Manual or electronic? The role of coding in qualitative data analysis

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Summary

Data analysis is the most difficult and most crucial aspect of qualitative research. Coding is one of the significant steps taken during analysis to organize and make sense of textual data. This paper examines the use of manual and electronic methods to code data in two rather different projects in which the data were collected mainly by in-depth interviewing. The author looks at both the methods in the light of her own experience and concludes that the choice will be dependent on the size of the project, the funds and time available, and the inclination and expertise of the researcher.

Key words: coding, qualitative data, data analysis

Introduction

The analysis of qualitative data is usually seen as arduous. The reason why it is found to be difficult is that it is not fundamentally a mechanical or technical exercise. It is a dynamic, intuitive and creative process of inductive reasoning, thinking and theorizing. Most qualitative researchers analyse their own data. Unlike some quantitative research, qualitative research usually lacks a division of labour between data collectors and analysts. Throughout analysis, researchers attempt to gain a deeper understanding of what they have studied and to continually refine their interpretations. Researchers draw on their firsthand experience with settings, informants or documents to interpret their data (Taylor and Bogdan, 1998). The object of analysing qualitative data is to determine the categories, relationships and assumptions that inform the respondents’ view of the world in general, and of the topic in particular (McCracken, 1988).

Over 20 years ago, Miles (1979) argued that the analysis of qualitative data was perhaps the most demanding and least examined aspect of the qualitative research process. This statement is still true to a large extent. Researchers, over the years, have pointed to the complexity of these data. Delamont (1992) warns that there are no short cuts and one must allow plenty of time and energy for the
task. Further, the analysis of qualitative data continues throughout the research and is not a separate self-contained phase. Ely et al. (1991) point out, that we come to qualitative research with whatever understanding of analysis we bring from previous work, the conventions of our respective disciplines and professions, the advice of our mentors and the models we have internalized from whatever we have read.

Raw data can be very interesting to look at, yet they do not help the reader to understand the social world under scrutiny, and the way the participants view it, unless such data have been systematically analysed to illuminate an existent situation. Coding or categorizing the data has an important role in analysis. It involves subdividing the data as well as assigning categories (Dey, 1993). Codes or categories are tags or labels for allocating units of meaning to the descriptive or inferential information compiled during a study. Codes usually are attached to chunks of varying-sized words, phrases, sentences or whole paragraphs, connected or unconnected to a specific setting. They can take the form of a straightforward category label or a more complex one, for example, a metaphor (Miles and Huberman, 1994). Seidel and Kelle (1995) view the role of coding as noticing relevant phenomena; collecting examples of those phenomena; and analysing those phenomena in order to find commonalities, differences, patterns and structures. Creating categories triggers the construction of a conceptual scheme that suits the data. This scheme helps the researcher to ask questions, to compare across data, to change or drop categories and to make a hierarchical order of them. Gough and Scott (2000) argue that it may be useful to identify two distinct, albeit linked, phases to data coding: one focusing on meanings inside the research context and the other concerned with what may be meaningful to outside audiences.

Tesch (1990) used the terms ‘data condensation’ or ‘data distillation’ as a description of the eventual outcome of a qualitative analysis, implying that the body of data did not merely become smaller and manageable in the analysis process because there was less to deal with, but was the result of interpretation and organization. She viewed the establishment of categories both as an organizing tool and an important part of the outcome. Ely et al. (1991) contend that at its most useful, the process of establishing categories is a very close, intense conversation between a researcher and the data that has implications for ongoing method, descriptive reporting and theory building.

A category, however, cannot be created in isolation from the other categories we want to use in the analysis. When we devise a category, we are making decisions about how to organize the data in ways which are useful for the analysis, and we have to take some account of how this category will ‘fit’ into this wider analytic context (Dey, 1993). Codes are links between locations in the data and sets of concepts or ideas, and they are in that sense heuristic devices, which enable the researcher to go beyond the data (Coffey and Atkinson, 1996). Two analytic procedures are basic to the coding process, though their nature changes with each type of coding. The first pertains to the making of comparisons, the other to the asking of questions. In fact, grounded theory is often referred to in the literature as ‘the constant comparative method of analysis’ (Glaser and Strauss, 1967). Category names can come from the pool of concepts that researchers already have from their disciplinary and professional reading, or borrowed from the technical literature, or are the words and phrases used by informants themselves (Strauss and Corbin, 1990).
Coding and analysis are not synonymous, though coding is a crucial aspect of analysis. Qualitative data analysis is not a discrete procedure carried out at the final stages of research. It is, indeed, an all-encompassing activity that continues throughout the life of the project. Even if the researcher is not involved in a formal analysis of the data at the initial stages of research, s/he might be thinking how to make sense of them and what codes, categories or themes could be used to explain the phenomena. Previously, researchers tackled the laborious task of coding manually. Lofland (1971) and Bogdan and Bilken (1982) are among the few authors who describe the basic procedures of manual coding using the various methods, such as cut-and-paste and note cards.

Electronic methods of coding data are increasingly being used by innovative researchers. Nevertheless, computer programs for text analysis have been around since 1966 (Tesch, 1990). The segmentation of field data and retrieval of marked data segments is a valuable resource in the management of qualitative data. It is an established approach that in recent years has been reinforced by the development of microcomputing strategies (Weaver and Atkinson, 1994), many of which essentially recapitulate the same logic of data handling. They substitute rapid and comprehensive searching supported by software for the uncertain and slow process of manual searching and filing. The computer and the text analysis packages do not do the analysis for the researcher. The user must still create the categories, do segmenting and coding, and decide what to retrieve and collate. No amount of routine analytic work will produce new theoretical insights without the application of disciplinary knowledge and creative imagination (Coffey and Atkinson, 1996). The programmes, nevertheless, take over the marking up, cutting, sorting, reorganizing and collecting tasks qualitative researchers used to do with scissors and paper and note cards (Weitzman and Miles, 1995).

Researchers who use the packages are often amazed that this kind of work, with its thousands of pages of data, could ever have been conducted by hand (Ely et al., 1991).

Miles and Huberman (1994) point to two methods of creating codes. The first one is used by an inductive researcher who may not want to pre-code any datum until s/he has collected it, seen how it functions or nests in its context, and determined how many varieties of it there are. This is essentially the ‘grounded’ approach originally advocated by Glaser and Strauss (1967). The other one, the method preferred by Miles and Huberman, is to create a provisional ‘start list’ of codes prior to fieldwork. That list comes from the conceptual framework, list of research questions, hypotheses, problem areas and/or key variables that the researcher brings to the study. As explained below, the first method was used to code data in Study One, in which the data were coded manually; and the second method in Study Two, in which the data were coded electronically, though the ‘start list’ was not produced until the exercise of coding the data was about to commence in Study Two.

The research studies

The design of the two studies employed a qualitative methodology and was concerned with an ethnographic case study. Ethnography is a cultural description that shows how people describe and structure their world (Marshall and Rossman, 1989) and ethnographic research lends itself well to topics which are
not easily quantified (Frankel and Wallen, 1990). The emphasis is on documenting or portraying the everyday experiences of individuals by observing or interviewing them. An ethnographer studying a culture endeavours to portray that culture in a realistic and enriching fashion in order to convey to the reader the authentic flavour of that culture.

As well as being an ethnography, one study aimed to paint a picture of a group of teenage girls as a single case, and the other proposed to portray the life of a group of male and female students as trainee teachers and then as newly qualified teachers of mathematics, again as a single case. Cohen and Manion (1989) place case study in the alternative paradigm of research which can be both interpretive and subjective. A case study examines a single instance, which could be a pupil, a class, a group, a school, a community or a profession, to illuminate the wider population to which it belongs. In this respect, it is similar to ethnography. The two are not mutually exclusive as they have cognate features and it would be appropriate to refer to studies like the two being discussed as 'ethnographic case studies'.

The studies were not ethnographies in the anthropological sense, as they did not involve observation, but relied primarily on interviewing for gathering data. Nor were they case studies of a single case, but regarded the group of British Muslim girls and the group of trainee/newly qualified teachers as a single instance. Hence they combined features of the two qualitative strategies for methodological purposes.

**Study One: the aspirations of teenage British Muslim girls**

Study One was conducted for my PhD thesis. It sought to determine the aspirations of adolescent British Muslim girls and to ascertain how these aspirations were being shaped. It also sought to examine outside influences, which could be considered instrumental in shaping the girls’ ambitions. The parents and the teachers were thought to be the two important groups who had guidance and advisory roles critical for moulding these aspirations. It was therefore felt necessary to construct a research design that took into account not just the perceptions of the girls, but also those of their parents and teachers. This kind of triangulation not only illuminated the same issues from three different perspectives, but also manifested how the perceptions of the parents and the teachers encroached on the girls’ aspirations. Furthermore, this strategy proved invaluable in checking the validity and reliability of the data. The study did not set out to check hypotheses or theories, but intended to generate theory grounded in the data.

The data for the study were collected at three secondary schools by interviewing in depth of a total 24 adolescent Muslim girls in the final year of compulsory schooling, one or both of their parents, and 18 teachers involved in teaching these girls. The interviews were conducted in two phases, with a reduced sample interviewed in the second phase. A preliminary analysis of data collected by first phase interviews was undertaken to identify the issues addressed. These were then pursued more thoroughly in the second phase.

Qualitative researchers believe that only qualitative data respect the complexity, subtlety and detail of human transactions. Bliss, Monk and Ogborn (1983) identify two strategies which are commonly used for analysing these data: to report results in terms of a relatively simple category scheme, or to put before the reader by extensive, though necessarily selective, quotation the data themselves, hoping thus that the essential flavour comes through. A combination of the two above-mentioned strategies was used to analyse the data. The analysis
Qualitative data analysis was a lengthy, complex and sometimes frustrating process. Several analyses were carried out in the two phases, both during the fieldwork and after its completion. This involved listening to the interview tapes; transcribing 99 interviews; translating parental interviews – which were in community languages – into English; reading the transcripts a number of times; summarizing the transcripts and composing six matrices and choosing categories; coding statements; linking themes; selecting quotations; and ultimately, generating theory grounded in the data and writing it up in a coherent fashion.

At the conclusion of the first-phase interviews, three matrices were devised on very large sheets, one each for the pupils’, the parents’ and the teachers’ interviews. On each matrix, comprising numerous squares, the interviewees’ pseudonyms were inscribed vertically, and the questions asked in the interview were inscribed horizontally in a condensed form. An abbreviated version of the interviewees’ answers to the questions was recorded in the corresponding squares. This provided an anatomic framework of the data permitting instantaneous interviewer and intra-interviewee comparisons and contrasts. The second-phase interviews were managed and interpreted in the same way as the first-phase interviews. Thus, a total of six matrices were produced.

The two matrices classifying data from pupil interviews in the two phases were examined together. Similarly, the two matrices with parental interviews, and the two with teachers’ interviews were studied. Together, the girls’ interviews classified 102 issues, the parents’ matrices listed 72 issues and the teachers’ matrices recorded 68 issues. From the six matrices collectively, a number of themes were identified, and were then found to be linked with one another; 67 broad categories were detected. The transcripts, summaries and the matrices were studied again and further links were found between the 67 categories. These were thus consolidated to result in 23 categories. These were: Ethnicity, Language, Religion, Freedom, Control, Gender, Family Patterns, Marriage in Islam, Arranged Marriage, Marriage and Career, Consanguineous Marriage, Intermarriage, Enthusiasm for School, Friends, Responsibilities and Extracurricular Activities, Relationship with Teachers, Participation in Lessons, Homework, GCSE Options, Further Education, Career Choices, Unrealistic Aspirations and Career Advice. A spider diagram was produced at this stage to make sense of the links between the themes.

At this point, the transcripts were perused one more time. Illuminative quotations were highlighted and coded using the 23 categories that had been identified. A number of these quotations were chosen to be used in subsequent writings. The emergent themes were contemplated again and these 23 categories were, again, found to be connected with one another and were further condensed, culminating in six decisive themes. These were: Identity, Family Life, Marriage, the Social Dimension of Schooling, the Academic Dimension of Schooling and Career Aspirations (Figure 1).

The analyses facilitated the generation of theory grounded in the data. The overall picture presented by the research portrayed adolescence as a period of hope, optimism and looking to the future, and a positive stage in the life of an individual. The teenagers were not expected to sever ties, grow up and become independent, but childhood dependence was gradually and gently complemented and then superseded by quasi-adult responsibility. If conflict and contradiction arose, they were dealt with through the support of the family. Yet, the adolescents were not passive recipients of advice, but active participants in shaping their multiple identities and aspirations by means of a subtle
combination of negotiation and persuasion. Significantly, their identities and aspirations reciprocally influenced each other.\footnote{1}

\textbf{Study Two: the transition from BEd student to primary teacher of mathematics}

Study Two was an externally funded project. The project team comprised four researchers, including the author.\footnote{2} The study recorded the transition of a group of final-year primary BEd students from trainee to mathematics teacher at a primary school. Notably, all these students were non-mathematics specialists, i.e. none of them studied mathematics as their major subject at university. Thirty final-year primary BEd students at a university were interviewed in depth in two phases. A reduced sample was interviewed again, in a further two phases, when the teachers had secured their first teaching post at a primary school.

The interviews were tape recorded and transcribed verbatim. The research team met to examine some of the 30 transcripts from the first-phase interviews to determine the main categories to be used to code the data. Once a consensus was reached, I embarked upon the task of coding. The rich data were coded by using NVivo, a software package designed to aid the analyses of qualitative data, which is the most recent version of NUD*IST (Non-numerical Unstructured Data, Indexing Searching and Theorizing).
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The first step was to load NVivo on to my computer, and I then created a project in NVivo, calling it the ‘First Phase’. The interview transcripts, which were in a Word format, were saved as Rich Text Files (RTF) and these RTF documents were imported into NVivo. The computer was now ready to start coding electronically. Since the research team had already agreed on the main categories, I prepared a list of these codes (called ‘nodes’ in NVivo). These were: Identity, Teaching and Learning, and Policy. These three main nodes were each assigned a position on top of the three ‘trees’ that constituted the node listing for the project. I then started to enter some of the sub-categories (called ‘child nodes’ in NVivo; nodes parallel to each other are called ‘sibling nodes’) in the trees under the main nodes that they related to. Further, I added to the list four nodes which we had identified, but could not fit into a tree (called ‘free nodes’ in NVivo), because their meaning did not link with the three higher-level ‘tree nodes’. They, nevertheless, were included because they were significant.

Coding can be carried out by selecting segments of text using line numbering in the document, or by highlighting the specific quotation to be coded. Opening the first interview transcript, I selected an excerpt. I chose not to code by using line numbering as sometimes a quotation starts and ends in the middle of the line and additional words are unnecessarily included in the chosen extract. I instead highlighted the quotation and clicked on ‘Coder’ at the bottom of the screen. This extract matched the tree node called ‘identity’. I clicked on ‘identity’ in the node listing and then clicked on ‘code’. The colour of the extract, which was red when I had highlighted it changed to blue, indicating that the extract had been coded. The entire document was coded in a similar fashion, using different tree nodes, child nodes and free nodes, some more than others and not all nodes being used for coding individual transcripts. I was also able to insert more child nodes into the node list as I identified additional categories during the process of coding individual interviews. This clearly illustrated that coding involved not just premeditation, but reflexive and reflective activity. As Miles and Huberman (1994) contend, codes will change and develop; other codes flourish, with too many segments getting the same code, thus creating the familiar problem of bulk, calling for breaking down codes into subcodes.

Once all 30 transcripts were coded, I was able to exploit the search facility of NVivo and to generate extremely useful reports, which I could save and print. The ‘Document Coding Report’ pertained to a single interviewee and collected all the extracts from the interview under separate node headings. The ‘Node Coding Report’ related to individual nodes and assembled all the extracts from those interviews in which that node had been used to code data. Furthermore, I was able to generate another document, which I could print, but not save, though it could be generated again and again if required. This was the interview transcript with ‘coding stripes’. This showed an entire interview in a smaller font with brackets on the side indicating the text that was coded and the nodes that were used to code that bit of the text. Together the three above-mentioned reports proved to be enormously helpful when we embarked on the task of theorizing.

Tesch (1990) argued that identifying the boundaries of text segments and coding them de-contextualized the segments, since they were carved out from their place in the original data. The next step was their re-contextualization, which meant bringing together all segments with the same code. In computer terms, re-contextualization is accomplished through the searching, sorting and assembling functions of qualitative analysis programs. This is precisely what the three reports produced in NVivo executed.
The data for the study were collected in a further three phases. The interview transcripts for each phase were coded in a similar manner. Every phase necessitated the generation of new codes, though some of the existent codes in the node list became redundant as they were not used in every phase. The final node listing, illustrating all 52 nodes that had been used during the four phases of research, looked like this:

1. notion of play
2. real vs ideal
3. school vs college structures
4. theory vs practice
5. (1)/self
6. (1 1)/self/resource
7. (1 1 1)/self/resource/subject knowledge
8. (1 2)/self/student
9. (1 2 1)/self/student/college structures
10. (1 2 1 1)/self/student/college structures/career entry profile
11. (1 2 1 2)/self/student/college structures/reflection
12. (1 2 2)/self/student/in relation to others
13. (1 2 2 1)/self/student/in relation to others/peers
14. (1 2 2 2)/self/student/in relation to others/tutors
15. (1 3)/self/individual
16. (1 4)/self/teacher
17. (1 4 1)/self/teacher/professional
18. (1 4 2)/self/teacher/developing sense of being a teacher
19. (1 4 2 1)/self/teacher/developing sense of being a teacher/initial coping strategies
20. (1 4 2 2)/self/teacher/developing sense of being a teacher/classroom management
21. (1 4 2 3)/self/teacher/developing sense of being a teacher/ownership
22. (1 4 2 4)/self/teacher/developing sense of being a teacher/responsibility
23. (1 4 2 5)/self/teacher/developing sense of being a teacher/multiplicity of tasks
24. (1 4 2 6)/self/teacher/developing sense of being a teacher/skills
25. (1 4 3)/self/teacher/relation to others
26. (1 4 3 1)/self/teacher/relation to others/pupils
27. (1 4 3 2)/self/teacher/relation to others/colleagues
28. (1 4 3 3)/self/teacher/relation to others/parents
29. (1 4 4)/self/teacher/relation to school structures
30. (1 4 5)/self/teacher/maths teacher
31. (1 4 6)/self/teacher/motivation to teach
32. (1 4 6 1)/self/teacher/motivation to teach/specialism
33. (1 4 6 2)/self/teacher/motivation to teach/parents
34. (1 4 6 3)/self/teacher/motivation to teach/own teachers
35. (1 4 6 4)/self/teacher/motivation to teach/love of children
36. (2)/teaching and learning
37. (2 1)/teaching and learning/maths
38. (2 1 1)/teaching and learning/maths/conceptions of maths
39. (2 1 2)/teaching and learning/maths/experience of maths
40. (2 1 2 1)/teaching and learning/maths/experience of maths/as pupil
41. (2 1 2 2)/teaching and learning/maths/experience of maths/as university student
42. (2 1 2 3)/teaching and learning/maths/experience of maths/as trainee teacher
43. (2 1 2 4)/teaching and learning/maths/experience of maths/as NQT
It was found that there was considerable flexibility in coding within NVivo. I could uncode excerpts as easily as I coded them. I could even remove a code from the node listing quite simply, which in turn uncoded the quotations which had been coded using that node. A node could also be renamed or moved from one tree to another or become the child node of a sibling node, or vice versa. An extract could be coded as many times as required if more than one node was applicable. I could also start coding an extract with a different node in the middle of something which had already been coded. Since we worked as a team and wanted to contemplate the codes together, while only one of us was going to undertake the coding in NVivo, we had to predetermine many of our categories. Nevertheless, a researcher working independently could readily create nodes and code documents directly in NVivo, eliminating the need for prior thorough perusal of transcripts.

The study showed the transition from student to primary teacher of mathematics as a remarkable process of coping with shifting and multiple identities. There were feelings of responsibility, ownership, multiplicity of tasks and an acute and developing sense of being a teacher. A degree of ambivalence was evident as regards government policy on mathematics teaching. The imposition of national testing for trainee teachers was largely seen as unfair, insulting and a waste of time. On the other hand, despite some scepticism and fewer opportunities for pedagogical innovation and versatility, the introduction of the National Numeracy Strategy (NNS) was, in the main, perceived positively by this group of professionals who showed signs of enthusiasm and looking forward to working within the framework. While subject testing was an impediment, the NNS was clearly facilitating their task as teachers of mathematics and was therefore granting them professional empowerment, something that teacher trainers and educational researchers may view as a novel concept and not associated with top-down innovations.3

Conclusion

Researchers who are more accustomed to quantitative research may be tempted to quantify qualitative data to elucidate events and views. Social phenomena, however, need not be explained numerically. It is the quality and richness of the response to a social situation which we should focus on. While it may be interesting to know how many people feel positively or negatively about something, this is not the intention of qualitative inquiry. The idea is to ascertain ‘what’ they feel, and ‘why’ they feel that way. This will also incorporate ‘who’ feel the way they do, and ‘where’, ‘when’ and ‘how’. Such a detailed scrutiny clearly cannot be carried out by using numbers, percentages and statistics. This applies
Qualitative data are textual, non-numerical and unstructured. Coding has a crucial role in the analyses of such data to organize and make sense of them. Researchers have discussed coding in the context of data reduction, condensation, distillation, grouping and classification. What coding does, above all, is to allow the researcher to communicate and connect with the data to facilitate the comprehension of the emerging phenomena and to generate theory grounded in the data. This paper has examined the use of manual and electronic methods to code data in two projects. The development of computer software packages to assist in the tagging and retrieval of data appears to have made the life of the researcher relatively easy. Data analyses were tedious and frustrating in the first project. In the second, electronic coding made the process relatively smooth, though considerable time had to be spent initially to get acquainted with the package. The computer also facilitated the analyses to be carried out in more depth and the reports generated were invaluable. Nevertheless, coding was an intellectual exercise in both the cases. The package did not eliminate the need to think and deliberate, generate codes, and reject and replace them with others that were more illuminating and which seemed to explain each phenomenon better.

Dey (1993) argues that the first stages of any initial categorization of the data are bound to be rather slow and tentative. As researchers progress with categorizing, our decisions should become more confident and more consistent as categories are clarified, ambiguities resolved and we encounter fewer surprises and anomalies within the data. This should improve considerably the speed and efficiency with which we can categorize the data. This turned out to be the case in both the studies illustrated above, whether coding was undertaken manually or electronically, and the categories were determined beforehand or during the process of coding.

While the use of software may not be considered feasible to code only a few interviews, it gives the researchers the opportunity to play around with their data and familiarize themselves with the package sufficiently to be able to code confidently. It is certainly worth the additional hassle to learn to use the package proficiently if a large number of interviews are to be analysed. The search facility of NVivo and the subsequent generation of comprehensive reports undoubtedly recompense for the hours spent in getting accustomed to the package. The choice, however, will be dependent on the size of the project, the funds and time available and the inclination and expertise of the researcher. Once learned, the ability to code data electronically will turn out to be a useful skill in researchers’ repertoire not only for their own benefit, but also to teach novice researchers.

There are a number of assumptions related to the analysis of qualitative data. It is believed that since qualitative research involves a smaller sample and does not deal with large datasets, it does not require a great deal of time for analysis like quantitative research. On the contrary, the analysis of qualitative data is rigorous and is not a separate self-contained phase in the research process. Indeed the analysis can start during the period of data collection as soon as some data are available to be perused, and several analyses may be undertaken during the course of the fieldwork. The researchers may also reformulate their research questions as they go along, in the light of the data that they have collected. The final analysis is an intense and prolonged period of deliberation, which may take months, requiring considerable expertise on the part of the researcher. If quantitative data analysis involves long periods of time, so does the analysis of
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qualitative data. Coding, a crucial stage of qualitative data analysis, is tedious and time-consuming when carried out manually, and it may take several weeks to get acquainted with a software package to code qualitative data electronically. This is something that the research community and sponsors of social science research need to take into account, and those who have not done it already should build it into their development plans to allow time for training to use packages for analysing qualitative data.

Notes

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1 For a discussion see Basit (1997).
2 This project was funded by a grant from the Economic and Social Research Council (R000223073). Besides the author, the project team comprised Tony Brown, Olwen McNamara and Lorna Roberts.
3 For a detailed analysis see Basit (2003 in press).

References


