# Computer Assisted Qualitative Data Analysis Software. Using the NVivo and Atlas.ti in the Research Projects Based on the Methodology of Grounded Theory

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**Abstract** Our presentation raises the matter of the application of specialist software which assists qualitative data analysis in research based on the procedures of grounded theory (GT) methodology. The aim is to present the relationships between the procedures of GT methodology and the Atlas.ti and NVivo software. During our presentation, we would like to demonstrate the manner in which the functions available in the Atlas.ti and NVivo software may be applied when carrying out analysis based on GT methodology. Hence, while we focus on technical issues (collecting, editing, segregating and ordering the data), we also look at the analytical possibilities (the process of coding, searching in respect of codes, writing memos, creating relationships between the codes, establishing a network view) of the presented software.

**Keywords** Grounded theory methodology · CAQDAS · Atlas.ti · Nvivo

## 1 Introduction

Development of modern technologies provides researchers with new manners and opportunities of realization of research projects. Quickly developing computerization and informatization bear great significance in this field. Modern technologies impact the research process increasingly more intensively, by providing innovative methodological tools, such as specialist computer programs. Within recent decades, we have been able to notice highly dynamic development of computer-assisted qualitative data analysis software, and the list of available programs is constantly becoming longer (c.f Lewins and Silver 2004). Apart from relatively simple tools with limited possibilities, we have so developed programs as Atlas.ti or NVivo,

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which provide the researcher with possibilities to establish connection between codes, to perform complex searches for data, generate hypotheses, and further also to construct theories (Fielding 2007: 463; Kelle 2005: 486). Such software helps in the creation of complex collections of data, and their comprehensive arrangement, according to the researcher's intentions. NVivo and Atlas.ti have a quite long history now, and they managed to reach leading positions among CAQDA software. These are tools that underwent numerous modifications, and which have been continuously improved for more than twenty five years, paving the way to quality researchers.

In our case, we used opportunities provided by both these programs to analyze the data on the basis of grounded theory methodology. Our comments and observations related to the process, are briefly described below.

## 2 Background

In our research we attempted to identify the perspective of the examined social actors, understanding the procedural dimension of the researched phenomena concerning people with disabilities who are socially excluded. Therefore, the grounded theory methodology turned out to be especially useful for us. We were aware that this choice of methodology is connected with particular ontological and epistemological assumptions, which form the framework of the research conducted. Hence, we made every effort for the research process to take place in accordance with methodologically correct procedures which, in the case of GT, comprise open, selective and theoretical coding, theoretical memos, theoretical sampling or a constant comparative method.

Taking the complexity of the GT procedures into consideration, together with a significant number of data, which we were keen to analyse, we started to look for a manner for rendering the research process more efficiently and effectively. We came to the conclusion that a good solution would be to find support in the form of computer programs (CAQDA). Therefore, after a trial-and-error period, we selected the Atlas.ti program, which we believe suits our needs best.

## 3 Methods

Grounded theory is treated in the literature of the subject as a research strategy, the main purpose of which is to develop a theory (c.f Creswell 1998). This strategy consists in development of a theory (of a moderate reach) based on systematically collected empirical data (Strauss and Glaser 1967; Glaser 1978). Therefore, the theory derives from analyses of empirical data, showing itself during systematic field research, arising from data, which are directly referred to the observed part of the social reality. Hypotheses, notions and their qualities are developed, modified and verified during empirical studies. Therefore, development of a theory is strictly connected with a long-standing research process. It may be stated that a researcher's purpose is gradual transfer from empirical material to higher levels of abstractive thinking, through creation of hierarchically differentiated categories and their qualities, to the construction of hypotheses and theories.

The logics of the research process is based on seeking an increasingly higher conceptual level, and as a result, dropping data and turning to theorization. A key role is played in this context by the process of coding, i.e. ascribing batches of material with particular labels that reflect their sense and meaning allocated by social actors, and reflected by the researcher. These actions are accompanied by particular procedures of methodological correctness, which in the case of GT include, among others, theoretical sampling, constant comparative method, coding, writing notes. The process of empirical data collection takes place, in the case of the grounded theory method, gradually, on various phases, but alternately, with analysis and interpretation performed in parallel.

## 4 Working Environment

Both presented programs are powerful tools aiding the qualitative analysis of text data, as well as of graphic materials and audio/video files. NVivo and Atlas.ti offer an array of functions supporting tasks connected with a systematic approach towards qualitative data analysis. Atlas.ti and NVivo support the process of exploring phenomena hidden in the data, and they help to deal with the complexity of analytical procedures, at the same time offering a friendly and intuitive working environment. Both programmes support researchers' concentration on material analysis, providing functions facilitating management, edition, comparing and creating hypotheses and theories out of significant loads of data, all of this in a creative, flexible and at the same time systematic way (Fielding and Lee 1991).

It is worth emphasizing that the discussed programs belong to the category of applications supporting development of theories, and this is why they correspond very well to the requirements put forward by the grounded theory methodology procedures. This in turn generates specific solutions implemented in NVivo and Atlas.ti, and which are directly reflected in the appearance of the applications themselves, their structure and available options.

The creators of both programs face various habits of analysts—as ordinary computer users—who have their customs related to the manner in which they operate the equipment and particular software. NVivo allows, among others, to show, hide and move certain elements visible on the screen. There is also a possibility to use certain functions from the drop-down menu, or icons located on the menu bar, and through certain combinations of keyboard shortcuts (Schönfelder 2011). As a result, the program offers significant freedom in creating the working space, and adjusting it to individual user's needs. The case is similar with the Atlas.ti program, where users may implement various modifications in an easy manner, according to their preferences. The HU editor serves as the main instrument, which offers access to all other tools of the program. Users may decide which parts of the window to display and adjust its appearance to their own needs.

## *4.1 Open Coding*

A basic analytical action that we undertook was the coding process, which consisted of ascribing data fragments with labels describing the content of each particular fragment. The coding took place according to the open scheme, when numerous codes were ascribed. Afterwards, we moved to axial coding—which focused on selected key categories of a higher, theoretical meaning (Strauss and Corbin 1990). Such coding performed in Atlas.ti and NVivo took place through marking a text, fragment by fragment, with each section subsequently being ascribed certain labels. What is significant is that as our ideas evolved the generated codes could be modified. Therefore, a previously ascribed code could change its name, become merged or replaced with another code, as the theorization process progressed.

During the analysis process, we developed almost 500 codes, which were gradually combined, grouped or simply excluded, as a consequence providing a number of 40 categories. While the interviews and notes from observations were coded in two manners: "in terms of scope", regarding the time, when the story took place, and "in terms of details", where certain fragments corresponding to particular leads were marked in relation to scopes. A key of material codes was developed during the analysis. Codes grouping into a hierarchical code took place from the bottom. Each period was provided with almost a hundred codes, which were afterwards arranged into more general categories, until three main groups were achieved.

It seems that authors of NVivo and Atlas.ti assumed a possibility of coding as one of the main objectives while developing the software. From this perspective, the NVivo and Atlas.ti applications seem to meet the researchers' expectations, who use the grounded theory methodology in their research, especially that coding and categories generation, and creation of connections between them, pose a major part of work done by an analyst using GT. A result of categorization and combination of codes is the construction of hypotheses and development of theories on their basis.

Both programs, Atlas.ti and NVivo proved to have similar functionalities in the process. Both allowed to carry out the coding process, which, according to us, remained in compliance with grounded theory methodology procedures.

## 4.2 Relationships Between the Codes

Another step in the analysis based on GT is axial coding, when connections between categories and subcategories were determined. Analytical procedures of focused coding allow, according to Anselm Strauss, to recognize the relationships between the structure and the process. Also in this scope, the NVivo and Atlas.ti programs provide the researcher with support, because they have elaborated functions, which support development of the hierarchy of categories, but also enable the creation of connections between codes. It is significant because thanks to such tools, it becomes possible to continue the analysis and to take it to a higher conceptual level (Fielding and Lee 1998). The existence of various functions, which on one hand allow to create a structure of categories, and thus facilitate the process of arranging the coding results, therefore enabling reflection of the "superiority-inferiority" relation (including specification of categories, subcategories, and their qualities), and on the other hand allow to determine the character and relations connecting the generated categories more precisely, cause it to become real to use the coding paradigm in the coding process. In other words, the coding paradigm means a general theory of action, which may be used to develop a structure or "axis" of a developing theory.

In the research that we described, we applied the five-element of Strauss and Corbin model (1990), in order to construct an initial analytical scheme: causative conditions, intervening conditions, context, micro-actions and consequences. Using the suggestions proposed by Strauss and Corbin (1990), we constructed a structure of notions explaining the phenomenon that we studied. After completion of those actions, the purpose of studies, which was initial and general until now, has become more concrete and precise. Using the suggestions proposed by Strauss and Corbin (1990), we constructed the following structure of notions explaining the phenomenon that we studied:

- First of all, the causative conditions, which in our study meant the level of motivation to act despite the disability;
- Second of all, the phenomenon (the main category), so, according to our analyses, it was the reconstruction of the process of going out of the social space of marginalization and social exclusion;
- Third of all, the intervening actions, meaning the cognitive model or the concept of disability;
- Fourth of all, the context, which was brought down, among others, to limitation or strengthening of environmental impacts, as well as actions and behaviors of other people;
- Fifth of all, strategies of actions/interactions, represented by two extreme categories: (a) independence (inner locus of control), (b) dependence (outer locus of control).

Moreover, on the basis of the coding paradigm's elements determined as such, we managed to operationalize the so-called consequences, which meant the reconstruction of the notion of disability, and the assumption of the concept of social exclusion of this category of persons.

## 4.3 Searching with Regard to Codes

The logics of the research process in grounded theory methodology is based on seeking an increasingly higher conceptual level and, as a result, dropping data and turning to theorization. In this context, the constant comparative method, which consists of searching for differences and similarities between fragments of data, codes or cases is of great significance. Increasingly, more general categories revealing underlying uniformities are generated on the basis of similarities and differences' analysis. Preservation of a work style, recommended by the authors of *The discovery of grounded theory*, i.e. treating the study as a whole process that is consciously directed at generation of theories, leads very quickly to—as claimed by Strauss and Glaser (1967)—the formulation of a multiplicity of hypotheses. At the beginning not connected, in a short time they start to form a theoretical framework of the research. Therefore, from the perspective of the processual character of theories generation, it seems useful that the created inquiry and interconnected search query may be updated according to subsequent changes introduced into the project. We can restate the inquiry in regular time intervals, and hence monitor the development process of our coding, and evaluate whether the recent analyses head in a direction that is satisfactory for us.

Computer programs, which we used to analyze the data, have special functions, which enabled to "verify" the hypotheses through scanning parts of interviews and notes from observations. Therefore, computer assisted qualitative data analysis software may be useful to improve theoretical concepts, and to create and "establish" hypotheses.

In our research, we verified our intuitions related to the impact of the process of leaving social marginalization of a disabled individual, exerted by social welfare institutions. In order to research such an initial hypothesis, the option of searching data in terms of spatial presence of codes in source materials turned out to be useful. For example, we can introduce proper configuration, pointing to segments of texts coded with the first code, and segments coded with the second code, appearing at a certain distance from the first ones. Therefore, the hypothesis of relation between leaving social marginalization and impact by a social welfare institutions, may be studied through searching for all elements of the text, coded by "leaving from social marginalization", and fragments coded with "impact by a social welfare institution", located at a certain distance from the first one (expressed with a number of verses).

In practice, while using Atlas.ti or NVivo software, the procedure of comparison was realized through the application of the data search option. This process consisted of reviewing fragments of a text and other data, which were coded with a particular code. Hence, we obtained knowledge on opinions of a given topic, which we understood in an analytical category, expressed by particular speakers. Also in this scope, both programs showed similar functionalities, although in our opinion, NVivo turned out to be more intuitive. Atlas.ti required us to spend more time to get familiar with its functions of searching through data.

## *4.4 Memos*

A crucial action within the process of the generation of theories was theoretical coding. It takes place through theoretical memos, i.e. the thoughts of a researcher about the encoded categories and hypotheses, written in a theoretical language. Notes writing has accompanied an analyst applying the grounded theory methodology since the beginning of the research process. These notes may be related to the whole project, collected data in general or any source of data individually, and also subsequent stages of analysis and particular codes (Saillard 2011). Therefore, preparation of notes is of crucial meaning on each level of the coding and data analysis process (c.f Strauss and Corbin 1990). In other words, starting with open coding, a research should, as far as possible, write down all ideas related to the process of interpreting data and drawing conclusions from the analysis. In this context, the tools, e.g. comments, notes or annotations—offered by CAQDAS packages—gain on importance for the qualitative approach, enabling realization of analyses with application of the grounded theory methodology. Therefore, Saillard suggests to call them “reflection tools” of a researcher (2011).

In both programs, *memos* are separate components of the whole project, which could be connected with other elements, such as codes or source documents. In the NVivo and Atlas.ti programs, a role of theoretical notes is played by memos, i.e. records of theoretical thoughts and concepts by a researcher. The concept of memos in the discussed programs is analogical to the procedure of generating notes in the grounded theory methodology. They are there to help the researcher move to a higher conceptual level, and they serve the generation of theories as tools of theoretical coding. Also in this case, a researcher gains a possibility to ordinate such data, and to provide them with a certain structure, e.g. by cataloging memos, and describing them with data, in order to monitor the changes arising in the process of data analysis and interpretation. Writing notes is a significant task on each stage of qualitative analysis. The ideas recognized in the notes are often certain “puzzle pieces” which can be connected afterwards and used at the stage of writing reports. Both programs enable the researcher to fluently move between open and focused coding, writing memos, modeling. Through that, they can support the process of collecting, analyzing data and theorizing (Bringer et al. 2006).

## 4.5 A Mind Map

Strauss and Corbin (1990) suggest that during the process of generating theories, apart from coding, segregating and arranging information, seeking for patterns between data, using a system of notes, we should also lean on visual representations of connections and interdependencies between generated analytical categories. Any visualizations in the form of charts, diagrams or networks are useful to organize relationships between categories, which emerge during selective coding. From the GT methodology perspective, the most significant are the models, which form the basis for diagrams that integrate data. Any schemes, diagrams or models are used for visual representation of connections and interdependencies, which exist between components of the developed theory. What is more, contrary to linear representations of various relationships, the network distribution of those relations is closer to a human manner of perceiving reality, and it therefore becomes one of the most important interpretation processes of an analyst.

In the Atlas.ti and NVivo software, we used the function 'network view creation' to determine and review initial concepts and ideas on questions which lie in the field of our interest. We also used it to create visual representations of relationships between elements of the project, to identify emerging patterns, theories and explanations, or document and register subsequent stages of work over the project.

Thanks to such a visualization of data, it has become much more convenient for us—researchers performing analyses that head towards generation of theories—to compare various elements of a single project. First of all, representation of subsequent stages of an analysis in the form of a mind map allowed improved observation of relationships and patterns of data. At the same time, application of the modeling function allowed to develop a project draft, and a vision of our own ideas as related to the development of the material.

At the end, it is worth adding that while using a computer program, and creating various visual representations of the data analysis that we led (including creation of an integrating diagram that somehow crowned the whole process), we can document the course of all actions undertaken by a researcher in this scope. Therefore, we—as researchers—can monitor subsequent stages of formulation of our analytical "path", and we also become more transparent for our recipients thanks to that, who obtain a possibility to look into the course of the whole research process. Such a direct and tangible expression of this action may be the presentation of a natural history of the study, which we can not only present in a descriptive manner, but also through data exported from the program, and include them into our work in the form of a report.

## 5 Conclusions

Atlas.ti and NVivo may be highly supportive in every scientific field, and they may have highly practical application whenever qualitative data is used. NVivo an Atlas. ti software are equipped with instruments which facilitate the process of meeting the requirements connected with generating grounded theory, providing the researcher with new tools allowing to take care of the emerging theory to be fit and modifiable (Glaser 1978). What makes NVivo and Atlas.ti interesting for analytics applying grounded theory methodology is the possibility to develop material according to the logics of abductive research conduct. It means that the researcher becomes equipped with such functions and options of software which allow to follow the path leading from detailed data to developing general conclusions that may then be verified by the researcher coming back to the source materials.

During work in the described programs, while using the implemented functions, we managed to perform data analysis (interviews, notes from observations of existing data, as well as audio and video materials), in a manner which corresponded to requirements put forward by grounded theory methodology procedures. It is also worth emphasizing that the programs turned out to be helpful as tools for collection of, and at the same time control over a significant amount of materials, which may be simply processed, modified, sorted and reorganized, as well as sought through. It enables a researcher to gain greater control over the collected data. It is also accompanied by a possibility to subordinate various elements of the projects, among others, through grouping them in accordance with the preferences of a researcher (Wiltshier 2011). The Atals.ti and NVivo programs allow comprehensive arrangement of data—both source materials and any information resulting from an analysis carried out by a researcher. It also must be kept in mind that the computer software devoted to qualitative data analysis creates a possibility of constant modification of all project elements, together with the emergence of new data (Bringer et al. 2006). A flexible manner of creating and modifying the project elements allows a researcher to follow the data, and the generated code may be quickly modified if we decide that it does not reflect the data content to a sufficient extent (Glaser 1978). At the same time, the system of analytical notes allows fluent alteration of actions related to collection and analysis of data.

From that view, Atlas.ti and NVivo programs allow to conduct particular tasks regarding the analytical process, which would be impossible in such a dimension or in such a relatively short time when applying traditional ways of research. Nevertheless, it needs to be noticed that computer aided qualitative data analysis is not equal to the best method for designing and conducting research, but it is a kind of alternative for traditional methods. The choice that will be made by the researcher should depend on his/her personal preferences, type of research and character of the explored field. It seems that the most important aspect is not about the way of carrying out the research—traditional or with CAQDA—, but about the question of choosing proper research techniques, methods and tools that will be adjusted to the actions planned by the researcher (Kelle 1995).

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