

4-22-2022

Encounters with CAQDAS: Advice for Beginner Users of Computer Software for Qualitative Research

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Recommended APA Citation

Niedbalski, J., & Ślęzak, I. (2022). Encounters with CAQDAS: Advice for Beginner Users of Computer Software for Qualitative Research. *The Qualitative Report*, 27(4), 1114-1132. <https://doi.org/10.46743/2160-3715/2022.4770>

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Abstract

We intend this article to be predominantly for researchers who would like to use software of the CAQDAS family in their research projects. Our experience as researchers and CAQDAS instructors shows that the introduction of software into the analytic process often poses a challenge. This is true for both novice and more seasoned researchers with entrenched habits of conducting research in a traditional manner. The literature available provides few answers to the questions preoccupying inexperienced users; our aim is to close this gap by providing useful information. We discerned major problem areas for scholars who are just setting off on their journey with CAQDAS. We tackle these issues in our article by providing replies to key questions: Is CAQDAS for me? How can I effectively search for and identify a suitable program? What should I bear in mind when using CAQDAS? By pitting benefits against limitations of CAQDAS implementation, we intend to address the expectations of using software in research.

Keywords

computer assisted qualitative data analysis software, CAQDAS/QDAS, qualitative research

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Acknowledgements

We would like to extend our thanks to all those who joined our study and devoted their time to recount their experiences with CAQDA. We would also like to express our appreciation for fellow colleagues who have contributed to the advancement of the concept of computer analysis of qualitative data in Poland over the years. Last but not least, we would like to thank anonymous reviewers for their valuable comments and indications.

Encounters with CAQDAS: Advice for Beginner Users of Computer Software for Qualitative Research

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We intend this article to be predominantly for researchers who would like to use software of the CAQDAS family in their research projects. Our experience as researchers and CAQDAS instructors shows that the introduction of software into the analytic process often poses a challenge. This is true for both novice and more seasoned researchers with entrenched habits of conducting research in a traditional manner. The literature available provides few answers to the questions preoccupying inexperienced users; our aim is to close this gap by providing useful information. We discerned major problem areas for scholars who are just setting off on their journey with CAQDAS. We tackle these issues in our article by providing replies to key questions: Is CAQDAS for me? How can I effectively search for and identify a suitable program? What should I bear in mind when using CAQDAS? By pitting benefits against limitations of CAQDAS implementation, we intend to address the expectations of using software in research.

Keywords: computer assisted qualitative data analysis software, CAQDAS/QDAS¹, qualitative research

Introduction

Researchers have used CAQDAS – computer-assisted (or aided) qualitative data analysis software – since the 1980s (Lewins & Silver, 2014; Wolski, 2018). Some scholars consider it a natural element of the investigation process that is indispensable for proper analysis. However, others remain unconvinced and approach the consecutive versions of software with distrust (Anderson-Gough et al., 2017). Since the first software was launched, there has been an ongoing debate as to what are the benefits and the drawbacks of implementing a CAQDAS package for the analysis of data. As a consequence, users of CAQDAS (especially beginners) may be unsure about how to use the software. The problem is further compounded by the rapid development of CAQDAS packages in the past ten years. There is a broad selection of available software, with a vast array of built-in options and features (Fielding, 2007; Wolski, 2018). The immense diversity of programs leaves many investigators unsure as to how to pick the software that is tailored to their needs. In effect, researchers face a conundrum: is it worthwhile to use CAQDAS and bear the cost (in the form of license purchase and the time investment in getting familiar with the software) and, if so, which software is best to adopt?

As we are long-time users of CAQDAS ourselves, we can see that there are few papers that guide beginner users in their decision-making regarding CAQDAS. The bulk of the literature covers the functionalities of particular packages and is aimed at more advanced users. This gap became even clearer when we received feedback from CAQDAS academic courses

¹ QDAS and CAQDAS (Computer Assisted Qualitative Data Analysis Software) are terms both used in the field to describe qualitative data analysis software (Wolski, 2018).

we teach for undergraduate sociology students and social study graduate students, as well as training sessions and workshops for more experienced qualitative researchers with little or no experience with CAQDAS. The participants of these courses and workshops often raised questions and doubts as to getting their bearings among the myriad features and options of respective software varieties and identifying the best match for them. Curious about how novel users perceive CAQDAS, we examined the feedback from the participants of both our academic classes and extracurricular workshops. Results reveal that newcomers often manifest a positive attitude towards software deployment but are confused at respective stages, from selection to practical application. We found it critical to discuss the criteria with which to select software as well as the expectations of CAQDAS that oftentimes prove unrealistic.

We therefore designed our article to offer advice and recommendations to aid those who are considering using CAQDAS and searching for some hands-on knowledge on the subject. Drawing on our own teaching experiences as well as feedback from workshop participants and students, we discuss the three most salient questions posed by researchers setting out on their adventure with CAQDAS: Is CAQDAS for me? How can I be effective in the search for and identification of a suitable program? What should I bear in mind while using CAQDAS? We hope to revise what novice researchers assume CAQDAS can do for them by offsetting the benefits against limitations. Our experience suggests that novice CAQDAS users often hold unspecified and unrealistic expectations of the software (e.g., that CAQDAS can “bail them out” of data analysis).

Even though we conducted a qualitative study on feedback from workshop participants and students, instead of detailing how we did that study, in this paper we aim to present the findings of that study together with our teaching observations that reveal the major reservations and challenges users and potential users have in considering CAQDAS, as well as some ways to overcome these difficulties. We see this is a noteworthy contribution to the discussion on the application of CAQDAS given that most other studies focus on already accomplished users who report on the projects they completed. While our considerations seem to fit for CAQDAS users in Poland, a country where we reside and pursue a living, they may be more widely applicable for researchers anywhere who are taking their first steps in using CAQDAS. In covering these issues, it is our sincere intention to equip novice CAQDAS users with knowledge on the scope of the application of the software and its available features and limitations.

Background: Our Context in Poland

For more than ten years in Poland we have seen both academics and practitioners from commercial research facilities show a growing interest in computer-assisted qualitative data analysis. This tendency aligns within a global trend of applying technology throughout the entire range of research and analytic processes in the social sciences. Even though CAQDAS is becoming increasingly popular in Poland, it is far from a mainstay in research. There are still many persons who have reservations regarding CAQDAS implementation and wonder if the software isn't more of a hindrance than a help in conducting analysis in research. In contrast, many attendees of our academic courses and extracurricular workshops for beginner CAQDAS users tend to have high expectations of the software, often considering it to be a solution to all analytic difficulties (MacMillan & Koenig, 2004).

Over several years of teaching students and workshop participants how to use NVivo and Atlas.ti software, we were able to see the participants become familiar with the logic of computer-assisted qualitative data analysis and its usage. We treated the feedback from students and workshop participants not only as feedback for us (and the institutions employing

us) on the quality of our work, but also as a source of knowledge about preferences and needs as well as difficulties and doubts related to the use of CAQDAS.

From the main issues we were hearing from participants in our classes and workshops, we conducted 25 unstructured interviews (Patton, 2002) with the participants in our classes and workshops between 2015 to 2019 in major cities in Poland. The interviews were usually conducted immediately following the seminar/workshop, on the same premises, in the very room we held the seminar or workshop. The questions that came up in the interviews covered the following topics: the perception of the CAQDAS role in the analytic process, decision-making leading up to the choice of a specific software package, expectations and apprehensions around CAQDAS use, the mode of CAQDAS application in the conducted research projects, and the impact of software on the research process. We interviewed 16 academic staff and nine representatives of local government and commercial research organizations. There was a prevalence of people aged 20-40, at the threshold of their academic or professional careers, who were considering using CAQDAS for work purposes. There was a slight prevalence of men among the interviewees (14 men and eleven women). The common characteristic of participants was the lack of, or a relatively scarce exposure to, CAQDAS tools. We also utilized observations we made during our workshops and seminars as an additional source of data. We used grounded theory methodology (Charmaz, 2006) to analyse the data.

We grouped the results of the analysis of the interviews into three main themes: methodological reflections on CAQDAS use, expectations, and, last but not least, concerns regarding the implementation of such software packages in research practice.² Please find in Table 1 a synopsis of the *hopes and expectations* of study participants concerning both analytic and non-analytic aspects of CAQDAS implementation.

Table 1

Hopes and expectations around analytic and non-analytic aspects of CAQDAS application

Non-analytic aspects of CAQDAS implementation	Analytic aspects of CAQDAS implementation
-ease of navigating vast material	-improved coherence of actions undertaken by the researcher
-facilitated teamwork	-increased transparency of analyses along the way
-possibility to integrate various types of data	-direct access to the process of analysis at every stage
-possibility to segregate various types of data	- data may be browsed against a broader context of the material collected, thus facilitating interpretation
-assurance of improved data protection against loss and access by unauthorized users	-creating relations between analytic categories using various operators (e.g., logical operators such as contradicts, is a property of, is associated with, is cause of, is part of)

² The conclusions derived from our research project were collected in the form of an unpublished report. Only a small portion of them (partial conclusions) were published (Niedbalski & Ślęzak, 2016, 2021). The findings were also used to develop guidelines for novice researchers using CAQDAS, as included in this publication.

Non-analytic aspects of CAQDAS implementation	Analytic aspects of CAQDAS implementation
-increased convenience of data storage and archiving for potential future use	

Please find in Table 2 a synopsis of the *concerns* of study participants associated with both analytic and non-analytic aspects of CAQDAS implementation in a research project presented as a tabular compilation.

Table 2
Concerns regarding analytic and non-analytic aspects of CAQDAS application

Non-analytic aspects of CAQDAS implementation	Analytic aspects of CAQDAS implementation
-incompatibility of programs with certain data types (e.g., failure to process certain file formats)	-possibility of excessive partition into categories
-excessive role of technology in research, corroding the direct relation between the researcher and data	-the sense of “absolution of responsibility” for the tasks undertaken (e.g., coding)
-overcoming the incongruity of the features of a respective program with the requirements of a specific research project	-risk of the researcher’s disengagement with the actions undertaken
-fear of schematization of actions undertaken by the researcher	-sense of constraint and dependence on the technical solutions built into a particular program

Advice for Novice CAQDAS Users

Drawing on our study and observations, we identified three main categories (expressed as questions) of issues preoccupying researchers at the outset of their work with CAQDAS. These include:

- Is CAQDAS for me?
- How do I effectively search for and select a suitable program?
- What should I bear in mind when using CAQDAS?

Is CAQDAS for Me?

Although many of the participants we interviewed recognized the benefits of implementing CAQDAS in a research project, it is imperative that researchers consider the actual case for incorporating computer-aided analysis. Otherwise, instead of the anticipated added value, only disappointment may await them.

Key Issues Informing the Decision to Implement CAQDAS

Prior to the purchase of license for any program, researchers would be well-advised to rate their knowledge and skills in four realms. Firstly, they should assess their analytic skills in terms of the methodology of their choice. Are they familiar with the characteristics of the adopted analytic approach and capable of applying the procedures of a particular methodology in practice? Secondly, they should evaluate their computer-savviness and habits around computer operation (Prein et al., 1995). As Gilbert et al. (2014) point out, the role of CAQDAS in a project depends on the researcher's general computer skills and proficiency in qualitative research methods. Users with limited computer skills may stumble with program operation to the point where they fail to take advantage of its potential. They might even achieve an outcome inferior to the result they would get in a conventional, non-computer-assisted way.

On one hand, experienced qualitative researchers who lack computer proficiency may shun CAQDAS, while on the other hand, users with scarce research expertise but high computer skills may go too far in relying on program architecture. They may make use of available features, regardless of their alignment with research goals (Gilbert et al., 2014). It merits mentioning that the authors of publications aimed at popularizing CAQDAS usually center on the technological capabilities of the software. They downplay the fact that no program potential can be harnessed without knowledge of the methodology being used (MacMillan & Koenig, 2004). As a result, some researchers may treat CAQDAS as a proxy for using validating techniques for research, analysis, and discovery (Gilbert et al., 2014; Thompson, 2002). They may believe that by simply learning to operate a program they can actually master the art of analysis (MacMillan & Koenig, 2004). This approach is dubbed the "wow factor" by MacMillan and Koenig (2004), referring to an unrealistic expectation of CAQDAS as something more than just an organizational support for a method. For CAQDAS to genuinely support analysis, the researcher must understand both qualitative analysis and the functionality of the software (Evers, 2018).

Thirdly, researchers entertaining the idea of implementing CAQDAS should consider their beliefs on how to conduct qualitative analysis and how it is affected by the use of CAQDAS. As some of our participants professed, analysis may be compromised if CAQDAS is introduced. These participants claimed that computer software provides excessive structure and narrows down the analyst's room for maneuvering, which runs counter to the methodological spirit of qualitative research (Bringer et al., 2004; Lonkila, 1995; Seale, 2008):

To me, computer programs are a bit of a blockage to the researcher. It might be so that you can arrange, segregate, and divide all the elements, but flexibility and creativity are lost in the process. The researcher's work begins to be informed by the functionalities of the program. (I4)

What is more, some interviewees were skeptical of converting research procedures into features available in CAQDAS programs:

All in all, I am wondering whether it is feasible to seamlessly transpose everything that applies to a research method, namely, the principles, procedures and so forth, into a computer program. Does the researcher preserve the "purity" of actions in line with the adopted method in such a scenario? Perhaps the very act of implementing a computer program spurs the creation of some novel method or modification of an existing method. (I6)

Interviewees who raised the aforementioned misgivings made a point that computer program use constricts sociological imagination, confines the creativity of the researcher (by imposing a particular internal architecture of the software upon reasoning), narrows down analysis and interpretation to the scope of what was coded and strips specific pieces of data of their unique context, thereby hindering the capture of associations between elements in the data:

You may get the impression that the very structure of these programs forces the researcher to operate under predetermined conditions and the room for maneuvering is curtailed by the program... I think it may sometimes impede work and make the researcher dominated by the tool. And the program is just such a tool. (I9)

Researchers who hold such convictions and concerns regarding CAQDAS may never conduct analysis by means of software, despite using some of its other features (e.g., for data searching).

Fourthly, researchers pursuing using CAQDAS should resolve whether they are willing to devote a sufficient amount of time to learning program navigation. Mastering any computer program takes time. It is time-consuming not only to figure out the functionalities and the internal architecture of the program, but also to become proficient in the implementation (and often, in the creative adaptation) of the available features so as to do justice to the procedures required by the method employed by the researcher. The researcher cannot default to program features that are ready-to-use and fully conforming to the method applied³ (e.g., related to coding, ordering, segregating, or searching data). Software intended to aid qualitative data analysis may be treated as a “toolbox”, a collection of tools that can be used in different ways (Gilbert, 2002). Whereas a single functionality of a program may be used to various research ends (e.g., organizing, exploring, interpreting, reflecting), a specific analytic operation may be executed by means of various tools. Gilbert et al. (2014) provide the example of memos that may serve to organize data, to reflect on data and the research process through writing, or to interpret data through an explanatory note that might even become integrated into a report. Each of these actions may be also carried out with other tools available in the program. In this regard, no program is an ideal fit “out of the box” and needs customizing to meet specific research needs. There will always remain a gradient of alignment and compatibility between software and the adopted research method. Software suitability for the research purpose at hand should be assessed thoroughly.

On all these counts, it is understandable that it takes a long time to learn software use, and this might prove an obstacle to start using a computer program (Rodik & Primorac, 2015). For this reason, when pondering the question “Is CAQDAS for me?”, it is worthwhile to consider whether we can sign up for training sessions⁴ or lean on peer advice. However, external guidance cannot fully prepare anyone to use a computer program. Despite all valuable assistance from other people, effective learning of software requires not only training, but also time spent on one’s own, manipulating the software and working with data (Evers, 2018).

³ This is true for both the various types of features and their designations, varying across software packages (e.g., the term “hyperlinking tool” in ATLAS.ti, “hyperlink” in QDA Miner, “textlink” in MAXQDA and “link” in NVivo; Evers, 2018).

⁴ Despite the growing popularity of CAQDAS, QDA is still underrepresented or altogether absent in the university syllabus in some countries; the timeframe allotted for their teaching is insufficient or the academic courses center on just a single program (Paulus & Bennett, 2017; Rodik & Primorac, 2015).

Motivations for Implementing CAQDAS in Research

To exhaust this topic, let's raise one more issue: the researcher's rationale behind the application of CAQDAS. The single most prominent reason for resorting to software among our students was to accelerate the analytic process by making it more ergonomic. Almost one third of them claimed that computer programs streamline the researcher's work.

Computer software may surely prove helpful in the work of a researcher. This predominantly stems from the fact that software accelerates many operations that were time-consuming in traditional settings. (I4)

Interviewees were quick to mention such CAQDAS functionalities as fast retrieval of salient information (e.g., fragments of coded data), direct access to a range of data (e.g., by virtue of various compilations of data), and the implementation of tools aimed at the facilitation of data ordering.

I may not take full advantage of the potential of the software as I confine myself mostly to such features as data searching. However, it is precisely this feature that I think is key for me. Previously, I had to fumble through heaps of material. Now, I can proceed with just a few operations, and I instantly get a result that turns out to be significant for me. (I12)

CAQDAS also affords efficient processing of a large body of materials. This is possible by means of ordering various project elements that span source materials, transcriptions, or descriptions (e.g., of pictures) as well as all other pieces of information subject to analysis according to the researcher's preferences (Gibbs, 2013; O'Kane, 2020; Seale, 2008; Wiltshier, 2011). This puts the researcher in a position to obtain a reliable, general picture of the data (Welsh, 2002) and to gain greater control over the collected material. The researcher begins to perceive an overwhelming amount of data as manageable (O'Kane, 2020). This point is further reinforced by the ease of adjusting data coding or segregation in a program that would have to be done arduously in multiple documents or files in a conventional way. Since each stage of analytic work is recorded in the program, all the codes, categories, and memo notes may be summoned at will for easy inventory and one can capture the entire evolution of the researcher's (or researchers') analytic concept. Therefore, the analytic and methodological background of a project may be readily captured⁵ in a clear way (also in presentations and publications) (Bringer et al., 2004; Morse & Richards, 2002). This option contributes to the transparency of the analytic process:

Such programs have many advantages or features. Apart from what I have said already, it is particularly valuable to preserve the transparency of the entire analytic process. What I mean by this is its clarity and instant follow-up on what has been done so far. (I7)

⁵ Several years ago, many authors complained that researchers do not adequately explain how they use their CAQDAS of choice and/or what value the tools adds to analysis (Gibbs, 2013; Jones & Diment, 2010). However, there is a growing number of articles dealing with how to raise research transparency and trustworthiness thanks to CAQDAS implementation (Carvalho & Santos, 2021; Dalkin et al., 2021; Friese, 2016a; O'Kane et al., 2021; Oswald, 2019).

Indeed, the authors of scientific articles regarding CAQDAS point to similar gains and promise directly or indirectly that software use can improve the quality, rigour, and trustworthiness of research (Anderson-Gough et al., 2017; Carvalho & Santos, 2021; Jones & Diment, 2010; O’Kane et al., 2021; Oswald, 2019; Rademaker et al., 2012; Silverman, 2013; Welsh, 2002).

This positive reaction raises concerns that CAQDAS popularity reflects a trend of growing positivism/scientism within qualitative research (Anderson-Gough et al., 2017) with the hidden agenda of convincing skeptical positivists about the rigour of inductive research (Blismas & Dainty, 2003, as cited in Woods et al., 2016). Mangabeira et al. (2004) observe that software implementation can add additional legitimacy and credibility in the eyes of academic audiences. This is a tempting for early-career researchers who are striving to build their professional statuses by showcasing their skillfulness in manipulating advanced computer programs (Rodik & Primorac, 2015). As Anderson-Gough et al. (2017) argue, qualitative researchers should explain what it means to fulfill the criteria of enhanced rigour, validity, and reliability in conformity to their research method of choice and why they seek to meet them by means of CAQDAS. Such researchers should take caution not to confound CAQDAS use with an automatic improvement of research quality (MacMillan & Koenig, 2004).

The response to the question “Is CAQDAS for me?” should reflect the researcher’s actual assessment of what need(s) the software must meet, as well as the researcher’s willingness to become familiar with a slightly different mode of analysis. The initiation of data processing by means of a software package pushes the researcher out of their comfort zone and requires setting aside the necessary time to acquire new skills for dealing with qualitative data (Andrade et al., 2018; Paulus & Bennett, 2017).

How to Effectively Search for and Identify a Suitable Program?

Once ultimately convinced of using a computer program for the analysis of data, the researcher faces the problem of the selection of a suitable program (Anderson-Gough et al., 2017). The diversity of available packages coupled with their inevitable divergence from the ideal match for the researcher’s needs (as we mentioned earlier) can evoke a sense of confusion. Basing on our study, along with didactic experience, we discerned several guidelines that could serve as a (at least preliminary) diagnostic tool to pick out a program pertinent to the objectives of a given researcher. We present them below.

The Type of Project

The primary concern should be with the type of project to be facilitated with CAQDAS. In cases of individually-run research, most packages are fit for project purposes. However, if the researcher is embarking on a team project (especially with a global reach), that is bound to be considerably more complex and requires a planned division of work.

Our interviewees looked for programs allowing for simultaneous analysis by a team of researchers. In this respect, it was vital for the software package to be equipped with features such as identifiability of team members (including the verifiability of the character, author, and timing of all the modifications) and database sharing and synchronic coding (O’Kane, 2020; Seale, 2008; Wiltshier, 2011). Incidentally, our interviewees observed that a teamwork-facilitating program affects the methodological dimension of the project, affording the practical execution of triangulation procedures (Denzin, 2006; Flick, 2004):

It is my opinion that the thrust of CAQDAS rests with its affordance of multiple-layer triangulation. The programs enable the integration of qualitative and quantitative data, the use of various research methods and teamwork,

irrespective of member location worldwide. In this sense, these are universal tools, bridging the gaps between different methodologies, techniques as well as research circles and centers. (I8)

The scheduled time horizon of the project is of importance as well. It makes a difference if this is a short-term, one-off endeavor or an enterprise with future sequels (perhaps conducted in stages set apart by milestones at longer intervals). Depending on the needs, the researcher would need to consider purchasing either a time-limited or perpetual software license. Unfortunately, different software packages are not mutually compatible, and it is not possible to transfer the project back and forth across them (Evers, 2018). Correspondingly, any long-term project may bind the researcher to a given program for an extended time.

The Method Underlying the Project

The second point to consider is the method underlying the project. Amid the dynamic development of CAQDAS, an increasing number of programs targeted a vast, diverse audience of researchers. According to their authors, the packages should meet the versatile needs of researchers originating from various theoretical schools and applying divergent methods. Nonetheless, some programs were devised with a specific target group in mind. For instance, MaxQDA was designed to cater to the phenomenological approach, Atlas.ti was created to serve research based on hermeneutics and grounded theory, while QDAMiner supported deductive approaches (Evers, 2018; Friese, 2016). This conceptual legacy remains recognizable in some of the functionalities of the programs. At this juncture, we should mention that some of the participants of our study complained about CAQDAS (especially Atlas.ti and NVivo) having strong roots in GT. Similar misgivings resonate with other authors who fear that software profiled to accommodate GT procedures forces researchers to implement an analytic strategy compatible with GT (Gibbs, 2013; Welsh, 2002; Woods et al., 2016; Woods, Paulus, et al., 2016). Contrary to the above claim, Kelle (2004) noted that the coding, indexing, cross-referencing, and comparing techniques available in CAQDAS programs are simply different versions of data management protocols that are long-standing, well-known, and universally used in social science research. As Gibbs (2013) remarks, this type of software does not impose fixed patterns of analysis or particular analytic activities. It is solely a tool that lends itself to various uses, most being able to fit to the researcher's needs.

We were keen to find out which data analysis methods our interviewees considered when using computer programs. It came as a bit of a surprise that some interviewees (mostly junior staff that hailed from disciplines other than sociology) failed to name a specific method and seemed content with simply stating that they shall proceed with "qualitative research." It was not our intention to evaluate the methodological awareness of our interviewees; however, the absence of a clear and direct designation of a research method of choice may imply a superficial and, thus, simplistic understanding of research methodology, which may, consequently, lead to an inappropriate use of CAQDAS tools (Kordasiewicz & Haratyk, 2013). Interestingly, over a half of the interviewees (irrespective of their adopted methodological and theoretical approach) acknowledged defaulting to grounded theory to guide any research with the implementation of CAQDAS:

These are my first steps in computer analysis. I read a little on the subject and it seems that such an analysis calls for the principles of grounded theory. That's why it is clear to me that grounded theory is the default choice if you want to work with a computer program. (I2)

For those CAQDAS users we interviewed who relied on grounded theory methodology, they often departed from its principles in practice. The procedure of coding, covered in detail in the literature on the different variants of GT, provides an instructive example (Charmaz, 2006; Glaser, 1978; Glaser & Strauss, 1967; Strauss & Corbin, 1990). Contrary to the recommendations laid down by the authors of GT, most interviewees took to coding with a so-called starter code list, not even attempting to modify it in the course of the analysis (or hardly altering the list). While some admitted to either coding data by means of several codes or recoding the data (i.e., altering existing codes), over one-third of self-proclaimed GT followers coded their data only once. Most interviewees took advantage of codes exclusively to retrieve data fragments of interest rather than to generalize or build theories.

First and foremost, I code. Then I aggregate these codes and search the material after coding data. This seems to be the most important feature. Anyway, I find the computer programs to be extremely useful to this end. This is its major advantage to me. I can readily create codes to find already coded fragments of data in the text in a hassle-free manner. (I2)

This behavior may be explained to some extent in the light of the diversity within grounded theory itself, with its multiple variants advocating slightly different guidelines concerning the respective analytic steps (Charmaz, 2006; Glaser, 1978; Strauss & Corbin, 1990). A cornucopia of choice may turn out to be a problem, especially for novice researchers. What also comes into play is that CAQDAS application requires mapping respective methodological procedures onto the features available in the program. Each CAQDAS program is distinct both in terms of its functionalities and its nomenclature. Each program's functionalities must be independently mapped onto the procedures and principles of a specific research method.

An efficient (and appropriate) deployment of a CAQDAS tool of choice is contingent upon the mastery of three skills: an experienced analyst, an adept computer program operator, and a savvy methodologist to bring program functionalities into alignment with research procedures. Beginning CAQDAS users oftentimes fall short in regard to these skills and are liable to breach the procedural requirements of the research strategy they wanted to pursue.

The Type of Data

The third issue to ponder is the type of data subject to analysis and, more precisely, their homogeneity (e.g., whether all data is textual) or divergence in terms of type (e.g., stenographic records, documents, audio and video recording, photographs, posters, drawings, etc.). The leading advantage of CAQDAS consisted mainly in the versatility of data types available for analysis (such as text, audio, and video materials):

Text, image, and video – this combination seems ideal to me. This way, I can draw on all kinds of data. Now I can work with various materials with a much higher degree of efficacy and ease. (I14)

In response to researchers' growing demands, more sophisticated programs now offer visual analysis (Gibbs, 2013; Rodrigues et al., 2018). They are also equipped to incorporate novel types of digital data, e.g., geo-tagging data for the sake of a single project, linking data with an external geographic information system and data capture from a range of web sources such as blogs, discussion groups, Facebook, and Twitter (Andrade et al., 2018). A researcher planning to process various types of data recorded in different formats should double-check

the CAQDAS program for format compatibility as well as data handling across different formats, data segregation (by type) and data integration (in various modes that reflect the respective analytic rigours). There are also discrepancies in the prerequisites for data preparation across various programs. The latest versions of some programs (such as NVivo, MaxQDA or Atlas.ti) allow for coding directly from audio or video sources, without the need to transcribe data.

The Character of Data Analysis

The fourth consideration to examine is the envisioned character of data analysis and the program functions serving such an analysis. Our interviewees especially appreciated the possibility of managing the structure of codes as well as creating and altering them as needed. Even though they did not employ this functionality in practice, as we mentioned earlier, they praised CAQDAS for providing the ability to alter all project elements in response to novel data (Bringer et al., 2006; Gibbs, 2013; Rademaker et al., 2012). Researchers value the system of analytic annotations, enabling them to simultaneously gather and analyze data. In effect, the transition from raw data to theorizing, after the manner of inductive reasoning (Friese, 2019), lends itself much more readily to computer-aided analysis than to management without computer facilitation:

Qualitative analysis demands that data be processed and revisited multiple times, for instance, by recoding. To me it is a true boon that I can proceed with this task in a timely manner in a program, even automatically to a certain extent. Frankly speaking, I now think of such manual modification as a taxing feat without the ability to search or alter the whole body of data at once. (I7)

Two other features built into the programs of the CAQDAS family were of utmost importance to researchers. The functionalities facilitating the search for fragments encoded by means of a given code or codes are seen as exceptionally useful, as is the so-called “auto-coding.” This feature allows the attribution of codes to text fragments retrieved by a program based on key words specified by the researcher. It is an intriguing example of how intense development of big data and machine learning can impact the practice of qualitative analysis (Evers, 2018). On the one hand, CAQDAS allows textual data to be subject to purely quantitative operations such as calculations of word or phrase frequency in a given body of text. Such software helps parse data in pursuit of patterns (differentiating between exceptions and rules). On the other hand, CAQDAS programs can capture the numerical parameters that characterize codes or categories This serves to validate both code groundedness (that is to say, the number of quotes linked to a specific code) and code density (a measure of how many interdependencies between respective codes exist).

As much as it might be desirable to have as much functionality as possible in one software package from a user perspective (Evers, 2018), extensive functionality may not be a priority for everyone. The participants of our study expressed a feeling of being overwhelmed with a profusion of available features (especially in overequipped programs like Atlas.ti, MaxQDA, and NVivo) that far exceeded their needs:

To my mind, there are many various features that may prove completely useless to the researcher or that may be rarely used. I understand that these may meet some researchers’ needs, but I think it would be sensible to simplify some functionalities. (I8)

Their concerns seem to be shared by many software users, spurring a countertrend of “light” CAQDAS versions that are now on the rise, with only basic functionalities offered (programs such as f4analyse and Quirkos). Some extensive packages include varying degrees of software complexity from basic or light to more robust versions with more features (i.e., NVivo Starter, Pro and Plus; MAXQA Base, Standard, Plus and Analytics Pro; and Transana Basic, Professional and Multiuser). Such trimmed versions cost less and are easier to master and operate (Evers, 2018). Consequently, they constitute a notable alternative for beginner users of CAQDAS. The researcher, however, is under no obligation to use all the options available in the program, no matter how many there are. A prudent user should practice modesty and activate only those functionalities that comply with the adopted methodological principles (Bringer et al., 2004). Following such a policy mitigates the risk of subjecting analysis to the idiosyncrasies of software, that is, indiscriminately taking advantage of all available (and increasingly technologically advanced) features without any consideration of the underlying goals or the impact on qualitative research practice (Brown, 2002; Woods et al., 2016; Woods, Paulus, et al., 2016). To this end, the researcher should indicate most salient program functionalities before determining an optimal software package.

On this note, it is helpful to remember that CAQDAS packages might be tools of qualitative analysis, but they can successfully be used to cope with projects governed by mixed methods. This said, programs of the CAQDAS family are not meant to handle the statistical analysis of quantitative data. For example, information retrieved from closed question surveys must be processed by means of packages such as SPSS or Statistica. However, such quantitative data may be imported from these primary programs to CAQDAS and, subsequently, integrated with qualitative data as part of a single project (Konopásek, 2008).

The Preferences and Habits of the Researcher

Further down our list of factors to inspect are the preferences and habits driving the way the researcher operates software. This is a straightforward consideration bearing on the comfort of handling a program. Defaulting to keyboard shortcuts, relying on contextual menus to access currently used features or opting for any other interface solutions shapes the user experience landscape. CAQDAS programs offer a variety of user interface types. For instance, the visuals of NVivo are modelled on the layout of Microsoft or MacOS systems (depending on the program version), whereas the user interface of Atlas.ti and MaxQDA are more distinct and less similar to other commonly used programs; however, this in no way diminishes their functionality and ergonomics.

Another point to consider is program activation mode. It may be essential to the researcher whether the program requires installation (e.g., Atlas.ti, Coding Analysis Toolkit (CAT), MaxQDA, NVivo, QDAMiner) or whether it is accessible in the cloud via the Internet, as a web application without the need for installation (Computer Aided Textual Markup & Analysis (CATMA), QCAMap and WebQDA). It is also of growing relevance to researchers that the package be available for iOS and android devices (e.g., Atlas.ti, Dedoose, MaxQDA, WebQDA) (Andrade et al., 2018; Oswald, 2019), thereby enabling the import and export of data between other tools and applications. Exhausting the inventory of technical issues is the range of language versions of the program. Researchers welcome the possibility to handle software in their mother tongue (Andrade et al., 2018). As one of our interviewees said:

I think the greatest shortcoming for me is the lack of Polish versions of software. Even though I know English, it always takes a while to get familiar with the nomenclature used in the program. I suppose it may even put off some persons

from using the software. Not everybody feels fluent in a foreign language environment. (I1)

In effect, packages with comparable functions may vary with respect to the perceived ease and intuitiveness of their operation. Given the above, user-friendliness is an individual question. Researchers could immensely benefit from sampling a variety of programs to find their best match. Most manufacturers and resellers of various software types allow researchers to become familiar with their products by offering trial versions. These versions usually have built-in limitations such as incomplete functionality or time-sensitive access (the program is deactivated after a specific time period). Nonetheless, such trial versions demonstrate the potential of the tool showcased, as well as its internal architecture and layout. Prospective users are thus allowed to test the program and take a more informed decision before the final purchase.

The Institutional Context of Research

Last but not least for the assessment of program utility to the researcher is the institutional context of research, often exerting an immense impact on the researcher's decisions. The institutional landscape is shaped by such aspects as the availability of funding for the purchase of license for the researcher's package of choice, specific requirements concerning program selection put forth by the sponsoring institution (proprietary or representing project partners), coexecutors' roles in decision-making (Anderson-Gough et al., 2017), and the possibility to join training sessions or gain assistance from peers in the course of program learning (Rodik & Promorac, 2015). The experiences shared by our study participants show that these practical issues may markedly limit the researcher's liberty in software selection.

Researchers will tackle the question of "selecting a suitable program" relative to their needs by bringing into play the following factors: the type of processed data, the method adopted, the mode of conducting analysis, and the organizational context of the project. However, there is no replacing the sampling of a program to ensure that the choice is right. For this reason, it is sensible to closely inspect the program's features or, better, to compare several programs prior to final decision (and definitely before the purchase of software) (Anderson-Gough et al., 2017). It is best to consider software selection at the stage of project design and not to wait until the start of data analysis. This step is sure to prolong project preparation time but can spare the disappointment with the wrong choice of program that either turns out to be of little use during analysis or is completely off the mark as far as the initial researcher's expectations are concerned.

What to Keep in Mind When Using CAQDAS

Once the researcher settles on a specific software after investigating one's needs and convictions regarding CAQDAS and is ready to implement the software in research, there are still some more general concerns to address. CAQDAS use, regardless of its type and technological advancement, carries a number of implications. A researcher determined to take up CAQDAS should give thought to the following:

- CAQDAS is not an instrument for statistical analysis and statistical computations (although some programs enable simple numerical compilations).
- No program can code and analyze materials of its own accord, contrary to what some novice researchers hope for (Rodik & Primorac, 2015).

- Program implementation is not a preventive measure against the researcher's own fallacies, especially bias, lack of reliability or inability to interpret data.
- As the very name suggests, programs of the CAQDAS family are intended to support and not replace the researcher's analytic work (Lonkila, 1995). While some programs such as NVivo, Atlas.ti, or MaxQDA allow for automated coding based on the results of data search, the process remains secondary to the settings entered by the researcher. Furthermore, the outcome of automated coding requires the researcher's thorough scrutiny along with subsequent frequent adjustments.
- CAQDAS is no cure-all for the methodological deficiencies of a researcher (Anderson-Gough et al., 2017; Gilbert et al., 2014). Unsatisfactory results of research facilitated by CAQDAS derive from the mistakes and instances of negligence of the researcher and are not the direct effect of program defects. All accountability for the level of analysis and the quality of work rests with the researcher (Bringer et al., 2006). CAQDAS is just a useful instrument, part of your toolkit as a researcher (Anderson-Gough et al., 2017).

There also arise concerns in terms of how CAQDAS program application can affect analysis on a yet deeper level; we would like to follow up on the concerns voiced by the participants of our study. Some phenomenologists claim that technology can influence cognition analogously to how building architecture shapes our way of thinking about and experiencing the world (Goble et al., 2012). This means that the structure of the program may impose particular modes of segregating, searching, or analyzing the collected material (e.g., in the context of coding, by forcing the researcher to order the created codes in a hierarchical way) (O'Kane, 2020). There are researchers who fear that software architecture provides excessive structurality and narrows down the analyst's room for maneuvering, which runs counter to the methodological spirit of qualitative research (Saillard, 2011). This is the stance advocated by Glaser (2003) and Holton (2007), who blame commitment to software use for overlooking many alternative paths of data interpretation, as well as for obstructing or outright blocking creative analysis. Similar arguments have emerged from the outset of CAQDAS development. CAQDAS critics highlight the risk that software could serve to distance the researcher from the data, encourage quantitative analysis of qualitative data, and create a homogeneity in methods across the social sciences (Welsh, 2002). Interestingly, these epistemological concerns are rarely discussed in connection with other tools (for instance, generic programs intended for data management such as Word or Excel; Hahn, 2008; Ritchie, 2003). Their effect on the course of analysis is usually below the academic radar as if they were somehow more methodologically innocent (Gilbert et al., 2014; Rodik & Primorak, 2015). Nonetheless, *each* tool influences research practice. This pertains to audio and video recorders, word processors, or even note-taking (Gibbs, 2013; Gilbert et al., 2014).

However, research in the modern era can hardly be done without resorting to technological advances. For this reason, rather than abstaining from their implementation altogether, it is advisable to reckon with both the many benefits and the potential risks they may bring. We believe that tools alone cannot compromise research integrity in terms of misalignment with a method of choice or neglect of good research practices. A potential source of problems for the researcher lies with improper implementation of tools or disregard of possible related risks. Jackson et al. (2018) draw attention to this issue, noticing that the continuous criticism of CAQDAS in the research literature results from addressing erroneous modes of software application (or its inappropriate application) rather than the specifics of the tool itself. Bourdon (2002), in turn, notices that most of the limitations attributed to CAQDAS software arise when researchers who decide to take it into use treat it as a handy or convenient

tool instead of a fully integrated component of the research project itself. As underscored by O'Neill et al. (2018), CAQDAS programs should not be treated as a process separate from the overall research methodology (Leitch et al., 2016; Oblinger & Oblinger, 2005; Sinkovics & Alfoldi, 2012).

Some authors recognize the metalevel effect of CAQDAS on the way a research project is executed. A researcher involved in the application of a specific package is faced with multiple choices and analytic decisions. Woods et al. (2016) observed that using CAQDAS can enhance the researcher's reflexivity and agency over their analysis. Obviously, CAQDAS can facilitate reflexive practices only inasmuch as researchers choose to be reflexive and are disciplined in doing so (Woods et al., 2016). As long as the researcher ensures thoughtful CAQDAS use and compliance with the principles of the adopted research method, computer tools may bring positive effects in analytic work (Macmillan & Koenig, 2004).

Conclusions

The development and subsequent growing diversity of CAQDAS products have led to an overhaul of the qualitative researcher's workshop and an upending of the habits of conducting research. The continual optimization of CAQDAS has failed to resolve the problem of integrating the technological factors and the methodological procedures of qualitative research in a way that would be clear and satisfactory to all users. There are still opinions that software architecture imposes specific solutions that lack full compatibility with the needs of qualitative researchers and the requirements of respective research methods. This is attested to by a number of publications by experienced researchers who pursue qualitative analysis and use CAQDAS, as well as by the views expressed by our interviewees, novice software users. However, software authors and producers strive to make programs adaptable to various analytic strategies as well as diverse researchers' needs. Moreover, the programs currently available on the market are the result of the cooperation of many researchers who tested them in their projects and provided their authors with feedback, thereby contributing to the improvement of specific tools (Friese, 2016; Gibbs, 2013). Although much is yet to be done in this field, one thing seems certain – future generations of researchers will continue to look for novel ways of conducting research. It cannot be ruled out that one of the avenues they take is the development of computer-aided qualitative data analysis.

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Acknowledgements: We would like to extend our thanks to all those who joined our study and devoted their time to recount their experiences with CAQDA. We would also like to express our appreciation for fellow colleagues who have contributed to the advancement of the concept of computer analysis of qualitative data in Poland over the years. We would also like to thank our friend Katarzyna Kobos for her invaluable help in the translation and linguistic correction of the text. Last, but not least, we would like to thank editors and anonymous reviewers for their valuable comments and indications.

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Article Citation

Niedbalski, J., & Ślęzak, I. (2022). Encounters with CAQDAS: Advice for beginner users of computer software for qualitative research. *The Qualitative Report*, 27(4), 1114-1132. <https://doi.org/10.46743/2160-3715/2022.4770>
