

Scoping Review of the Qualitative Research using Data Analysis Software

Mapeamento das Pesquisas Qualitativas usando Softwares de Análise de Dados

Mapeo de Investigación Cualitativa utilizando Software de Análisis de Datos

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Resumo

Os métodos qualitativos permitem uma grande variedade de desenhos de pesquisa, que têm como característica comum a investigação de fenômenos de forma aprofundada, sendo possível o uso de *softwares* de análise qualitativa de dados (QDAS). O presente artigo objetiva analisar procedimentos metodológicos de aplicação de softwares QDA, considerando os procedimentos de pesquisa, origem, coleção e análise dos dados, de modo a prover uma visão geral de aplicação dessa tecnologia. A investigação consistiu de uma pesquisa exploratória de natureza qualitativa conduzida por meio de um mapeamento sistemático da literatura realizada na biblioteca digital IEEE Xplore®, na biblioteca digital ACM e na base de dados EBSCO. Após a aplicação do protocolo da pesquisa, contendo os critérios de inclusão e exclusão, obteve-se uma quantidade total de 20 resultados selecionados, que foram categorizados conforme as informações fornecidas pelos autores. Os resultados indicam que os QDAS devem ser considerados ferramentas de suporte à pesquisa qualitativa, ajudando o pesquisador na organização e análise de dados não estruturados, classificação da informação, análise de relações e vinculações entre dados. Seu uso é muito diversificado, todavia, importante destacar que as funcionalidades dos softwares não substituem ou suplantam as habilidades e competências do pesquisador que, na qualidade de usuário do sistema, precisa ser capaz de desenhar pesquisas de qualidade, apurar amostras de dados condizentes com o objeto de pesquisa, assim como, ter o conhecimento necessário das funcionalidades que os QDAS ofertam para seu uso adequado, pois, estes pontos influenciam no resultado.

Palavras-chave: Métodos Qualitativos de Pesquisa. QDA. Mapeamento Sistemático de Literatura.

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Abstract

Qualitative methods allow for a wide variety of research designs, which have as a common characteristic the investigation of phenomena in depth, being possible the use of qualitative data analysis software (QDAS). This article aimed at analyzing methodological procedures for the application of QDA software, considering the research procedure, source of data, data collection and data analysis, in order to provide an overview of the application of this technology. The investigation consisted of an exploratory research of a qualitative nature conducted by means of a scoping review of the literature carried out in the IEEE Xplore® digital library, ACM Digital library and the database EBSCO. After applying the research protocol, containing the inclusion and exclusion criteria, one obtained a total amount of 20 selected results, which were categorized according to the information provided by the authors. The results indicate that the QDAs should be considered as tools to support qualitative research, helping the researcher in the organization and analysis of unstructured data, classification of information, analysis of relationships and links between data. QDAs use is very diverse, however, it is important to highlight that the QDA functionalities do not replace or supplant the skills and competences of the researcher who, as a system user, needs to be able to design quality research, ascertain data samples consistent with the object of research, as well as have the necessary knowledge of the features that the QDAs offer, for its proper use, since these points influence the result.

Keywords: Qualitative Research Methods. QDA. Scoping Review.

Resumen

Los métodos cualitativos permiten una amplia variedad de diseños de investigación, que tienen como característica común la investigación de fenómenos en profundidad, siendo posible el uso de software de análisis de datos cualitativos (QDA). Este artículo buscaba analizar los procedimientos metodológicos para la aplicación del QDA, considerando el procedimiento de investigación, fuente de datos, recolección de datos y análisis de datos, para proporcionar una visión general de la aplicación de esta tecnología. La investigación consistió en una investigación exploratoria de carácter cualitativo realizada a través de un mapeo sistemático de la literatura realizado en la biblioteca digital IEEE Xplore®, en la biblioteca digital ACM y en la base de datos EBSCO. Luego de aplicar el protocolo de investigación, que contiene los criterios de inclusión y exclusión, se obtuvo un total de 20 resultados seleccionados, los cuales fueron categorizados según la información brindada por los autores. Los resultados indican que las QDA deben ser consideradas herramientas de apoyo a la investigación cualitativa, ayudando en la organización y análisis de datos no estructurados, clasificación de información, análisis de relaciones y vínculos entre datos. Su uso es muy diverso, sin embargo, es importante resaltar que las funcionalidades del software no reemplazan ni suplantán las habilidades y competencias del investigador que, como usuario del sistema, necesita ser capaz de diseñar investigaciones de calidad, conocer muestras de datos consistentes, así como tener el conocimiento necesario de las características que ofrecen los QDAs, para su correcto uso, ya que estos puntos influyen en el resultado.

Palabras clave: Métodos de Investigación Cualitativa. QDA. Mapeo Sistemático de la Literatura.

1 INTRODUCTION

Qualitative research aims to understand phenomena in depth, since it is essentially interpretive (MATTAR; RAMOS, 2021) and it comprises a wide range of methods. The basic characteristics that qualitative research methods share are the choice for thorough analysis and deep understanding of detail to reconstruct the whole, in addition to the adaptation of the method to the object of study and not the opposite. These traits demand a thoughtful approach and sound knowledge on the part of the researcher regarding the context of use and choice of the methodology (CARDANO, 2017). In addition, Yin (2016) acknowledges five characteristics of qualitative research: (i) it allows the study of the meaning of people's lives under real-life conditions; (ii) it allows the representation of opinions and perspectives of the participants of a study; (iii) it considers the contextual conditions when approaching a research object; (iv) it provides insights into existing or emerging concepts when approaching human social behavior; and (v) it uses multiple sources of evidence rather than relying on a single source.

In this aspect, Kuckartz and Rädiker (2019) and Gilbert, Jackson and Di Gregorio (2014) define the term qualitative data as an umbrella term for non-numeric and unstructured data, which can range from texts (resulting from the transcription of interviews and focus groups), documents, photos, audio and video. Kuckartz (2014) highlights that qualitative data is not a weak form of data when compared to quantitative data, but a very different form of data that requires systematic analysis. In order to analyze data, Gilbert, Jackson and Di Gregorio (2014) present a continuum of data complexity with aspects that should be taken into notice in a qualitative research, highlighting that the increase of data analysis complexity influence the complexity of data management. According to the authors, these aspects are: (i) similarity/dissimilarity of data types and formats; (ii) the degree of structure of data collection (structured/unstructured); (iii) single person or homogeneous group/multiple people or groups; (iv) single site/multiple sites of data collection; (v) data collection in one point in time/longitudinal studies; (vi) linear data collection procedures/iterative data collective procedures; (vii) data collection and analysis by one researcher/data collection and analysis by a group of researchers (GILBERT; JACKSON; DI GREGORIO, 2014).

The aforementioned complexity circumscribed in the qualitative analysis justifies the use of specific systems for handling these data. Thus, a software-mediated qualitative data

analysis began in the 1980s (WOODS *et al.*, 2015; GILBERT; JACKSON; DI GREGORIO, 2014) and they are known as Computer Assisted Qualitative Data Analysis Software (CAQDAS), or just Qualitative Data Analysis Software (QDAS). Silver (2018) reports that the first QDAS packages were NUD*IST (that later became NVivo), The Ethnograph, WinMAX (that later became MAXQDA), HyperRESEARCH and ATLAS.ti and he also provides a timeline that maps the release of QDAS packages according to the year of release of the softwares and also a timeline that correlates the stage of development of the QDAS packages to the critical moments of qualitative research.

It is important to emphasize that QDAS do not perform the analysis, but allow its systematization, since they help in the processes of handling, coding and recording of data, by explaining patterns and relationships present in the corpus of the studied sample (FRIESE, 2019). Supporting this view, Gilbert, Jackson and Di Gregorio (2014) acknowledge that QDAS are mainly used for four types of activities in qualitative analysis: organizing data (grouping data, linking different bits of data), exploring data (becoming familiar with and recording comments on data), interpreting and reflecting on data (making connections, memo writing, mapping data) and integrating data (making connections and references within and with other studies). According to the authors, the fundamental capabilities of QDAS in general are:

- Assign multiple codes to a single portion of text/audio/video/photograph.
 - Cross-reference the relationships among codes for constellations or patterns.
 - Import nominal, ordinal and/or interval data as a means of comparing subgroups in the data.
 - Track researcher ideas through the use of links and memos.
 - Provide output in the form of reports that can be used for analysis and presentation of findings outside of the software.
- Additional features are also available many in the products, such as:
- The ability to code an increasing range of data formats, such as audio, video, or pdf files.
 - The ability to track multiple users within the system, or even to limit some users' access as "read only" in order to manage teamwork.
 - The ability to create visual representations (models and charts) of data.
 - The ability to access program functions in multiple ways (menus, keyboard shortcuts, contextual menus) and to customize the interface. (GILBERT; JACKSON; DI GREGORIO, 2014, p. 227-228).

Woods *et al.* (2015) emphasize the advantages of using QDAS over manual analysis: (i) it extends the possibility of coding, retrieving and analyzing data beyond manual limits, thus

allowing the use of more complex and exhaustive coding schemes; (ii) it improves the qualitative analysis, by allowing to relate texts to non-textual materials; (iii) it enables an analytical process with less subjectivity in qualitative research, since issues such as rigor, validity and reliability are easily demonstrated. Furthermore, Saldaña (2021) acknowledges that the use of QDAS makes it possible to organize complex coding systems in formats such as hierarchies or clusters, allows the quick retrieval of coded keywords and data, in addition to allowing coding processes in groups of researchers or by oneself.

However, Woods *et al.* (2015) report concerns about how the use of QDAS can influence qualitative research in unwanted ways, such as their use without the necessary reflection and critical awareness and the consequent conduction of "tailored" research designs designed to suit the functionality of the software. In addition to this concern, Gilbert, Jackson and Di Gregorio (2014) also mention difficulties in transitioning from manual coding to software use related to difficulty in managing analytical distance from data. It means that in some cases, novice researchers may experience a possible lack of familiarity with data (distance from data) due to the use of the software. Other difficulty reported is known as the "coding trap", or an excess of codes generated with the use of the software, what impedes researchers to get a perspective of the whole (closeness to the data). Besides, Gilbert, Jackson and Di Gregorio (2014) mention the lack of meta-awareness on the software use, what results in a difficulty in checking whether the software outcomes actually answer what the researcher expected in the design, since it is easy to misunderstand its use and make the wrong questions to the software. Souza, Souza and Costa (2014) also highlighted the challenges of creating a common vocabulary for qualitative analysis and training novice researchers to learn how to integrate their analysis processes with the functionalities of QDAS. In order to avoid such problems, Saldaña (2021) advocates that novice learners should learn to code manually before advancing to the use of software. Woolf and Silver (2018) and Silver (2018), on the other hand, suggest an approach based on transcending the difficulties described above and planning software use from the very beginning, since the very posing of the research question throughout the whole research process in an iterative way.

One identified the research on QDAS as a potential area for conducting studies within the theme of qualitative research, based on its advantages, on the few empirical studies on the use of QDAS (WOODS *et al.*, 2015) and the lack of protocols or systematic reviews on this

topic (SALVADOR *et al.*, 2019). In this sense, considering the complexity circumscribed in qualitative research (GILBERT; JACKSON; DI GREGORIO, 2014; KUCKARTZ; RÄDIKER, 2019), which demands rigor in its conduction for the reliability of the results (CARDANO, 2017; MATTAR; RAMOS, 2021), the use of QDA software become relevant. However, due to the diversity of softwares available for this purpose, and due to the fact that new researchers may have doubts when choosing a given QDA, this research aims at analyzing methodological procedures for the application of QDA software, considering the research procedure, source of data, data collection and data analysis, in order to provide an overview of the application of this technology. This is justified by elucidating, to new and fruitful researchers, the potential use of QDAS in scientific research, supporting the choice of a certain tool. It is not part of the purpose of this article to analyze and/or evaluate the adequacy of the research methods used by the respective authors.

2 METHODOLOGY

The present study is an exploratory research of a qualitative nature and carried out a scoping review, also known as systematic mapping of the literature. The procedure consisted of five steps: (i) definition of research questions; (ii) conducting research on relevant primary studies; (iii) screening of documents; (iv) classification scheme based on abstract, keywords; and (v) data extraction and mapping of studies (PETERSON *et al.*, 2008).

The questions we sought to answer were:

- (Q1) What are the most used QDAS in qualitative research?
- (Q2) What are the types of research conducted using QDAS?
- (Q3) What are the main limitations perceived in these researches?

The search was carried out in September 2021, in the IEEE Xplore® digital library, in the ACM digital library and in the database EBSCO. IEEE Xplore® digital library was chosen because of its importance in the field.

IEE Xplore® digital library is associated with an organization dedicated to the advancement of technological innovation in the areas of engineering, computing and information technology worldwide, being, therefore, a digital library specialized in the subject of software, including those for use in the present research.

The ACM digital library was chosen because it is the leading-edge digital library of the Association for Computing Machinery (ACM), the world’s largest educational and scientific computing society.

EBSCO was chosen due to its large offer of databases. The detailed research protocol is available in Table 1 below.

Table 1 – Protocol used in the scoping review.

Protocol of the Scoping Review	
Objective	To present an overview of the use of qualitative data analysis software (QDAS) in qualitative research.
Questions	(Q1) What are the most used QDAS in qualitative research? (Q2) What are the types of research conducted using QDAS? (Q3) What are the main limitations perceived in these researches?
Source of search:	IEEE Xplore® Digital Library. ACM Digital library, EBSCO
Search Date	Searches were carried out in September 2021
Descriptors used in search	“qualitative data analysis”
Search Filters	The temporal filter was used to limit the search to the period from 2017 to 2021, in order to get the most recent research.
Inclusion Criteria	1. Scientific articles published in journals or conference proceedings; 2. Availability of complete archives of articles in the data base / digital libraries (MANUAL CHECK); 3. Presence of the descriptor used in the search (see above) in the abstract of the article (MANUAL CHECK); 4. Articles reporting primary studies (MANUAL CHECKING).
Exclusion Criteria	Repeated articles and those that did not comply with the above inclusion criteria (MANUAL CHECK).).
Data extraction	Classification by means of categorization of the keywords of the abstracts and mapping of studies by extracting data from the retrieved studies.

Source: The authors (2021).

We chose to search with the descriptor "qualitative data analysis" to obtain a broader sample of articles that were still aligned to the research objective. The last step consisted of a thematic classification scheme of the research methods used in the retrieved studies, by means of the categorization of the full text of the selected articles, by using the methodological typology proposed in Mattar and Ramos (2021). The classification was computed according to information provided by the authors of the selected papers.

3 RESULTS AND DISCUSSION

The searches in the selected databases met the following criteria: the search term “qualitative data analysis” was applied to the abstract. For a better delimitation of the research, articles that had linked full text were chosen, due to the need to verify in them characteristics

related to the data analysis systems used by their respective authors. A time frame was also made from the month of January of 2017, as the initial searches, carried out without the use of other filters or delimiters, only for the complete sentence, did not result in the retrieval of articles in dates prior to this one. Results were limited to articles published in journals and conferences. The selected subjects were qualitative research, focus groups, data analysis, data analysis software, research methodology, research, thematic analysis, comparative studies. The others were considered irrelevant due to the lack of relationship with the subject studied.

Initially, the searches resulted in 50 articles in the Ebsco database, 26 articles in the ACM Digital Library and 58 articles in the IEEE® Xplore Digital Library. After reading the abstracts by all authors, articles that were not relevant to the study were excluded, as they did not include the use of qualitative data analysis software.

After applying the research protocol, containing the inclusion and exclusion criteria, one obtained a total amount of 20 selected results, to know: Tesfay *et al.* (2021), Dors *et al.* (2020), Marshall *et al.* (2020), Dirisu *et al.* (2020), Almeida *et al.* (2019), Andrade *et al.* (2019b), Fornari *et al.* (2019), Sá and Costa (2019), Alcorn *et al.* (2019), Bessat *et al.* (2019), Díaz *et al.* (2019), Mahyar *et al.* (2019), Berdanier *et al.* (2018), Nayak *et al.* (2018), Dyrstad *et al.* (2018), Shrestha *et al.* (2018), Simpson *et al.* (2017), Gorro *et al.* (2017), Badea and Popescu (2017) e Donnelly *et al.* (2017), which were categorized according to the information provided by the authors, according to the methodological typology proposed in Mattar and Ramos (2021).

The characterization of the sample is expressed in Table 2, expressing the affiliation of the authors, the QDAS used and the research objectives.

Table 2 – QDAS used and main objectives of retrieved works.

Data bases	Authors/Year/ Affiliation	QDAS	Main Objectives
IEEE Xplore®	Almeida <i>et al.</i> (2019)University of Aveiro	WebQDA	To define improvements and updates that may optimize and increase the quality of WebQDA tools.
	Andrade <i>et al.</i> (2019b) University of Aveiro University of Tiradentes	WebQDA	To understand the use of reflexive practice in software development studios and their contribution to practical learning of software engineering.
	Dors <i>et al.</i> (2020) Pontifical Catholic University of Paraná Federal University of Technology of Paraná	Atlas TI	To describe an end-to-end system for the collection, analysis, storage and visualization of qualitative and quantitative data, developed by using e-Science Central platform cloud analysis.

	Simpson <i>et al.</i> (2017) Newcastle University Rochester Institute of Technology	Own Software	To report how reliability can be assured in qualitative data by using analytical text principles.
	Berdanier <i>et al.</i> (2018) University Park	Natural language processing methods	To perform qualitative data analysis by using natural language.
	Gorro <i>et al.</i> (2017) University of San Carlos National University University of California	Word2Vec	To examine suggestions for the strategy of reduction of risk in disasters provided by residents in disaster prone areas in the Philippines.
	Badea and Popescu (2017) University of Craiova	Coll Annotator	To describe the tool, its justification, functionalities and some details of its implementation.
	Fornari <i>et al.</i> (2019) University of São Paulo University of Aveiro	WebQDA	To identify and compare digital tools used for carrying out Systematic Literature Reviews.
	Sá and Costa (2019) University of Minho Research Centre Mediation Institute Lusofone University University of Aveiro	WebQDA	To experiment collaborative practice and learning in qualitative research.
EBSCO	Alcorn <i>et al.</i> (2019) Texas Tech University Kansas State University	NVivo 11	To evaluate sanitary and food safety questions in schools.
	Marshall <i>et al.</i> (2020) University of Guelph	NVivo 11	To identify challenges and opportunities for professionals and communities to improve the protection of water fountains in indigenous areas in the province of Ontario.
	Tesfay <i>et al.</i> (2021) Deakin University Flinders University	NVivo 11	To study about the efficiency of nutritional counselling to HIV carriers in a region of Ethiopia.
	Dirisu <i>et al.</i> (2020) University of Ghana Ahmadu Bello University Teaching Hospital	NVivo 10	To explore the barriers for the adoption of prevention of mother to child transmission (PMTCT), intervention in Kano, the second most populated State in Nigeria.
	Nayak <i>et al.</i> (2018) Battelle Public Health Center for Tobacco Research Georgia State University University of Oklahoma	NVivo	To explore the attitudes of the operators of product stores and private virtual servers in relation to the potential sector regulation, potential governmental regulation of EVPs.
	Bessat <i>et al.</i> (2019) University of Lausanne	MAXQDA 12	To investigate the perception of doctors concerning an eMCI tool (clinic decision algorithm).
	Donnelly <i>et al.</i> (2017) University of Calgary Hamad Medical Corporation Qatar Ministry of Public Health	NVivo 09	To investigate attitudes and perceptions of arab men in relation to breast cancer screening (BCS) and what they perceive as incentives and barriers for the participation of women in BCS.
	Dyrstad <i>et al.</i> (2018) University of Stavanger	NVivo 10	To evaluate the response to lessons physically active and identify facilitating and limiting factors for the implementation of the program Active School in Stavanger, Norway.
	Shrestha <i>et al.</i> (2018) University of Sanford	NVivo 11	To explore behavior patterns that lead pregnant women to consume alcohol in an indigenous community.

ACM Digital	Díaz <i>et al.</i> (2019) University of the Basque Country	W3C's Open Annotations	To analyze how it is possible to share data of systematic literature reviews for further larger research.
	Mahyar <i>et al.</i> (2019) University of Massachusetts University of California San Diego	Atlas TI	To analyze the opinion of civic leaders about data collection in the practice of digital education.

Source: The authors (2021).

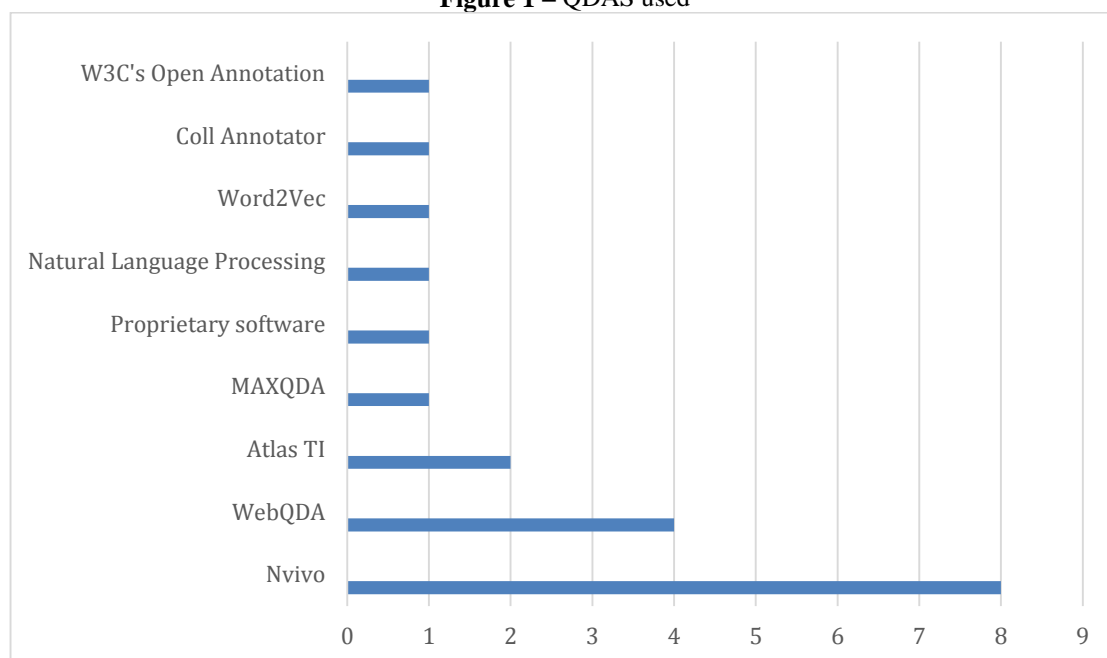
Regarding the affiliations of the authors (Table 2), most affiliations are from the United States, followed by Portugal, Brazil, United Kingdom and Canada. Regarding the source of the retrieved articles, half of the articles came from journals (10 articles) and the remainder from conference proceedings (10 articles).

Among the selected works, one can highlight the varied uses of QDAs, especially for the implementation and evaluation of public policies such as control of alcohol abuse by pregnant women, prevention of HIV, regulation of vape using or nutrition of school children. This is due to the need to have feedback and participation of the addressed communities in the steps of implementation and or evaluation of public policies, what demands a deeper understanding of these communities' needs. Such understanding is not always possible to get from quantitative data, therefore, qualitative methods or mixed methods can provide such information in greater depth. Such methods can thus be used by governments, marketing companies, industries, health and non-profit sectors.

Some of the articles selected also dealt with the improvements of QDAs in order to develop functionalities that were suggested by users. Moreover, the selection also included articles that dealt with the possible combination of machine learning and natural language processing to optimize qualitative data analysis and coding with QDAs. Since the QDAs do not automatically code, but aid the management of the process, coding large amounts of data is time-consuming and difficult to systematize, especially when done in collaboratively research teams. This seems to be a concern for the most recent versions of the software, since all of them released modules that allow research in collaborative teams. In addition, training algorithms to code in thematic categories can be used in the future to facilitate such coding, since artificial intelligence can optimize the process.

To answer the first question proposed in the scoping review (Q1: What are the most used QDAS in qualitative research?), the Figure 1 below shows the occurrence of qualitative data analysis software in the selected studies, as reported by their respective authors.

Figure 1 – QDAS used



Source: The authors.

There was a prevalence of NVivo in the selected studies, followed by WebQDA and Atlas TI. All of the softwares have proprietary software licenses, with the exception of W3C’s Open Annotation, which is an open-code software. One decided to focus efforts on elucidating the characteristics of QDAS with more than one occurrence of use, namely MAXQDA, Atlas TI, WebQDA and Nvivo. The characteristics of these softwares were identified in Almeida et al. (2019) and on the websites of its suppliers and are expressed in Table 3.

Table 3 – Comparison among QDA softwares

	Atlas TI	MAXQDA	NVivo	WebQDA
Design	Designed for qualitative and mixed methods data analysis	Designed for qualitative and mixed methods data analysis (It has a statistical module)	Designed for qualitative and mixed methods data analysis.	Collaborative-based software designed for qualitative analysis
Licensing	proprietary software	proprietary software	proprietary software	proprietary software
Demo / Test version	A trial license allows full use of functionalities for up to five days within a 90-days period. After the	A trial license allows full use of functionalities for 14 days. After expiration, it will end automatically, unless	A trial license will allow full use of functionalities for 14 days. After the trial period expiration, it will end	A trial license will allow full use of functionalities for 15 days. After the trial period expiration, the

	trial license expiration, the program defaults to a restricted version.	it is activated with a purchased serial number (projects are saved on the hard disk).	automatically, unless it is activated with a purchased serial number.	projects remain in visualization mode only.
Available platforms	Windows MAC Web version Mobile version (iPad, Android)	Windows MAC Team Cloud Module	Windows MAC Collaboration Cloud Module	Web-based version
Latest version	Atlas TI 9	MAXQDA 2022	NVivo (released in 2020)	WebQDA 3.0 (released in 2016)
Data formats supported	<p><u>Text</u>: rich text format (.rtf), plain text (.txt), MS Word files (.doc, .docx, .txt), Portable Document Format (.pdf), Open Office (.odt), HyperText Markup Language (.htm, .html)</p> <p><u>Graphic</u>: .bmp, .gif, .jpeg, .jpg, .png, .tif, .tiff</p> <p><u>Audio</u>: .aac, .m4a, .mp3, .mp4, .wav</p> <p><u>Video</u>: .3g2, .3gp, .3gp2, .3gpp, .asf, .avi, .m4v, .mov, .mp4, .wmv</p> <p><u>Metadata</u>: Endonote xml, .ris, .Bib</p> <p><u>Social Media</u>: Twitter</p> <p><u>Geolocalization</u>: Geo-Data</p> <p><u>Annotation</u>: Evernote</p>	<p><u>Text</u>: rich text format (.rtf, .rtfd), plain text (.txt), MS Word files (.doc, .docx, .txt), Portable Document Format (.pdf), Open Office (.odt)</p> <p><u>Table</u>: Excel files (.xls, .xlsx)</p> <p><u>Survey</u>: SPSS (SAV), direct import from SurveyMonkey</p> <p><u>Graphic</u>: .jpg, .gif, .png, .tif, .svg, .bmp</p> <p><u>Audio</u>: Windows: mp3, wav, wma, aac, m4a mac: mp3, wav, aac, caf, m4a</p> <p><u>Video</u>: .mp4, .mov, .mpg, .m4v, .3gp, .3gpp, (.avi, .wmv Windows only), SRT (video subtitles)</p> <p><u>Metadata</u>: .ris, .txt</p> <p><u>Social Media</u>: Twitter, Youtube</p> <p><u>Geolocalization</u>: Geolink</p>	<p><u>Text</u>: .doc, .docx, .txt, .rtf, .pdf, .odt (MAC only)</p> <p><u>Table</u>: Excel files (.xls, .xlsx)</p> <p><u>Survey</u>: SPSS, direct import from SurveyMonkey</p> <p><u>Audio</u>: .mp3, .m4a, .wav, .aac, .aiff, .amr, .au, .caf, .flac, .ra, .wma, .ogg, .asf</p> <p><u>Video</u>: .mp4, .avi, .mov, .3gp, .wmv, .flv, .mkv, .webm, .mpg, .m4v</p> <p><u>Metadata</u>: Endonote xml, .ris</p> <p><u>Social Media</u>: Twitter, Youtube, Facebook</p>	<p><u>Text</u>: plain text (.txt), MS Word files (.docx), Portable Document Format (.pdf)</p> <p><u>Table</u>: Excel files (.xls, .xlsx).</p> <p><u>Graphic</u>: .jpg and .png files can be imported as files (images embedded in text documents are lost upon importing into webQDA)</p> <p><u>Audio</u>: .mp3, .wav</p> <p><u>Video</u>: .mp4, .ogg, .webm</p> <p><u>Metadata</u>: .ris, .xml, BibTeX</p>
Output	Docx/Doc/ RTF Excel PDF Concept Maps Word Cloud	Docx/Doc/ RTF Excel PDF Concept Maps Word Cloud	Docx/Doc/ RTF Excel PDF Concept Maps Word Cloud	Docx/Doc/ RTF Excel PDF Concept Maps Word Cloud

	Graphics Tables Images	Graphics Tables Images	Graphics Tables Images	Tables Images
Data visualization	Concept Maps Code Maps Hypertext Density maps	Concept Maps Code Maps Hypertext Density maps	Concept Maps Code Maps Hypertext Density maps	Code Maps Hypertext
Webpage	atlasti.com	maxqda.com	qsrinternational.com/ nvivo	webqda.net

Source: QDAS respective webpages (2021) and Almeida *et al.* (2019).

In order to answer the second question (Q2; What are the types of research conducted using QDAS?) of the scoping review, which inquires about the frequency of occurrence of the selected types of research, Table 4 below shows a summary of the methodological procedures of the studies, as informed by the authors of the articles.

Table 4 – Methodological procedures of retrieved works.

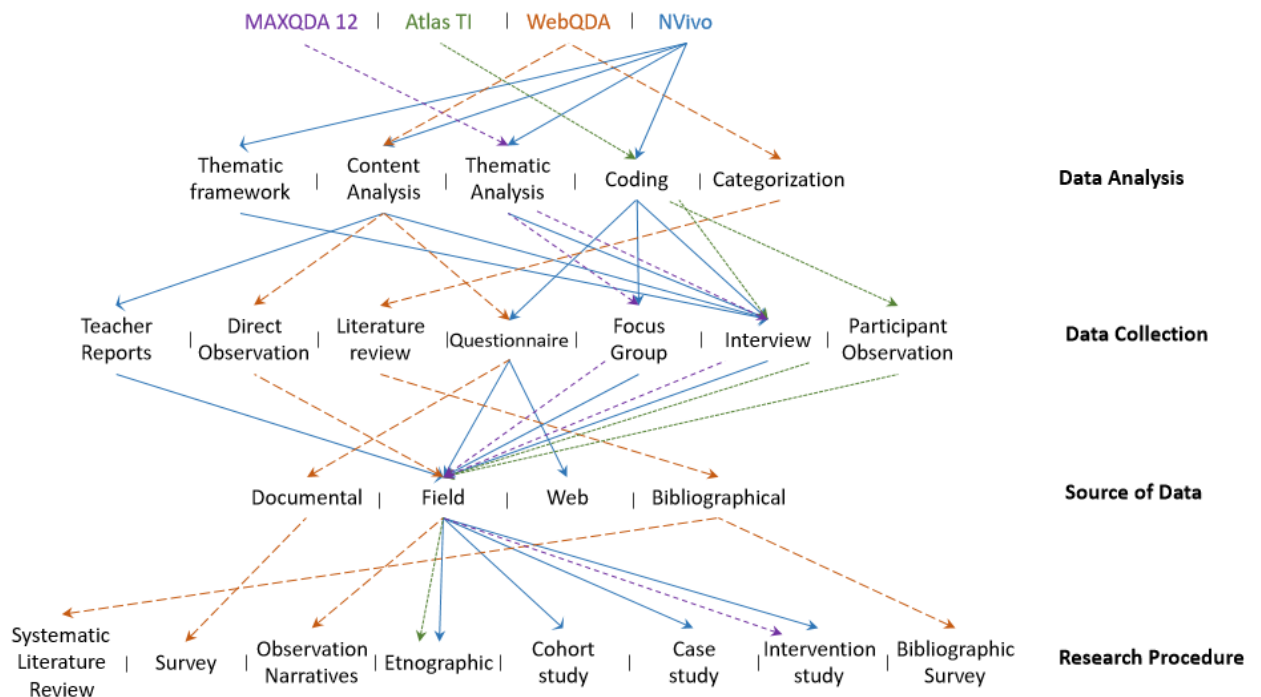
Author/Year	Research Procedure	Source of Data	Data Collection	Data Analysis
Almeida <i>et al.</i> (2019)	Survey	Documental	Questionnaire	Content Analysis
Andrade <i>et al.</i> (2019b)	Bibliographic Survey	Bibliographic	Literature review	Categorization
Dors <i>et al.</i> (2020)	Ethnographic	Field	Participant Observation	Coding
Simpson <i>et al.</i> (2017)	Case study	Field	Interview	Coding
Berdanier <i>et al.</i> (2018)	Case Study	Documental	----	NLP to enhance coding
Gorro <i>et al.</i> (2017)	Survey	Web	Interview	Topic Modeling Word Embedding
Badea and Popescu (2017)	----	Documental	----	Content Analysis
Fornari <i>et al.</i> (2019)	Systematic Literature Review	Bibliographic	----	Content Analysis
Sá and Costa (2019)	Observation Narratives	Field	Direct Observation	Content Analysis
Alcorn <i>et al.</i> (2019)	----	Field	Focus Group	Coding
Marshall <i>et al.</i> (2020)	Ethnographic	Field	Interview Focus Group	Coding
Tesfay <i>et al.</i> (2021)	Cohort study	Field	Interview	Thematic framework Coding
Dirisu <i>et al.</i> (2020)	----	Field	Interview	Thematic Analysis
Nayak <i>et al.</i> (2018)	----	Field	Interview	Thematic Analysis
Bessat <i>et al.</i> (2019)	Intervention study	Field	Interview Focus Group	Thematic Analysis
Donnelly <i>et al.</i> (2017)	----	Field	Interview Questionnaire	Coding
Dyrstad <i>et al.</i> (2018)	Intervention study	Field	Interview Teacher Reports	Content Analysis
Shrestha <i>et al.</i> (2018)	----	Web	Questionnaire	Coding
Díaz <i>et al.</i> (2019)	Systematic Literature Review	Bibliographical	----	Coding

Mahyar <i>et al.</i> (2019)	----	Field	Interview	Coding
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Source: The authors.

According to the results, the methods are diversified, what demonstrates a wide range of uses for QDAs, ranging from the analysis of systematic literature reviews to ethnographic, intervention, cohort, survey or case studies. Common data collection methods are interview and focus groups, but reports, observation logs, documents and bibliographic material are also mentioned. Since it is also possible to code directly in video, audio and graphic documents, QDA use can make the analysis very rich and thorough. Regarding data analysis, coding, theme analysis and content analysis were more frequent, with mentions to natural language processing to enhance coding, topic modeling and word embedding. The most used softwares were MAXQDA, Atlas TI, WebQDA and NVivo and, based on the studies that used them (Table 3), a representation was created to visualize the potential of these tools for conducting research. It is noteworthy that it is not part of the purpose of this article to analyze and/or evaluate the adequacy of the research methods used by the respective authors.

Figure 2 – Methodological procedures as QDAS used



Source: The authors.

The representation expressed in Figure 2 announces the potential use of each QDAS in the research methodological procedures, considering the research procedure, source of data, data collection and data analysis. For example, in the research by Dors et al. (2020) the Atlas TI software was used for coding (data analysis), by means of participant observation (data collection) with data obtained in field (source of data) in ethnographic study (research procedure). This mapping tends to be useful for incoming researchers regarding the choice of a certain software according to the type of research performed.

Regarding question 3 (Q3: What are the main limitations perceived in these researches?), which aims to answer what are the main limitations found in the CAQDAs, not all works made remarks about limitations perceived. Thus, a summary of the reports is available in Table 5.

Table 5 – Main limitations perceived by researchers.

Authors	CAQDAS	Main limitations of CAQDAS
Simpson <i>et al.</i> (2017)	Own software	Results are limited to the inter-relations of three aspects.
Fornari <i>et al.</i> (2019)	WebQDA	Researchers do not use all software functionalities.
Sá e Costa (2019)	WebQDA	Sample too small - only three students.
Alcorn <i>et al.</i> (2019)	NVivo	Use of intentional sample limits results.
Marshall <i>et al.</i> (2020)	NVivo	Limited sample size.
Dirisu <i>et al.</i> (2020)	NVivo	Research based on perception of participants. Sample may not represent general opinion.
Nayak <i>et al.</i> (2018)	NVivo	Sample selected by convenience is too small.
Bessat <i>et al.</i> (2019)	MAXQDA	Work focused on workers of a region only. Results may not be generalizable.
Dyrstad <i>et al.</i> (2018)	NVivo	Small sample.
Shrestha <i>et al.</i> (2018)	NVivo	Small sample.
Mahyar <i>et al.</i> (2019)	Atlas TI	Due to the small size of the sample, results are not generalizable.

Source: The authors.

According to the table, the most cited limitation did not concern the software per se, but it was related to the research design, in special sample choice. Since sample size and manner of selection may affect results, researchers should bear in mind that a shortcoming of the method is that results may not be generalizable. Other limitations mentioned were that researchers do not use all functionalities of the software and that the reason why this shortcoming happened should be further analyzed. Other interesting limitation mentioned was the need to previously know specific area contents, such as languages in order to perform the analysis.

5 FINAL CONSIDERATIONS

This article aimed to analyze methodological procedures for the application of QDA software, considering the research procedure, source of data, data collection and data analysis, in order to provide an overview of the application of this technology, by means of a scoping literature review using the IEEE Xplore® and ACM Digital Libraries and the EBSCO database. It was observed in this study that the most used QDA was NVivo, followed by WebQDA and Atlas TI. They are predominantly used by academics, public institutions, business organizations and teaching and research institutions to carry out research in the areas of social sciences.

QDAs help users organize and analyze unstructured data, enabling information classification, analysis of relationships and linkages between data. They support data analysis in various formats, among which, audio files, videos, digital photos, word text, PDF, spreadsheets and web data can be highlighted. Thus, with the use of QDAs, the researcher is able to identify trends, patterns and research gaps, building a solid body of evidence to describe the response and demonstrate their arguments.

In the present work, it was found that the most of the researches that amongst research of QDAs, the most common data analysis were coding, theme analysis and content analysis, with occurrences of natural language processing to improve coding, in topic modeling and in the incorporation of key words.

Regarding the theme of research that used QDAs, there is a diversified use. In general, it is focused on the coding and categorization of large amounts of data, when there is a need to obtain information with greater depth and complexity.

It was found that the QDAs accommodate research that uses the analysis of systematic literature reviews, surveys or case studies. Its use has the advantage of increasing the scope and depth of data analysis, exploring research gaps with greater complexity and completeness, allowing researchers to obtain research results with greater social impact.

The research also showed that the limitations to the use of QDAs are linked to the research design, sample size and the impossibility of generalizing the answers. It was also found that the researchers' lack of expertise in using the software's functionalities, the need for it to know in advance the content and area of research to be carried out, and the limitation arising from the language influence the results obtained by the QDAs.

In summary, QDAs should be considered as support tools for qualitative research, since they allow the exploration of research gaps that can hardly be seen just by interpreting the texts. The main contribution of this research is to help researchers and academics to visualize the importance of QDAs for qualitative research. It also offers support on what are the most used software, its application forms, advantages and limitations of its use.

The limitation of the research consisted in delimiting the investigation exclusively to the IEEE Xplore® and ACM digital libraries and the EBSCO database. Therefore, we suggest future researches where new investigations also include other digital libraries and/or other databases not restricted to the technology area, which will allow a vision of the use of QDA software in a wider range of knowledge areas. The limitation of the research consisted of the delimitation of the investigation to the IEEE Xplore® digital library. We suggest for future research that one carries out further investigations that also include other digital libraries and/or other databases not restricted to the technology area, for a broader view of the use of QDA software in several other areas of knowledge.

This study did not attempt to exhaust the theme, but rather to present a picture of the use of qualitative data analysis software in qualitative investigations. We also expect that the visualization of this panorama can support future research on the subject, as well as provide researchers with information to support the choice of certain software.

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