviews with the participants. Most of the information was gathered through Informal Interviews. As Figure 4 above presents, during HR project we conducted 20 Informal interviews, During ERP – 17, during Special Solution – 13, during H2O – 8, and during PoS – 4. The number of Formal interviews also gradually goes down with each project: HR – 7 Formal Interviews, ERP – 5, and Special Solution – 4. PoS, however had one Formal Interview more (total of 3 Formal Interviews) that H2O (2 Formal Interviews).

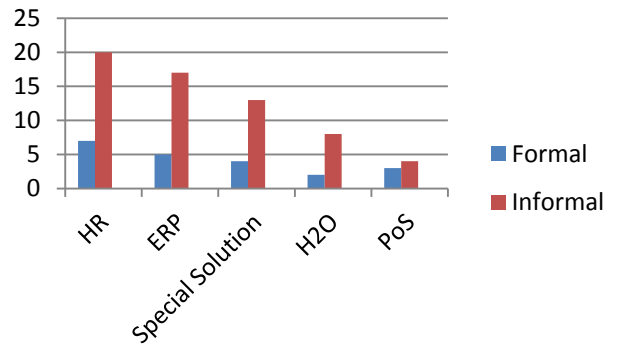


Figure 5. interviews with analysts

The table 2 below shows the interview times with analysts. For Special Solution project we had interviews with 4 different analysts. For ERP I had interviews with USER1, USER2 and USER3. USER6 and USER7 were interviewed for HR. USER6 had another interview for PoS. Interviewee for H2O project was USER7. In total we had 71 Hours’ worth in interviews with different analysts for the 5 projects that we were a part of. USER2, USER3, and USER6 were part of 2 projects.

USER1 was interviewed for the total of 13 hours for ERP project only. Both USER2 and USER3 were part of ERP and Special Solution projects. USER2 was interviewed for 8 hours in total and USER3 – for 4 hours only. USER4 was also interviewed for the total of 4 hours but he was a part of only Special Solution project. Another analyst for Special Solution project was USER5, but he was interviewed for 11 hours all together. USER6 was another analyst taking care of two projects: HR and Pos, and was interviewed for the total of 14 hours. We had a total of 6 hours of interview with USER7 for H2O project and 11 hours with USER8 for HR project.

TABLE 2. INTERVIEW TIMES WITH ANALYSTS

Analyst	Project	Time
USER1	ERP	13 Hrs
USER2	ERP, Special Solution	8 Hrs
USER3	ERP, Special Solution	4 Hrs
USER4	Special Solution	4 Hrs
USER5	Special Solution	11 Hrs
USER6	HR, PoS	14 Hrs
USER7	H2O	6 Hrs
USER8	HR	11 Hrs
TOTAL		71 Hrs

The interviews were providing me with the background information on analysts/ developers’ perspective. All interviews were in a manner to produce relaxed atmosphere for the developers to feel comfortable and speak of the topic freely. Such atmosphere was achieved by organizing the meetings in the participants’ spare time at a convenient location. The stress reduction was also achieved by the fact that the participants knew the researcher prior to the interview and it was their decision to participate in the study. It was also confirmed with the participants that there will be no outsiders present during the interview. All the data collection files and documents were confirmed to be kept at a secure location without any disclosure to the public. To make the participants feel

comfortable discussing their projects while being observed, they were advised to stop the audio recording at any time they felt uncomfortable. In case of embarrassment or any discomfort, the participant might choose not to answer the question asked, or ask to stop audio recording at all. In case of any psychological distress, the participants might choose to take a break and help themselves to hot beverages and snacks.

Data collection consisted of interviews with the analysts/ developers. Prior to the first interview the analysts/ developers were provided with an information sheet, which outlined the idea for my study, the purpose of the research and the way it is going to be conducted. For the information sheet, see appendix A. the information was also presented orally, to enlarge on the idea in the information sheet and to make it clearer. In case of any misunderstanding or lacking information, the analysts/ developers' questions were answered and the information was discussed and clarified. This discussion also gave me a chance to modify my protocol, refine, and put information into a clearer form. The analysts/ developers also signed a written consent allowing me to record, transcribe and analyze the interviews for my research, which is important for an interview-oriented study.

The analysts/ developers were answering the initial questions (not at all cases) that would give an overall idea and the background information to identify key points for further discussion. Then we and the analysts/ developers discussed a list of general topics and issues – the way they understand it, see interview agenda, appendix B (sometimes have been provided). During that we have not interrupt the participants rather than let them express their thought about the topic. The whole interviews were audio recorded, and we were also taking notes throughout the interviews. The note taking process identified the key points for further open discussion with the participants to bring in more in-depth focus on the situation. Some of the points divulged by the analysts/ developers revealed extra information in the area of interest for me, which we were not aware of. That was also discussed in more details.

The unstructured interviews with the analysts/ developers allowed flexibility to alter the order of the questions, which would allow the participants to share the information more freely. The language used during the interviews did not include jargon and thus was easy to understand by the participants in order to avoid any misunderstandings and give clarity to the information under discussion. Any technical language or jargon was avoided to escape ambiguity and make the participants feel relaxed and comfortable to discuss the issues, since they understood well what they were asked. By asking them open-ended questions we gave a chance for the participants to broaden the topic and bring light to the points that they thought were important, which also enlarged my scope of study, rather than tying me to theoretical knowledge.

This type of approach gave me possibility to code and identifies the relevant patterns while analyzing the collected data. The text for analysis was prepared from audio files and notes taken during the interviews. All the audio files were transcribed using the software NVivo, version 9. We read and re-read the written text (interview transcribe) from the interviews with each participant to become more aware and

familiar with the information provided. This process is referred to as immersion, according to van Manen [17]. It basically engages the researcher into the meaning of the text, helping to get initial interpretation of the text, which facilitates coding. During the coding phase, the data revealed particular patterns, which helped to create and prepare me for the second interview with developers/users.

After identifying the patterns and preparing questions for the following discussion, we met with the analysts/ developers. The structure of those meetings was driven by the data analysis and results from the interviews before. The purpose of those meetings was to link my understanding and participants' perspective. The researcher's understanding was double checked and confirmed with the analysts/ developers by providing feedback to the participants raised in the previous stage and by probing questions during the interview. The central aspect of producing findings from this interview was supported by rich and in-depth discussion of the participants' experience.

All interviews were audio recorded for further analysis and coding. During the interview we were taking notes, to direct the discussion to the particular points of interest, and get more clarification on the points not explained thoroughly.

The analysts/ developers were asked for documentation that was used during their software development process. The requested of those documents was based on findings from interview. The documents they were able to supply me with were emails between developers and clients, interview transcripts between analysts/ developers and clients/users. The participants were also asked permission for video recording their face-to-face meetings with the client for further analysis.

All interviews were conducted in the same style: using a lot of clarifying questions, which allowed exploring relevance of the topic. Unstructured interview allowed obtaining further information and uncovering the themes that we were not fully aware of. Allowing the participants to speak freely and express their point of view on the topic minimized interviewer bias.

F. Documentation

Archival document reviews were undertaken intensively during the stage of understanding the RD process. In order to understand the RD process in-depth, the researcher gathered and analysed the documentary materials such as the interviews between analysts/ developers and clients/users, meetings minutes, emails (group and individual), requirements documents, and meeting agenda.

A major advantage of this process is that the documents were generated contemporaneously with the events they referred to. Hence, they are less likely to be subject to memory decay or memory distortion compared with data obtained from an interview. However, an important disadvantage is that they may be subject to selective-deposit or selective-survival bias. Bearing the strengths and weaknesses of document review in mind, it was then employed in this research. For the case of in-depth understanding, this was to establish data in this research.

G. Utilization of Documentation

After the interview stage with the participants, documents were requested from analysts/ developers and clients. Documents included interview between analysts/ developers and clients/users, meetings minutes, emails (group and individual), requirements documents, and meeting agenda.

There were two types of emails: group and individual. The total number of emails received from the participants was 60. We also received 15 interview transcripts between analysts/ developers and clients, as well as 15 documents with meeting minutes. The text for these documents was organized in software NVivo9 and then analyzed accordingly. Any misunderstandings in the text during the analysis, vague data results, or gaps in communications between analysts/ developers and clients were discussed in further interviews between me and the participants, and then clarified.

The main reason for collecting documentation from the participants was to get in-depth understanding of the analysts/ developers' approach in order to collect system requirements and identify their strategies during requirement determination stage.

H. Ethical Conduct of the Research

Ethical approval for this research was obtained from the Auckland University of Technology Ethics Committee. One of the main concerns related to ethics was getting informed consent and providing the participants with confidence in taking part in the present research. By informed consent we mean the voluntary agreement of an individual to take part in a research, based on his/her understanding of the nature and purpose of the research itself [18]. Informed consent can have four constituents: disclosure (providing adequate information), comprehension (understanding the information), and competence (ability of participants to make a rational decision), and voluntariness [19].

To avoid lack of confidence and misunderstanding, all participants were provided with the aims of the research in a written form. The information sheets with this information were either presented directly in a face-to-face meeting or sent by email. After familiarizing themselves with the document, the participants had a chance to ask questions about the research and clarify the objectives and process. All the participants were made fully aware that they could withdraw from the research at any time without any consequences to the individuals. The participants were dealt with only after verbal explanation and after them voluntarily signing the written consent and information statements prior to the research. The researcher did not use any power relations towards the participants in order to collect the written agreements.

Confidentiality, as one of the main ethical concerns, was maintained by changing real names in the research report and substituting some specific details related to the identity of the participants to keep the personal nature of the research private.

VI. DATA ANALYSIS

The literature about qualitative research methods places great emphasis upon the methods used to go out and collect or generate data, but less emphasis upon the analytical techniques

that can be used to interpret these data. So whilst different approaches might be taken when conducting qualitative research, there are also requirements that there should be some consistency between methods, methodology and analysis, in order to demonstrate logic within the story being told. At the same time, in order for the research to be credible to the reader, the reader needs to be lead toward what the researcher thinks is most significant about the research findings. The importance of these findings must be made "transparent" and choices and assumptions made by the researcher made explicit in relation to the methodological perspective. For example, if you're a positivist and tend to use deductive method reasoning, you'll tend to do "this". If you're an interpretivist and tend to use inductive method reasoning, you'll tend to do "that".

A wide range of literature documents the underlying assumptions and procedures associated with analyzing qualitative data, including the evaluation of data and data analysis strategies, and inductive and deductive approaches. Many of these are associated with specific approaches or traditions, such as grounded theory Strauss & Corbin [20], phenomenology e.g., van Manen, [17], discourse analysis e.g., Potter & Wetherell [21], narrative analysis e.g., Leiblich [22], and thematic analysis e.g., Boyatzis [23].

In this study the inductive approach is used. The inductive approach, in this study, refers to an approach that primarily uses detailed reading of raw data to derive concepts, themes, and models, through the researcher's interpretations of the raw data. In other words, the researcher will begin from the area of study and create a theory from the collected data [20].

The purpose of this approach is to allow the result to emerge from the frequent, significant themes discovered in the raw data without applying any structured methodology. Unlike deductive analysis, where the key topics are usually reframed or left aside because a prior hypothesis is imposed on the data, in the hope of obtaining a desired result, inductive approach describes the actual effect of data on the phenomena. In other words, describing the data perhaps give insight about phenomena rather than supporting the result with the data.

The purpose of using an inductive analysis approach can be summarized in the following bullet points:

- To combine varied raw data into a brief summary;
- To create clear links between the objectives of the research and the results from the raw data and make those links clear to others and how those links fulfill the research objectives;
- To develop a theory based on the experiences and processes revealed by the text data.

Choosing an inductive approach through thematic analysis (a 'data driven' approach) for the study determines that the objective of the study is to obtain an understanding of a phenomenon, rather than to test a hypothesis. According to Boyatzis [23], thematic analysis functions as: (1) a way of seeing; (2) a way of making sense of seemingly unrelated material; (3) a way of analysing qualitative information; (4) a way of systematically observing a person, an interaction, a group, a situation, an organization, or a culture; and, (5) a way

of converting qualitative information into quantitative data (pp. 4–5). Furthermore, thematic analysis is commonly used to identify, report, and analyse data for the meanings produced in and by people, situations, and events [10, 20, and 23]. A theme is a ‘patterned response or meaning within the dataset’ Boyatzis [23]. Because thematic analysis has great flexibility, it has been applied to the social sciences, physical sciences, medicine and mathematics [23].

Thematic analysis can either realistically present experiences, meaning and the reality of participants, or examine the effects of those experiences, events and realities operating within society. Though any good theoretical framework carries a number of assumptions about the ‘reality’ presented in the data, a good thematic analysis will make these assumptions transparent.

Fossey et al. [24] describe thematic analysis as “a constant comparative method” which compares groups and clarifies text segments to help create a definition of categories or themes within data. In this sense, thematic analysis procedures focus on developing categories, derived inductively from the data itself, rather than from an a priori theory, to enable systematic description.

This approach starts with the collection of data from note taking, tape recording, and transcription – the same approaches that were used for information gathering in this study. According to Fossey et al. [24], “note-taking and tape recording is a useful combination that enables analysis of the material as a whole, while more specific components of interviews can be transcribed in full for detailed analysis”. The coding method used within my own study/research was ‘open coding’. Notes taken following an interview began the process of identifying emerging themes. Listening to the interview recording and reading the resulting verbatim transcriptions continued this process. The transcription of interviews was done by myself and a transcriber. A thematic analysis was then conducted to draw out salient themes. Initial coding was done using NVivo9, computer software designed for use in qualitative research. These themes that were discovered/described/analyzed were accompanied by verbatim

quotes to provide accurate reflections of participants’ meanings. A comparison was also made between the responses of developers to see if there are variations between stages of RD. Finally, as recommended by Fossey et al. [24], the themes were coded and organized to identify patterns and connections, in order to arrive at a meaningful analysis of the experience in question.

Figure 6 below summarizes data analysis strategies used in this study. The study consisted of several stages and cycles. In order to develop initial codes, we conducted a series of participant observations, interviews, and focus groups; we also studied the documentation which was part of different data collection methods. To identify the important parts of the raw data as initial codes, we collated data through recurrence or repetition of words and phrases. The parts of the data that were singled out through key point coding were identified as a series of initial codes.

In order to validate initial codes, we conducted a second series of participant interviews and focus groups. When the initial codes were confirmed, the data is summarized, and clustered into groups that relate to the research questions. By interpreting the data and assigning codes to the raw data, specific themes are identified. The identification and interpretation of the codes requires a long process of reading and rereading the collected information. Once a code is identified the data is studied again in order to identify and specify the parts of raw data which relate to the same theme. It is important to check that there is relation between the themes identified and the initial codes. This, in fact, was an ongoing process that I undertook, in order to make sure that no data was missing, and that previously collected and coded data was valid.

The validity of the coded themes is clarified after sorting and combining different codes under the same thematic umbrella. Spradley (1979) Domain Analysis helps to identify and specify the relations between the themes. This leads to combining some themes under the same umbrella, as well as defining the themes’ properties.

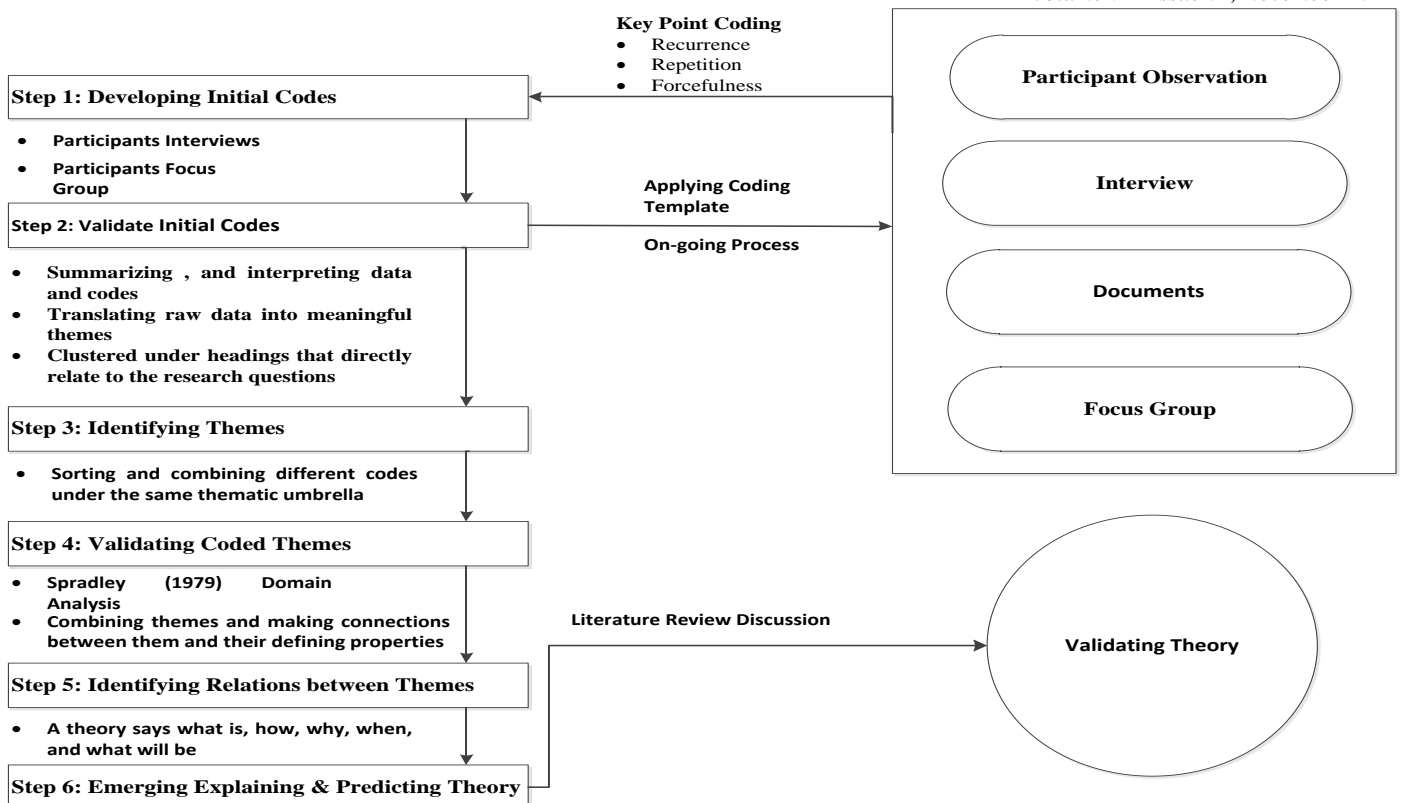


Figure 6 Diagrammatic representation of data analysis strategies (adapted from Spradley 1979; Owen, W. F., 1984; Miles & Huberman, 1994; Boyatzis, 1998; Allan, 2003, Gregor, 2006, and Thomas, 2006).

One of the final steps of data analysis strategies used in this study directed me to explaining and predicting theory about requirement determination. This process was achieved by identifying relations between themes, making it clear what the theory says about how-why-when-and-what process. Clear understanding of the themes and their relations leads to explaining and predicting theory. After this, the theory can be validated by literature review discussion, and identified as the final product of the study.

VII. SUMMARY

Study the phenomenon “how to develop a shared understanding of software requirements” in-depth and detail, needs to adopt the qualitative ethnography format that fits with the everyday reality work. This is because developing a shared understanding of software requirements is marked by complications, struggles and any other specifics that are “part and parcel” of the knowledge exploitation. This research represents an initial attempt to understand the impact of analysts’ on developing a shared understanding and, consequently, software requirements. In other words, meta-abilities, influencing skills and sharing attitudes are understood to be interrelated to the dynamics of the wider developing a shared understanding of software requirements, of which they are an integral part.

Analysts’ strategies of developing a shared understanding of software requirements in this respect are not understood. This is achieved by enabling the “best practices” in functioning requirements determination activities that are documented and stored within the software development companies. By and

large, the qualitative data is most appropriate for explore the themes and communication strategies of developing a shared understanding of software requirements. This is because it recognizes that the developing a shared understanding of software requirements are cultural products, not a natural phenomenon.

VIII. CONCLUSION

This research was conducted in the interpretive paradigm using an ethnographic approach. Multiple methods of data collection were used, including observation, interviews, focus group, and documents collection. All interviews were transcribed and these transcriptions, along with field notes, audio recording of the observation, and all written documents collected from the participants, comprised the texts that were used for data analysis. Data analysis was inductive, thematic analysis (data driven approach).

Ethnographic research proved to be an appropriate research method that provides great depth for any study that willing to understand a phenomenon in reality. Not only does it demonstrate and describe various people’s actions, but it also indicates what they say and they are doing (Myers, 1999). The researcher can reach an in-depth understanding of the group under study and the broader context in which the study took place through gaining an intimate familiarity with the everyday life of the participants. The research also provides an insight into what we “take for granted” and makes the researcher note the specificities of the life process within the group under study.

Since the ethnographic method works bottom-up, it is used to define a research problem. Even if the researcher has his/her own hypotheses, he cannot allow them to be known to the study group. That is one of the reasons why the ethnographic method uses naturalism as a methodological principle. Naturally occurring situations and behaviours can only be captured in natural settings and cannot be studied in laboratories or other artificial settings. The researcher has to combine two roles, as a participant and an observer. It is hard to predict what the extent of the researcher's participation will be, as in the process of the field work, their participation could vary from complete immersion in the program to complete separation from it and acting as a spectator. The researcher's role as a participant allows them to "live" and "feel" what it is like to be part of the group, while the role of the observer allows them to study the behaviours and perceptions of the group as events occur naturally, without imposing his/her own views and assumptions (so as to minimize his/her effects on the people under study). The description of the results of such an approach including being both a participant and an observer, can provide a generalized analysis of behaviours in similar settings in terms of their relationship to the context in which they occur. The behaviours which occur, however, might be seen as "strange" by another social group or sub-section of society. The fact that these occurrences might seem strange to other groups must also be recognized or discussed by the researcher when identifying the way of life of the group. This way, we can say that the ethnographic approach is used to define problems which cannot be predicted by the independent variable predisposing some conditions. Well known settings still can be included in the research provided that the research allows for the description of or accounts for unpredicted outcomes.

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