Nvivo as a Handy Tool in Qualitative Meta-Synthesis Studies in L2 Research

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Abstract: Although quantitative paradigm still appears to occupy a significant place in social sciences (more specifically in second language acquisition research), there has been a widespread interest in qualitative studies in these areas since the last quarter of the twentieth century. As more qualitative studies are being conducted, there emerges a need to synthesize their findings to draw generalisable conclusions to inform practice. This paper provides an overview of qualitative meta-synthesis by highlighting its key aspects. Then it goes on to discuss how NVivo, a computer-assisted qualitative data analysis software (CAQDAS) program, can be used to facilitate, speed up and improve the quality of qualitative meta-syntheses by increasing their depth. NVivo can be quite useful in qualitative meta-synthesis studies, not only because it helps organise the data but also because it facilitates such key activities during data analysis as coding, writing analytic memos, conducting keyword searches and comparing coding and analytical notes. Besides these, a highly practical tool is framework matrix, which helps prepare a neatly organized synthesis of research studies in spreadsheet format. This paper discusses the use of these tools in the context of meta-synthesis and offers some practical suggestions in this regard.

Keywords: *qualitative meta-synthesis, computer-assisted qualitative data analysis software (CAQDAS), NVivo, reflexivity, queries, second language acquisition research*

INTRODUCTION

For practitioners in second language (L2) education, it is difficult to draw conclusions from primary studies conducted independently by following and reading each study to guide their daily instructional practices. Quantitative and qualitative systematic reviews (i.e., meta-analyses and meta-syntheses, respectively) have offered a solution to this practical problem. On the one hand, meta-analysis studies are quite common in some fields of study (e.g., medicine, nursing, L2 education) (Zhang, 2023) as corresponding professionals in these areas (i.e., physicians, nurses, and language teachers) value informed and evidence-based practice by considering the results of empirical research. These studies allow researchers to calculate a shared effect size for multiple quantitative studies carried out on the same topic. On the other hand, meta-synthesis studies help researchers to analyse the results of primary qualitative studies to decontextualise and make sense of them from a broader perspective. In language instruction, for instance, teachers who want to make informed decisions about what approaches, methods, techniques or tools to use to address a particular instructional problem can use the results of both meta-analysis and meta-synthesis studies. While meta-analysis studies ensure breadth of knowledge, meta-synthesis studies provide depth of understanding on a given topic.

A meta-synthesis is a type of systematic review study which analyses the results of studies that involve the collection, analysis and reporting of qualitative data. According to Afshari et al. (2024), it involves "integrating the results of studies, re-understanding the findings, and ultimately interpreting them to generate new insights beyond what is obtained from individual studies" (p. 1). Although individual qualitative studies ensure depth of knowledge, they lack breadth of knowledge; meta-

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synthesis studies add breadth by incorporating data from many studies (Afshari et al, 2024). In this respect, these two types of studies can complement each other by providing complementary data.

While decontextualising primary studies appears to be a downside of meta-syntheses, they provide theoretical perspectives that could represent the results of multiple studies. In this way, according to Finfgeld-Connett (2018), it allows the results of primary studies to be generalizable beyond the study sample, and it enables us to understand what shared experience people might have on a social phenomenon or how their experience differ, thereby pinpointing divergent issues (Aguirre & Bolton, 2014). Qualitative synthesis studies are critical in that they help identify gaps in research about a particular topic.

Approximately two decades ago, Zimmer (2006) voiced her concern over meta-synthesis studies, on the grounds that a key feature of qualitative research is the uniqueness of the context in which it is conducted and that analytic mixing of results from many studies might violate basic assumptions of qualitative research. She further added that meta-synthesis studies involve a reductionist perspective in terms of generalizability, and this runs counter to the basic principles of the interpretivist approaches that qualitative studies value. However, the current scholarly community considers meta-synthesis a valuable tool that enables practitioners to make informed decisions. As Afshari et al. (2024) note, given the vast amount of research in the knowledge society, there is a need for producing a synthesis of research results and offering novel interpretations based on them.

However, although meta-synthesis studies are getting more and more popular (in parallel with the massive upsurge in qualitative research), qualitative synthesis studies vary a lot, not only in terms of their quality but also in terms of the way they are conducted (Cahill, et al., 2018). Current research also supports this. For instance, France et al. (2014) examined 32 meta-synthesis studies to evaluate their overall approach, aims, synthesis processes, how they analysed data from primary studies and to what extent they offered novel interpretations. The results indicated that the studies suffered from various critical methodological issues, including a mismatch between the research approach and the aim of the studies (in 13% of the papers), failure to follow the principles of meta-synthesis (in 66%), failure to describe how the analytic synthesis was carried out (only one paper [3%] clearly described how the analytic synthesis was carried out), and more than 30% of the studies failed to cite key papers on meta-synthesis. France et al. (2014) concluded that because the way methods, synthesis and results of meta-synthesis studies are reported are far from being clear and comprehensive, it is difficult to judge the rigour and credibility of these studies.

Besides the critical issues of methodological appropriateness and rigour, excessive amount of data available in qualitative research reports is a challenge that should be overcome by researchers who carry out meta-syntheses; it is usually difficult to manage, analyse and interpret many results from primary studies. Therefore, researchers often use qualitative data analysis software (Taylor et al., 2016), which is commonly known as computer-assisted qualitative data analysis software (CAQDAS for short) in meta-synthesis studies. Leading CAQDAS includes, but is not limited to, NVivo, ATLAS.ti, MAXQDA and QDA Miner, and more and more software is being developed (Zamawe, 2015) every year. Such software programs, according to Gibbs (2018/2024), not only facilitate analysis but also help manage all the materials (i.e., qualitative articles) in a particular project. CAQDAS provide researchers with the following benefits: (a) It helps researchers organise all the data in a single place and easily access it (Gibbs, 2014). (b) It allows researchers to import various types of data (e.g., textual, audio, video) (Basett, 2010; Gibbs, 2014) or in different formats (e.g., word/pdf documents, plain text files, spreadsheets etc.). c) It is very easy to code and retrieve the coded data (code and retrieve function). d) It offers advanced search queries (text search, word frequency search etc.) (Tracy, 2024). (e) It offers tools for analytic reflection that could guide the whole process of data analysis and writing up. As Udo and Stefan (2019) note, CAQDAS can be used as a toolbox that offers researchers what they need for their preferred method of analysis. Due to all these functionalities that CAQDAS programs offer, they might be a viable tool in meta-synthesis studies.

In sum, given a lack of knowledge about and proper practice in qualitative meta-synthesis, which is a valuable and popular research tool, the aim of the present study is twofold: (1) to provide an overview of the basic features of a meta-synthesis and (2) to discuss effective strategies for using NVivo, a useful qualitative data analysis software program, as a practical tool to facilitate a meta-synthesis, with a specific reference to L2 studies. Therefore, the present study can inform L2

researchers about how to carry out high quality meta-synthesis research, particularly by using CAQDAS.

META-SYNTHESIS STUDIES

A meta-synthesis provides a critical overview of the results produced by a group of systematically selected (sampled) studies. Both qualitative studies and qualitative strands of mixed-methods studies can be sources of data for meta-synthesis studies. It should be noted that, although some researchers use the terms "review" and "synthesis" interchangeably, synthesis involves much more than what is done in reviews. This is because a synthesis, according to Campbell et al. (2011), should involve extraction of data from primary studies and re-evaluating them. Moreover, while some authors (e.g., Harb & AlAzzam, 2023; Saini & Shlonsky, 2012) make a distinction between aggregative or interpretative approaches to meta-synthesis, current conceptions of this methodology overwhelmingly stress the importance of re-interpretation. In other words, adopting an interpretative lens in meta-syntheses is of utmost importance because, as Aguirre and Bolton (2014) state, the aim of an "interpretive qualitative meta-synthesis is not to generate a systematic review, a literature review, or quantify qualitative data, but to create a synergy of qualitative findings" (p. 283).

L2 research has recently experienced an upsurge of qualitative systematic reviews, particularly meta-syntheses on a variety of topics. Some of the recent studies include, but are not limited to, the use of technology in instruction (Cuocci et al. 2023; Koç & Savaş, 2024a; Koç & Savaş, 2024b; Özer & Akay, 2023), teaching language skills (Salman & Yanpar-Yelken, 2024; Taherkhani & Gholizadeh, 2023), curriculum design issues (Yedigöz-Kara & Bümen, 2022), language use in educational settings (Yıldız, 2021) and issues related to teacher education (Baysal & Bümen, 2021; Ng & Cheung, 2021; Uysal and Savaş, 2021; Toronyi, 2020). These studies can function as a model, especially for researchers who are new to qualitative meta-synthesis.

Key Issues in Conducting a Meta-Synthesis

Originality

Researchers who conduct meta-synthesis studies claim that thematic syntheses make a third-level interpretation, meaning that they offer more than a mere summary of their results (Lachal et al., 2017). In other words, the authors of meta-synthesis studies are expected to synthesize data from various studies and come up with authentic interpretations about the results of earlier studies. In this regard, meta-syntheses differ from other systematic reviews (e.g., narrative reviews or scoping reviews).

According to Margarete and Barroso (2007), supporters of qualitative paradigms claim that the nature of qualitative research hardly lends itself to synthesis. This might be due to contextual differences and the uniqueness of experience in social situations. The central role that interpretation holds in qualitative research seems to support this perspective as it would be difficult to synthesize various interpretations. However, although contextual factors might differ a lot, it is possible to find some shared patterns across different studies carried out in their own unique contexts as humans might have similar experiences and thoughts. In other words, while interpretation is subjective in its nature, it is also possible for different individuals to interpret phenomena in similar ways or arrive at an agreement in interpretation, which is commonly referred to as intersubjectivity (Schwandt, 2007), due to shared ways of thinking. Moreover, as meta-syntheses are a type of qualitative research, objectivity might not be possible, or even desirable, because researcher subjectivity is considered "as a natural and unavoidable part of any research, from design to data collection, to analysis, to the final write-up and sharing of the report" (p. 136) in the qualitative paradigm. Given (2016) supports this by highlighting that those who criticise qualitative inquiry for its being too subjective are aware, neither of "the nature of qualitative research" nor "the differences between subjectivity and objectivity" (p. 8). Cross-case comparisons help researchers to understand how experience of a phenomenon converges and diverges across different contexts. When used in combination with results from primary quantitative studies and with those from meta-analyses, synthesized data can inform practice in L2 contexts; data from these three can complement each other to produce more rigorous research outcomes.

Transparency and systematicity

As it is with qualitative research in general, major criteria regarding rigour, credibility and transparency should also be applied to a meta-synthesis study. Such a study should provide thick description by transparently elaborating on all the steps followed while doing the study. Explaining all the steps in detail (particularly the research questions, sampling and data analysis) ensures replicability of the findings. Researchers have to make it clear to the reader what decisions they made, how they sampled the articles to be included in the study (inclusion and exclusion criteria), what method they used to extract data from the articles, along with giving information about other details of their analytic journey. The synthesis report should include both the voice of the authors of primary studies and that of the authors (of the meta-synthesis study) themselves, and procedures should be explained clearly. For instance, Cuocci et al. (2023) provide thick description of what procedures they followed in their meta-synthesis study on technology-supported peer feedback in ESL/EFL writing classes. They clearly explain the steps involved in searching the literature and provide a set of criteria they used for initial screening.

As its name suggests, qualitative meta-synthesis is a qualitative endeavour, meaning that it can benefit from Tracy's (2010) the eight "big tent criteria", particularly from the criteria of credibility and rich rigour. Transparency is one of the components of credibility in qualitative research, so ensuring transparency not only increases the credibility of a qualitative meta-synthesis but also ensures its replicability. Replicability itself can also boost the credibility of a research study in turn. To ensure transparency in a qualitative meta-synthesis, researchers need to provide rich information (thick descriptions) about the following points:

(a) The evolution of the purpose and research questions in a qualitative study.
(b) The exclusion and inclusion criteria for selecting the sample in the study (Some studies are included in the study as they meet a set of pre-determined criteria, including but not limited to, research design, sample, and quality, while others are excluded based on the same set of criteria.)
(c) The data extraction and coding processes used in the study (In this respect, it is important to provide a sample coding framework, with sample codes, inclusion and exclusion criteria, and exemplary quotes).
(d) Provide thick description of the methods used for analysis and synthesis.

Sampling procedures

A key aspect of the sampling procedure in meta-syntheses is that it should be transparent and replicable. In other words, researchers are expected to elaborate on how they have selected the studies that constitute the sample in their studies. This means that they must clearly explain the inclusion and exclusion criteria they used for selection, the databases in which they performed the search, along with the search strings used for the queries. In this respect, it is customary for researchers to provide the exact search strings they used to carry out the research, the databases they used and the time of searching. Following a fully validated framework, such as Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009) or enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) statements (Tong et al., 2012) during sampling, data extraction and reporting could help increase the rigour and transparency of meta-synthesis studies. Recent studies in L2 research (e.g., Hughes, et al., 2022; Maravilla, et al., 2023; Koç & Savaş, 2024a, 2024b) usually use such criteria as a benchmark to increase the credibility of their findings. For instance, in their study on the artificial chatbots in language learning, Koç and Savaş (2024b) used PRISMA as a framework for selecting the studies to be synthesized; studies in L2 research often illustrated the sampling process in a flowchart clearly (e.g., Figure 1).
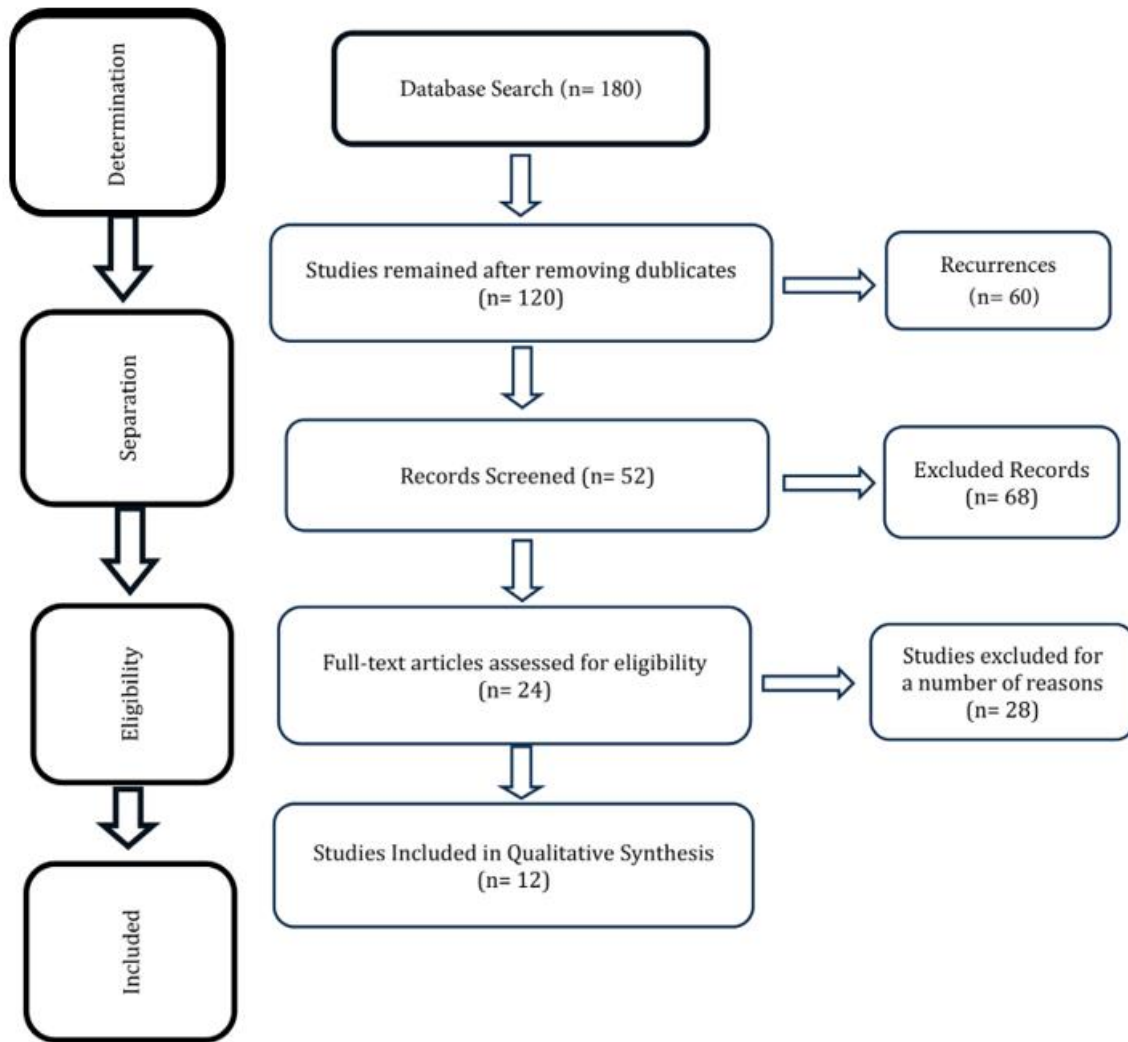
Figure 1. A Sample Flowchart Illustrating the Sampling of the Studies (Adopted from Salman & Yanpar-Yelken's study on Improving English Speaking Skills as a Foreign Language)

USING NVIVO IN QUALITATIVE META-SYNTHESIS STUDIES

Today, it is common to use technology to perform various tasks during data collection, analysis and reporting in research. Computers have been used in qualitative data analysis for approximately half a century, with early attempts being limited with software prepared for individual people with specific purposes in mind. Computer-assisted qualitative data analysis is defined as "the use of computer technology to code text, identify key phrases, perform content analysis, and retrieve coded sections of text" (Saini & Shlonsky, 2012, p. 176), and the software used for this purpose is computer-assisted qualitative data analysis software (CAQDAS). CAQDAS comes with its own strengths and weaknesses. For instance, while some software programs work well with visual data (e.g., Transana), other programs are more appropriate for texts (e.g. NVivo, QDA Miner) (Onwuegbuzie et al., 2012).

Being a CAQDAS program, NVivo (Lumivero, 2023) can help researchers speed up data analysis and the writing up of the results in meta-synthesis studies and increase their quality by fostering analytic thinking and reflexivity. NVivo facilitates indexing of data (coding), offers advanced text search features using Boolean operators and allows visualisation of data in different ways. Moreover, it can facilitate interpretation by providing a global outlook on the data and enabling them to compare the data (Ludvigsen et al., 2016). NVivo can also team up with bibliographic data management software. Once the relevant studies are identified, the data is imported into NVivo for

coding, analysis and synthesis to offer interpretation and generate a theory. NVivo offers several key tools with various functionalities in a meta-synthesis study (Table 1). However, most of these studies did not use CAQDAS in their analysis, which might imply that CAQDAS, particularly NVivo, is currently not widely used in L2 research. The sections that follow elaborate on how NVivo can be of help in qualitative meta-synthesis studies.

Table 1. Tools and Functions of NVivo in a Meta-Synthesis Study

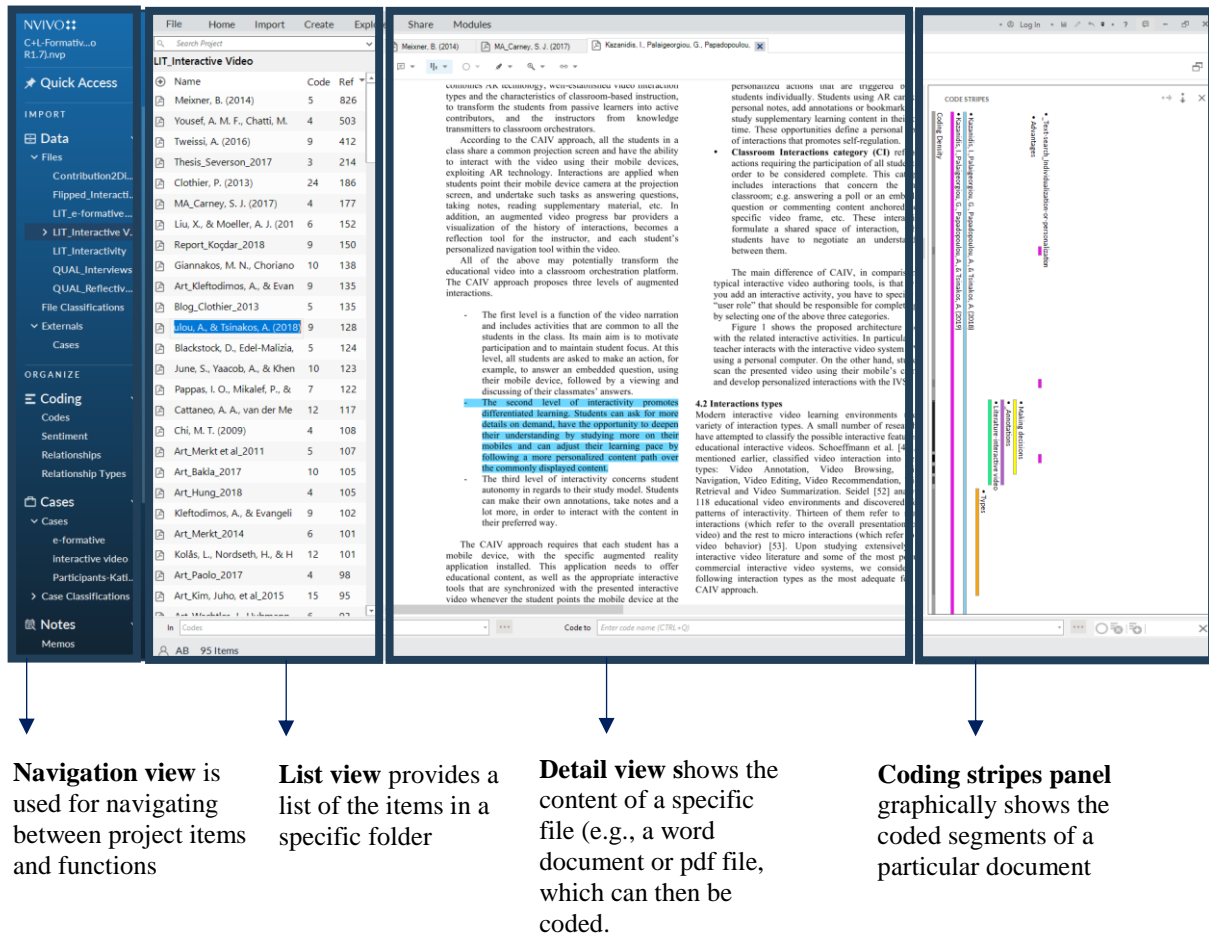| Tool	Function	The Use of the Tool in Meta-Synthesis
Data Organisation	Qualitative studies in various textual formats can be imported into the software and organised.	Primary studies to be analysed can be imported into the software, dynamically grouped (using dynamic sets) and organised in folders.
Coding and retrieving	Textual data (the results of primary studies) can easily be coded, particularly by using drag-and-drop coding.	The results of primary studies can be coded; the coded units can be checked and revised.
Querying	Conducting several key searches (text query [using Boolean operators and proximity search], word frequency query, coding query and matrix coding query)	Search tools can help ensure completeness of coding, with no key result being left out.
Writing Annotations and Memos	Creating notes on specific project items or their content in the form of annotations (in-document notes linked to particular text segments) or memos (text files linked to text segments or entire files).	The researcher can take reflective notes about the results of the primary studies, codes created out of them and possible interpretation to promote reflective thinking during analysis.
Framework Matrix	Researchers can prepare a table with research studies and their results in spreadsheet format.	Researchers can examine research results in a table and make within-case and cross-case comparisons in a comfortable way.

Organising Data Effectively

NVivo helps organise, manage and analyse qualitative data (Creswell & Poth, 2018; Woolf & Silver, 2018) in a literature review, qualitative data analysis or meta-synthesis. It allows researchers to create nested folders so that they can organise their cases (i.e., the qualitative articles to be synthesised) in the most effective way. It is quite practical to create folders and populate them with articles to be read, coded, and retrieved. Moreover, NVivo supports the importing and analysis of various data formats, including, Word documents, PDF files, text documents, images, audios and videos. It is also possible to import data from bibliographic data management software to create file classifications of the cases, so that the researchers can carry out operations (e.g., running a text search query only on articles published before/after a particular year or in a particular time span) based on the features of the cases. Globally considered, NVivo functions as a useful gadget that organises all the data and analysis (Figure 2).

NVivo facilitates the coding process in a qualitative meta synthesis as well. As coding is a frequent activity in qualitative synthesis, a user-friendly coding process and coding structure could ease the burden involved. It is possible to begin coding from scratch and create codes on the go. NVivo allows coders to create codes with multiple levels (i.e., codes, parent codes, child codes, etc.) and perform additional operations on them, such as searching, moving, deleting or merging. It is possible to neatly store all the analytic and thematic codes, along with codes created for reviewing the literature, in one place. Researchers can take notes (i.e., as annotations) directly within the cases or

codes, or they can store their analytic notes as memos. Such flexibility in creating codes and recording analytical thoughts on the coded data to promote reflexivity during the analysis.

Navigation view is used for navigating between project items and functions

List view provides a list of the items in a specific folder

Detail view shows the content of a specific file (e.g., a word document or pdf file, which can then be coded.

Coding stripes panel graphically shows the coded segments of a particular document

Figure 2. The User Interface of NVivo

Moreover, all the memos about the studies, coding, and analysis are stored in a single folder for easy access. It is also possible to connect a memo to a particular case or item in the project. Similarly, all the annotations are stored in a single folder, yet researchers need to open each case to see the annotations they wrote on that case. If they wrote annotations on 15 different articles in the meta-synthesis within the cases or codes, then they must open each to read the annotations for this. This is impractical because it is time-consuming to open files one by one. More importantly, it is not possible to code the annotations based on their content or purpose. Therefore, it is recommended that researchers code the annotated sections to an analytic code named "Annotations" with child codes (Figure 3). In this way, it becomes quite easy to review a set of annotations on a particular aspect of the project.

Codes					
Name ▲ ⊖		Files	References	Created on	Created by
_ANALYTIC CODES		0	0	25-Jun-20 15:56	KAB
_Annotations		77	248	25-Jun-20 15:56	EB
_Potential Quotes		25	38	25-Jun-20 15:56	AB
_Text-search_Automatic assessment		20	65	25-Jun-20 15:56	EB
_Text-search_Individualization-or-personalization		64	231	25-Jun-20 15:56	EB
Additional search terms		3	3	25-Jun-20 15:56	EB
ALTERNATIVE_Innovation effect		11	28	25-Jun-20 15:56	EB
Background		1	6	25-Jun-20 15:56	AB
Initially boring - now ok		5	5	25-Jun-20 15:56	AB
Weaker background		3	8	25-Jun-20 15:56	AB
Detailed search=Element of joy		23	46	25-Jun-20 15:56	EB
If-then		5	6	25-Jun-20 15:56	EB
Listening-comprehension		44	291	25-Jun-20 15:56	EB
Negative Case Analysis		19	37	25-Jun-20 15:56	KAB
Global Opinion		16	19	25-Jun-20 15:56	EB
THM_Discernible Improvement as a stimulus for learnin		0	0	25-Jun-20 15:56	EB
Linguistic Progress		0	0	25-Jun-20 15:56	EB
Raised Awareness		6	15	25-Jun-20 15:56	AB
THM_Interactive components for timely feedback		16	24	25-Jun-20 15:56	AB
Immediate feedback		33	46	25-Jun-20 15:56	AB
Jump feedback		9	36	25-Jun-20 15:56	AB
THM_Learning through meaningful input	⊖	0	0	25-Jun-20 15:56	EB
Comprehensible speech		8	14	25-Jun-20 15:56	AB
Enhanced Enjoyment		13	18	09-Jul-20 14:37	AB
Increased Motivation		8	14	25-Jun-20 15:56	AB

Figure 3. A Sample Coding Structure in NVivo

Note. This coding framework was adopted from the NVivo analysis file created in a qualitative study on interactive videos in second language listening comprehension, carried out by Bakla and Demiröz (2024); some procedures (e.g., coding, reflective thinking, writing memos etc.) remain the same in primary studies and meta-syntheses as both involve qualitative coding and analysis.

Coding and Thematising

The results of primary studies are reported in the "results" section and discussed in the discussion. The data in these sections are coded and analysed just like the data from qualitative interviews or observations. The themes that the researchers create during the data analysis in meta-syntheses are the results of the synthesis (Lachal et al., 2017). Qualitative syntheses involve a lot of coding of the results produced by primary studies. The researchers get familiar with the data before they can successfully synthesise data and create themes. Data coded in NVivo can be used for complementing analysis done using word processing or spreadsheet software. For instance, Wong (2012) used NVivo as a machine-readable filing system with many papers to test theories by providing rich data that could support what is coded in cells in a spreadsheet they created. They found it easy to use NVivo for coding data from the papers they synthesized; the extracted data in NVivo provided food for thought during team discussions and the write-up phase.

Margarete and Barroso (2007) warn against taking quantitative meta-analysis as a guide for carrying out meta-synthesis studies. This warning is easily justified as the nature of two paradigms differ greatly. In this respect, quantification (i.e., counting the occurrences of particular words, phrases etc.) does not go well with meta-synthesis studies as it is different from combining the results of primary studies in a systematic way (Aguirre and Bolton, 2014; Margarete & Barroso, 2007).

Using Text Search Queries

One of the handiest tools that NVivo offers while working with textual data is the text search query feature. The text search query is an advanced tool that allows researchers to use not only Boolean operators ("AND", "OR" and "NOT") but also additional features to control the scope of their queries. A particularly useful feature is near (i.e., proximity) search tool, which enables researchers to look for two independent words occurring in the same context. For example, if a researcher wants to examine the contexts in which how the words "students" and "video" are mentioned in a set of qualitative articles on flipped learning in language learning, he/she could use "video" as the search term, but the results will be too many to review quickly because it will bring all the occurrences of the search term. To see how the two words above appear together in a single context (e.g., within 15 words), a proximity search in NVivo can be conducted by adding a limitation about the context. The use of asterisk in words in the second search string in Figure 3 is intended for including the plurals of these words (i.e., students and videos) or any other word derived from the words in String 1 (Figure 3).

Search String 1: "student video" ~15

Search String 2: "student* video*" ~20

Figure 3. Sample Search Strings for Near (Proximity) Text Search in NVivo

The text search query can be used before a meta-synthesis is carried out, particularly while finding a worthy topic (another criterion in Tracy's [2010] eight big tent criteria). It is important to justify and provide the rationale for conducting a study. Literature can help justify a study and provide the rationale for it. It is important to find the gaps in knowledge to identify the topic of the meta-synthesis by using a phrase search (with inverted commas) or proximity search. In this respect, the synonyms of the phrase "further research" can be searched in a set of research papers (Figure 4) by using the Boolean operator "OR".

A Search String for Phrase Search*:

"further research" OR "prospective research" OR "future research" OR "more research" OR "additional research" OR "future researchers" OR "prospective researchers"

A Search String for Proximity Search:

"further research" ~15 OR "prospective research" ~15 OR "future research" ~15 OR "more research" ~15 OR "additional research" ~15 OR "future researchers" ~15 OR "prospective researchers" ~15

Figure 4. Sample Search Strings for Finding Gaps in Knowledge

Note. Additional synonymous phrases can be added to these search strings.

As qualitative synthesis studies typically integrate a huge amount of qualitative data, using text search queries can also enable researchers to check if coding is complete. For instance, it could be useful to run word frequency queries to identify the most frequent words across each code or theme (provided that the codes and themes are rich in content), which then could be used for checking the completeness of the coding. This procedure ensures that the researchers do not miss any content related to a specific code or theme, and it can further be supported by reading and manual coding.

Another useful technique used for ensuring the completeness of coding is the use of a compound query, which helps identify (a) text coded to two or more codes or (b) text coded to Code A but NOT Code B or vice versa. This query is intended for comparing the contents of codes. It is

particularly useful when, for example, researchers want to find instances of the word *assignment** accompanied by the word "flipped" in the same paragraph across the data. This query also allows for finding the same word (assignment) in a text that is coded in multiple (usually two) codes. For example, it finds the word "assignment" in paragraphs which are coded at the codes "out-of-class work" and "student performance". This query can help find the relationship between the codes in question as coders can identify "simultaneous coding" (also known as "overlap coding or double coding"), which is defined as "the application of two or more different codes to a single qualitative datum or the overlapped occurrence of two or more codes applied to sequential units of qualitative data" (Saldaña, 2009, p. 62). This type of coding also helps pinpoint specific words that have been missed although they were relevant to a particular code (Bazeley & Jackson, 2015). Similarly, text search queries can be used to make interpretations and draw conclusions based on data by reviewing each instance of a particular search string.

Using Reflection Tools to Increase the Depth of Analysis

A qualitative meta-synthesis study is more than the sum of the individual primary studies analysed in it. It is characterised by a process of analysis which involves analytical thinking and reflexivity while analysing the studies and writing up the results. NVivo offers several key features that can help researchers deeply reflect on what they are reading.

A fundamental activity in qualitative meta-synthesis studies is writing memos to create just-in-time records of theoretical ideas, insights, assumptions, and hunches. Memoing is so central to meta-synthesis studies that Finfgeld-Connett (2018) considers it a data analysis method as a substitute for detailed coding as the latter leads to too much decontextualization of the data from primary studies. NVivo directly supports this activity as it offers a tool with the same name (Memos). A memo is a text document in NVivo in which various notes are taken to create timely records of reflections about the project, literature, analysis, methods, results and so forth. It is not different from a typical text document in terms of its digital properties, but the way it is used in qualitative studies is so central. Normally, in qualitative research projects analytic memo writing begins right at the outset of the study (during research design or data collection). The main purpose of memo writing is to promote analytical and reflective thinking during data collection, analysis and reporting.

It is highly advisable to use two different types of memos. The first is a project memo that can be considered as a part of the audit trail of a project as it includes anything related to the project, including but not limited to, notes on how the project began, objectives of the study, development of research questions over time, search strings used in queries, problems experienced during the process and (suggested) solutions for them. There might be more than one project memo (e.g., a memo for recording methodological decisions and issues or another for recording notes on the results of individual primary studies). The second is a memo associated with a particular case (e.g., primary research articles or their sections). This type of memo can be written about any part of a primary study. Another categorisation of memos was made by Finfgeld-Connett (2018) in theory-generating meta-syntheses: within-study memos versus cross-study memos. While within-study memos are concise descriptive statements providing an overview of the results of primary studies, cross-study memos offer a synthesis of within-study memos conducted by comparing within-study memos. The framework matrix tool in NVivo is highly appropriate tool for making within-case and cross-case comparisons. More information is provided about this tool in the next section.

Framework Matrices for Synthesising Studies

A framework matrix is a table that appears like a spreadsheet with individual studies usually listed as rows and codes (e.g., purpose, methods, participants, data collection, results, implications, future research) as columns. Because numerous studies are read and coded in a meta-synthesis, organising data from many studies usually proves challenging. Framework matrices can be used to summarise and synthesise studies (e.g., the main results and pedagogical implications) for the literature review sections of quantitative or qualitative studies. In qualitative meta-synthesis studies, framework matrices can be used for preparing detailed representations of research findings. This tool allows researchers easily organise an overwhelming amount of textual data (results of primary studies) in large-scale meta-synthesis studies.

The cells can be automatically populated by using the "autosummarize" feature or the researchers can manually enter summary data into each cell. To be able use the autosummarize feature, the cases have to be read and coded before they can be automatically transferred to the cells in the framework matrix (Figure 5). To combine memos, coding and a framework matrix in a qualitative synthesis, the steps below can be followed.

Step 1: Read the results of each individual study and create a memo linked to each study.

Step 2: Take down within-case analytical notes summarizing and reflecting on the results of individual studies.

Step 3: Code the analytical notes (memos) by creating relevant codes, usually from scratch. *A priori* codes can also be used but they should evolve a lot during the synthesis. The purpose of coding is to categorise the findings from individual primary studies and the researcher's reflections on them to be able to compare them.

Step 4: Turn the individual studies into cases by using the command "Create as cases".

Step 5: Create a framework matrix by adding codes to columns and cases to the rows. Once the cells are automatically populated by using the "autosummarize" tool, a spreadsheet is created. Examining a column makes it possible to make cross-study comparisons, while examining the rows allows within-study comparisons.

Figure 5. A sample Framework Matrix to Be Populated Using the "Autosummarize" Function

It is possible to compare the results of studies by writing codes and reflections to a spreadsheet program, but the use of NVivo offers several benefits over spreadsheets in this respect. The first is the ease of coding. The analyst can use drag-and-drop feature to create codes and do further coding. More importantly, the coded textual are not separated from their contexts, which are of utmost importance in meaning-making processes. Any coded material can easily be traced back to the article where it is originally located. This helps eliminate the risk of making fully decontextualised interpretations. Finally, it is much easier to work with individual cells in a framework matrix, particularly when the content of an individual cell is too much to be seen on the screen at a time. NVivo automatically adds a scroll bar to the right of the cell, which can comfortably be used for scrolling up and down while reading the content.

Writing Annotations

Another useful reflection tool offered by NVivo is the annotation feature, which allows researchers to jot down just-in-time notes attached to parts of texts, images, audios, or videos. The annotation tool is particularly useful as researchers can record their thoughts and ideas about a word, phrase, sentence or a larger unit in a text. Annotations can fulfil various functions. For example, to provide information about his analytic journey during data collection and analysis, Bakla (2018) provided a table which explained the purposes of the annotations written during the data analysis. He mentioned the following purposes for writing annotations: "to call for deeper analysis, to point to contradictions, to identify intervening variables, to help test alternative interpretations and to provide material for the written report of the research" (p. 24). In short, they can be written on anything to promote reflective thinking during the synthesis.

Teamwork in Meta-Synthesis Studies

Because a meta-synthesis study not only entails a lot of hard work but also has to be completed in a particular time frame (Margarete & Barroso, 2007), researchers do teamwork to ensure faster and higher quality analysis. Another key reason why teamwork is recommended is that researchers with different expertise might be needed to complete a meta-synthesis study. To offer a theoretically oriented interpretation, it is essential that researchers possess expertise in the field of study in which the meta-synthesis is conducted. This is also essential for improved quality in research outcomes.

With NVivo, researchers can record the details of their work for their colleagues. Project memos, memos associated with individual cases in the data, annotations, hyperlinks, see-also links, codes can function as the audit trail of a meta-synthesis study. NVivo can store data about each iteration of analysis and coding. Anyone who examines these can follow the evolution of thoughts during the synthesis. As NVivo stores all the data (articles), coding, reflective notes and possibly some of the interpretations in one place, it is easier to ensure transparency of the data analysis, synthesis, and reporting. Moreover, by using coding comparison queries, researchers can compare their coding to investigate to what extent they agree or disagree in their coding. The percentage of agreement/disagreement and Kohen's Kappa statistic could be calculated by using this query to achieve higher inter-coder agreement levels. However, as qualitative synthesis is interpretative, it might be unreasonable to expect reviewers to achieve higher Kappa values. This idea has long been supported by some researchers (e.g., Vaismoradi et al., 2013; Yardley & Marks, 2003), who claimed that the more interpretative a qualitative study gets (e.g., in thematic analysis rather than in content analysis), the less relevant it is to seek agreement between individual coders in that study.

If researchers assume different responsibilities during coding and analysis, all these analytical tools can help them appreciate what other team members are doing and thinking during the process. This apparently helps prevent producing an incoherent narrative by multiple researchers working independently on the same dataset. As Wong (2012) notes, a different group of researchers can make different theoretical interpretations, yet it is important to provide a transparent account of meaning-making processes during the synthesis.

Barriers Against and Challenges Involved Using NVivo in Meta-Synthesis

There are several barriers against successful use of NVivo in qualitative data analysis in general and in qualitative meta-synthesis in particular. Firstly, most CAQDAS programs, including NVivo, are paid tools; it might be costly for some researchers, particularly for those in developing countries. Secondly, researchers have to allocate some time and effort to learn how to use NVivo for analysing qualitative data (Duff, 2008). Thirdly, it might not be appropriate for researchers who are not digitally minded. Moreover, some researchers might not prefer to learn to use this software unless they intend to use it for multiple research projects. Moreover, some researchers might hope that the software does the analysis itself; however, it should be noted that CAQDAS does not do the analysis for the researcher (Dörnyei, 2007; Tracy, 2024). It is obviously a misconception that analysis will be carried out by the software itself. To further explain this fact, Tracy (2024) stresses that CAQDAS does not analyse data on its own just as MS Word software does not write anything on its own. However, researchers with such expectations might get disappointed with what they get out of the

software during analysis. Therefore, it is essential that researchers should understand the functionalities offered by NVivo and other CAQDAS programs.

Besides such apparent barriers, there are some challenges or issues involved in using NVivo in qualitative meta-synthesis studies. As it is quite easy in NVivo to code and retrieve the coded texts, researchers might tend to code excessively or unnecessarily, creating a long list of descriptive codes with little or no interpretation. Coffey and Atkinson (1996) call this "coding fetishism" (cited in Barbour, 2018/2024, p. 152). Richards (2021) considers coding "a trap to researchers" and notes that "its danger is far greater with software" (p. 137). This is a significant issue in meta-synthesis because interpretation is a key aspect of coding the results of primary studies. This is because, as noted earlier, a meta-synthesis study is usually considered more than the sum of all the studies it is produced from; it offers new theoretical outlooks based on what is already presented in primary studies. Too much focus on coding can be a barrier against this. Secondly, researchers try to find patterns in the data, possibly overlooking meaning; this leads to getting away from the data and failure to appreciate what it says (Andrews, 2014). Richards (2021) suggests several strategies to avoid this problem including, but not limited to, (a) doing all coding efficiently, and if possible, automatically, (b) establishing a balance between thematic and analytical coding, (c) combining coding with thinking, and (d) stopping coding when it gets boring and revisiting it later (pp. 137–138). Qualitative researchers are recommended to consider these issues and challenges to be able to conduct successful meta-syntheses.

CONCLUDING REMARKS

The present study aims to provide an overview of meta-synthesis and how NVivo can be used to facilitate and improve the quality of it. It discusses basic issues related to the process of meaning-making and theorizing by using the results of primary research studies.

The way researchers code data or conduct queries (text search, word frequency, compound etc.), along with the way they use reflection tools in qualitative meta-synthesis, hardly differs from how they do them in regular qualitative analysis. What changes is the purposes that researchers have in mind while performing such tasks. In qualitative synthesis, researchers extract data and use it to create a theoretical outlook. They later use the extracted data to support their theoretical findings. They conduct cross-case analyses to be able to produce a shared interpretation for the cases included in the study. However, as Margarete & Barroso (2007) stress, due to the diversity of practices in conducting and writing up the results of qualitative research, conducting meta-synthesis is a challenging task. Therefore, it makes sense to use NVivo, to organise the project and do some additional activities like conducting queries on the data. NVivo can help organise the sheer amount of verbal data produced in primary qualitative studies. In this way, it increases the depth of the synthesis. Because the use of technology in instruction and research is quite common in L2 acquisition, L2 researchers can also benefit from using CAQDAS in their research studies.

With its handy tools that facilitate the organization of the primary studies and their results, NVivo also promotes reflection, which is fundamental to the whole synthesis journey. However, it should be noted that although NVivo (or other CAQDAS tools) can be highly useful while analysing and reporting data, it can hardly substitute for the expertise in qualitative research and research synthesis. NVivo can help L2 researchers mostly mechanically during the processes of reading the articles, coding data, recording insights, creating themes and reporting results. Therefore, thinking and theory generation rest with researchers. To do this, however, researchers must not only be knowledgeable about carrying out scholarly research in general and L2 research in particular, but they must also be adept at qualitative data analysis and reporting.

A particular challenge in qualitative research is that it is difficult for younger and less experienced researchers to find good models (e.g., articles with clearly written methodology and results sections) to follow while carrying out procedures in data collection and analysis in qualitative research. This equally goes for qualitative synthesis studies. The present paper provides just an overview of both qualitative meta-synthesis and the use of NVivo to conduct it. Therefore, qualitative researchers who conduct meta-syntheses can write practical papers which explain and further illustrate

the steps involved in carrying out a meta-synthesis study done using NVivo, with a particular focus on coding and interpretation. Similarly, as there are quite a few other CAQDAS programs (e.g., MAXQDA, Atlas.ti, QDA Miner, Dedoose, HyperRESEARCH) available on the market, researchers can write practical papers that explain how these software programs can be used for carrying out meta-synthesis studies. Moreover, prospective researchers doing L2 research could carry out meta-synthesis studies in a variety of different topics related to language education. Pinpointing topics in L2 research for meta-synthesis is not addressed in this paper as it is beyond scope of it. However a particularly useful strategy for finding a topic that could lend itself well to qualitative meta-synthesis would be to examine bibliometric studies, which provide a map of available research on a specific topic and reveal emerging research trends. This could enable future researchers to pinpoint where there is a need for further analysis of qualitative data from primary studies.

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