Improving Research Practices through User Insights of Qualitative and Mixed Methods Data Analysis Technology

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***T**his study examined current social science qualitative and mixed methods research practices in the adoption and use of data management and analysis technology with three questions: 1) who uses technology for qualitative and mixed methods data analysis? 2) what can be learned by knowing who these researchers are? and, 3) how might current perceptions inform improvements in future research practices? A mixed methods design encompassed a two-stage process for data gathering. A select group of international experts in the use of technology were recruited. Feedback from the experts informed the refinement of a survey instrument which was distributed to participants representing 29 countries (n=355). Results from the study identified a critical need for the combination of greater technological and methodological support from universities. Such support and advanced research training can enhance our understandings that technological confidence should not be confused with methodological competence. This call for improved methodological training in the appropriate use of digital tools in turn will benefit educational research quality and the teaching of higher education research.*

Keywords: QDAS, Qualitative Analysis, Mixed Methods, Curriculum Reform, Higher Education, Research Methodology

Introduction

In 2016, Salmona and Kaczynski described barriers users often face in deciding to adopt and appropriately make use of qualitative research technology. Yet, little is known about who such users are and how current social science researchers perceive their readiness to overcome these barriers. In this article the authors investigated this issue more deeply to better understand the users of social science qualitative research data management and analysis tools. Related challenges to investigating such perceptions included differences in qualitative and mixed methods researcher competencies and varying levels of technological skills. Accordingly, the study explored three main questions:

1. Who uses technology for qualitative and mixed methods data analysis?
2. What can be learned by knowing who these researchers are?
3. How might current perceptions inform improvements in future research practices?

Outcomes of this research are intended to further higher education curriculum reform and promote advances in professional development for qualitative and mixed methods research methodology.

There have been a number of studies which investigate variation in consumer consumption and adoption of technological innovations. In this study the authors built upon these earlier paths of inquiry and consider two main areas of work. The first investigated the use of technology as a tool to strengthen qualitative data analysis. The second path addressed the broader issues related to the adoption of qualitative data analysis technology supporting mixed methods inquiry. As for the use of technology driven qualitative data analysis, such tools have been used for decades and many have argued that they can be used effectively for a wide range of epistemological and methodological approaches (Dempster, Woods & Wright, 2013; Gilbert, Jackson & Di Gregorio, 2014; Silver & Lewins, 2014; Talanquer, 2013). Others, however, have cautioned that insufficient consideration may be given when software is brought to the qualitative data analysis process (Richards & Richards, 1991) and the impacts technology may exert on the research process (Coffey, Holbrook & Atkinson, 1996; Rodik & Primorac, 2015; Schwandt, 2007). For example, Blismas and Dainty (2003) argued that the use of data analysis technology can have detrimental impacts on the outcomes of research. Their study pointed to two fundamental issues of concern: consideration of "how analytic techniques are influenced by the particular package chosen [and that] computer packages can never replace the intuition of the researcher or need to make judgments." (Blismass & Dainty, 2003, p. 458). This concern regarding researcher limitations in controlling technology has persisted with little indication of fading away. As Silver and Fielding (2008, p.335) described, this worry has persisted for over twenty years as a recurrent myth that software will somehow take over the analysis process. In this study, the authors seek to better understand present day researchers' perceptions of technology for qualitative and mixed data analysis with the goal that such insights will help overcome misconceptions and inform improvements in future applications of digital tools in educational research and the teaching of higher education research methodology.

Background

In this study, the authors contend that even though digital tools are ubiquitous today in qualitative research, there remain researchers holding a negative view on the potential impacts of digital tools in qualitative and mixed data analysis. This may hinder the ultimate quality of social science research. The purpose of this study explored how users assess the value and benefit of adopting new data analysis technology, and how users capitalize on technological features and functionality to strengthen the methodological quality of their work?

This conversation regarding the use of data analysis technology in qualitative and mixed methods research takes place within a broader landscape regarding consumer adoption of any technological innovation. The seminal work of Everett Rogers (1962) viewed the adoption of technology as a process that takes place in differing steps among a taxonomy of propensity groups including: innovators, early adopters, early majority, late majority, and laggards. Parasuraman (2000) and Parasuraman and Colby (2015) advanced this exploration of technology readiness around four dimensions: optimism, innovativeness, discomfort, and insecurity through their Technology Readiness Index (TRI 2.0). From this perspective, optimism and innovativeness characterize individuals which encourage technological adoption, while one's discomfort and insecurity would discourage such adoption. These

classifications provide an ideal set of discriminating factors to examine variation between groups in terms of personal characteristics and how thoughts about incorporating any technology in qualitative inquiry can be better understood in the various population segments.

Mick and Fournier (1998) pointed to eight central paradoxes related to embracing new technology. They suggested that these paradoxes must be considered in understanding any consumer decision making about adopting technology and, if so, how they approach coping with the inherent cognitive and emotional challenges. These paradoxes include: control versus chaos; freedom versus enslavement; new versus obsolete; competence versus incompetence; efficiency versus inefficiency; fulfills needs versus creates needs; assimilation versus isolation; and, engaging versus disengaging. One important question to consider here is how critical and self-aware potential users are regarding their real competency with both technology and research methods.

Aligning degrees of engagement to social science research practices builds upon Mick and Fournier's (1998) paradoxes and framed the scope of this study. It is well known that qualitative data analysis software (QDAS) has been used for decades in both research and educational settings. Indeed, Di Gregorio and Davidson (2008) suggested that the use of such software applications has become a standard in qualitative research. Yet, the expression of epistemological and methodological concerns persists about the adoption and use of such technology.

An analytic lens informed this study which draws upon elements of the widely accepted Technology Acceptance Model (TAM) theory (Davis, 1986; Davis, 1989; Salmona & Kaczynski, 2016; Venkatesh & Davis, 2000). In essence, TAM determines acceptance by first considering user perceptions of usefulness of adopting a new tool and then the user perceptions of ease of use. Expanding on TAM, as a user increases their experience with technology, their resistance to adoption will decrease and perceptions of ease of use will increase. This acceptance of ease of use will also promote "more accurate perceptions of the effort needed to use a system" (Venkatesh & Bala, 2008, p. 282). As applied in this study, TAM offers an analytic lens from which to consider researcher perceptions of ease of use of qualitative analysis technology with increased critical perceptions regarding how such use may offer insights into their research methodology. For this study such a window potentially helps researchers seeking to get the most from technology to make sense of how they are going about adoption and how such adoption may promote methodological quality.

It is also important in this discussion to consider the importance of training as a necessary step in the appropriate use of data analysis technology when conducting social science research. Competence in the use of data analysis technology was highlighted by Kaczynski (2003) and is increasingly recognized as a research skill which aligns with methodological training (Jewitt, Xambo & Price, 2017; Paulus, Pope, Woolf & Silver, 2019; Silver & Woolf, 2015). In this study the relationship of social science research training and data analysis technology training was seen as connected. This connection is commonly recognized by continued adoption of data analysis technology by graduate students and doctoral candidates. Unfortunately, in the authors' experience, university graduate level coursework delivery which integrates data analysis technology training with qualitative research methods and data analysis remains limited. The perceptions drawn from this study of users therefore can offer valuable insights into the role of higher education in shaping and promoting advances in data analysis technology adoption.

In summary, this study expands upon an exploration into two barriers (Salmona & Kaczynski, 2016) to the learning and appropriate adoption of qualitative research data management and analysis technology: 1) perceiving the technology as easy to learn, and useful; and 2) methodological transparency where the researcher can conceptualize the research and understands how the technology is simply a tool to assist in the research. Extending beyond the two barriers, the study considered key issues regarding the use of technology and seeks to better understand how the paradoxes likely to be encountered are managed (Mick & Fournier, 1998). In addition, the study considered perceived transparency (Janz, 2015; Moravcsik, 2014; Wickham & Woods, 2005) and methodological precision (Barbour, 2001; Sohn, 2017; Zhao, Li, Ross & Dennis, 2016) in the context of any technology selection and adoption. Finally, this study discusses how helping users capitalize on the benefits of data analysis can inform improvements in future social science research practices (Di Gregorio, 2012; Moylan, Derr & Lindhorst, 2015; Richards, 2015; Rodik & Primorac, 2015; Roulston & Halpin, 2020).

Study Design

By investigating who uses qualitative and mixed methods technology in research a better understanding may be gained of the alignment of data analysis technology use with social science researchers and the quality of the findings they produce. A better understanding of this relationship can also promote insights into how current social science researchers perceive their readiness to use data analysis technology in their research.

The study was conducted by a three-member research team affiliated with the Institute for Mixed Methods Research; a global network of experienced researchers dedicated to the development and implementation of high-quality mixed methods research and evaluation in social science. [anonymous institute] is committed to modeling the effective presentation and utilization of research and evaluation results. Team members for this study share a wide range of interdisciplinary skills; academic affiliations with three universities, one of which is located in mid-western United States. In addition, the team was able to draw upon their international professional training experience and one member recognized as a software and app development expert.

The mixed methods study design was comprised of a dominant qualitative approach alongside the use of an embedded quantitative survey instrument. This "nested" mixed methods approach (Salmona, Kaczynski & Lieber, p.7, 2020) supported a dominant use of qualitative data while maintaining mixed methods methodological standards of practice. By nesting the use of a standardized quantitative instrument within a larger qualitative inquiry, quantitative findings could be drawn upon to enhance data triangulation (Hesse-Biber, 2010, p. 15). This positioning of the quantitative survey instrument into a supporting role thus assisted in promoting a synergistic emergence of deeper and more complex qualitative insights.

To investigate user perceptions of usefulness, the qualitative study component adopted a pragmatic utilization-focused path of inquiry (Patton, 2015, p. 155) with a flexible emergent design employing a two-stage process (Patton, 2015, p. 50). Stage one, initial data gathering provided valuable input from a select group of targeted international experts in technology use whose feedback and observations informed and enhanced the broader study design. Next, stage two data gathering involved a larger population sample (n=355). This process allowed refinements to a mixed methods online survey instrument which provided input from

both the larger population of technology users and the original panel of experts. For the quantitative component, the researchers used a standardized instrument described in the following section.

Data Collection and Sampling

Qualitative data triangulation was used in this study to further enhance the credibility of the mixed methods study design (Patton, 2015). Additional data sources, listed in Table 1, included interviews, team review of site documents, field notes, memos, and open response data from participants.

Table 1
Data Sources

Data Types	How Gathered	Connection to RQs
Interviews – Stage One	Written and verbal feedback from international experts obtained through interviews and emails	RQ1
Survey – Stage Two	Survey with open-ended questions. Accessed anonymously online, advertised through various Listservs (listed on the following page)	RQ1
TRI Instrument	Accessed anonymously online, advertised through various Listservs (listed on the following page)	RQs 1 & 2
Field Notes	Written by the research team throughout the research process and used as data for the study	RQs 1, 2 & 3
Memos	4 different types of memos were kept by the research team and used as data. These included: design, analysis, reflection and inductive / deductive shift memos	RQs 1, 2 & 3
Site Documents	These documents included training guides for different tools to help understand how different developers design and promote the value of their product. Also, website and marketing materials were used in this study	RQs 1 & 3

In stage one, the draft survey was distributed to a select group of 25 research specialists recognized internationally as leaders in the field of social science research methodology. The specialists were then interviewed for their feedback and comments on the survey. Selection criteria for the purposeful sample included authors of current publications in research journals and textbooks and individuals with demonstrated professional proficiency in qualitative research. Several of the expert participants had developed or been closely aligned with existing data analysis technology. This initial response rate was 72 percent (18 of 25 experts).

The online survey was delivered to the participating experts using SurveyGizmo, a cloud-based data collection service. The survey was designed with open and closed response questions requiring approximately 15-20 minutes to complete. A set of open-ended questions were attached at the end of the survey to allow participants to share more about their thought process and concerns about adopting research technology.

The survey questions were then modified based upon recommendations from the experts who completed the survey and were given the opportunity to provide narrative feedback. The

survey was further enhanced by the experts with targeted participant recruitment snowball sampling and recommendations for broader survey distribution.

The online survey, stage two, was distributed to a wide range of social science researchers including academics and graduate students with varying levels of research expertise. The open-ended questions can be seen in Appendix 1.

Outreach, using the following listed listservs, was designed for a global audience, where English is the primary language of communication and where qualitative methods is the subject of open discussion. These listservs and websites were used for online survey participant recruitment:

- International Doctoral Education Research Network (IDERN)
- QUALRS-L, an international qualitative interest group listserv
- EVAL TALK, American Evaluation Association listserv
- CAQDAS Networking Project, University of Surrey, UK
- Doctoral Net; doctoralnet.com
- QSR International; NVivo forum
- SocioCultural Research Consultants, LLC; Dedoose listserv

A total of 355 responses were gathered through this outreach which provided sufficiently complete data from 29 countries world-wide. Broken down by region there were 64 participants from Australasia; 17 from Canada, 9 from Central & South America; 8 from Central Asia & Africa, 26 from Europe; 226 from the United States; and 5 participants did not disclose their region.

In addition to responses to the online survey, participants also completed a quantitative standardized instrument, the Technology Readiness Index (TRI) version 2.0 (Parasuraman & Rockbridge Associates, 2014). The TRI is recognized as a reliable survey to broadly measure general beliefs/tendencies toward technology adoption. The value of the TRI instrument remains current as demonstrated by Bunz, Seibert, and Hendrickse (2020) in their recent study of attitudes to a virtual reality readiness scale. Agreement ratings in the TRI instrument are provided on items related to technology experience and comfort. TRI employed here is a 16-item streamlined revision of the original measure (Parasuraman, 2000) which seeks to index people's inclination to adopt and make use of cutting-edge technologies in their daily lives. TRI results include an overall 'techno-readiness score and sub-scale scores for each of four dimensions: innovative, optimism, insecurity, and discomfort. Sub-scale psychometric analysis for the current sample shows statistically significantly Cronbach's Alpha results ($p < .01$) for each sub-scale which is consistent with TRI 2.0 findings reported elsewhere (Parasuraman & Colby, 2015).

Data Analysis Process

The research team was in regular contact through email, telephone and Skype to monitor how the study unfolded. These communications provided important opportunities to discuss and fine tune the emergent study design and analysis toward assuring that valuable and complete data was gathered to address the primary research questions as well as to recognize and address any ethical concerns that arose.

The mixed methods data analysis process maximized the integration of open response qualitative data with fixed response data from a standardized quantitative survey instrument.

Qualitative findings were drawn from the analysis of both stage one and stage two open response data, site documents and memos. SurveyGizmo raw data were imported into Dedoose, a web-based data management and analysis application. The qualitative data were first open coded, both individually and then through team interactions. Once open coding was completed, the team met to discuss emerging themes identified through visualizing interconnectedness in the data. Memos and correspondence from team meetings informed the analysis process. In addition, publicly available online site documents from technology providers and research training documents further enhanced the analysis process. Findings from qualitative analysis were then integrated with the quantitative findings.

Investigation and analysis of participant characteristic differences and technology readiness (ANOVA) allowed the researchers to identify relationships between technology readiness, qualitative methods confidence and qualitative methods experience. Once this step in the analysis was complete results were imported to Dedoose for further mixed method analysis and qualitative exploration of data across differences in TRI, methods confidence and technology experiences and perspectives. Dedoose visualizations tools were then used to explore patterns across methods confidence and technology readiness levels and well-organized access and reporting of underlying qualitative content. An example of this qualitative visualization analysis process can be seen in the following excerpt (Figure 1) from the packed code cloud chart. The packed code cloud in Dedoose shows what codes are most prominent in the context of the study, using font size to demonstrate the relative occurrence of codes throughout the project.

Figure 1. Code Cloud

Rearranging the positioning of codes can also be a helpful means of exploring different relationships and identifying potential trends. An additional strategy to visualize these relationships may be aided through the code co-occurrence chart. This displays how often codes are applied together in the same study. Also, turning off overlapping excerpts shows

how many times codes have co-occurred in the same excerpt or selected section of text. The research team built and shared a single Dedoose project where they were able to apply a wide range of these visualization techniques throughout the data analysis process. Analytic memos were maintained by all members of the team for documentation of this ongoing process.

Findings

The guiding research questions in this study were designed to explore how using technology can strengthen methodological quality. First, to gain a better understanding of who the current and potential future users of technology are. This first question describes demographic characteristics, technological readiness, and perceptions of data analysis technology. Second, to explore what can be learned from those using this technology. Here the study investigated how users choose their QDAS and how they learn to use it. Third, to explore the reported perceptions and experiences with regard to overcoming the barriers to successful technology adoption. These insights potentially capitalize on the benefits of technology to inform future research practices.

The intent of this study is to extend and expand upon the earlier work of Salmona & Kaczynski (2016) which identified two barriers to the learning and appropriate adoption of research technology: 1) perceiving the technology as easy to learn, and useful; and 2) methodological transparency where the researcher can conceptualize the research and regards technology as simply a tool to assist in the research. In this study, QDAS applications are considered by investigating participants' experience with both research methodology and also data analysis technology. The results of this study build upon the earlier work with the following three findings.

Finding for Question #1: Who uses technology for qualitative and mixed methods data analysis?

The stage one experts can be described as predominately older as two were 31-40 years of age, three were 41-50 years of age, and 13 were older than 51. All experts had a Master or Doctoral Degree. As would be expected, this group reported high levels of confidence in qualitative research with 11+ years of experience. Interestingly, the majority did not have extensive experience with technology. Of this purposeful sample, four had 1-3 years of technology experience, one with 4-7 years, three with 8-10 years, and 10 with 11 or more years' experience. Of particular interest from the survey, seven experts expressed discomfort using web-based services and were more neutral regarding the maturity of cloud-based technology.

From a broad perspective, the sample, based on those reporting to the invitation (see above for details), consisted of 355 participants in stage two was:

- Largely female (73.7%),
- Very well educated (93.9% with Masters or Doctoral degree),
- Older (58.2% older than 40 years of age),
- Relatively experienced with qualitative or mixed methods research:
    - 28.6% with 3 or fewer years' experience,
    - 41.9% with between 4-10 years' experience, and
    - 29.5% with more than 10 years' experience, and
- Relatively inexperienced with technology:
    - 55.6% with 3 or fewer years' experience,

- 29.4% with between with between 4-10 years' experience, and
- 15% with more than 10 years' experience.

Finally, with regard to reported technological readiness in general, the TRI quantitative results showed that 45.1% of participants fall into the Higher or Very High readiness groups, 28.2% in the Lower readiness group, and 26.3% in the Very Low readiness group.

The qualitative open-ended survey questions included: challenges in using technology; how technology assisted work; how technology hindered work; approaches to overcoming any challenges; and factors/features in deciding to use technology. Looking within responses to technological challenges, emergent themes included: the software drives process; data preparation; software terminology; data sharing; and distance from data. This further focused on challenges regarding concerns about technology driving the data management and analytic process.

As to who uses the software, Participant 130 stated "I have found that people need to try out the different QDA software packages and choose the one that best reflects how they would approach the research without any software at all. Not everyone's brain processes the data in the same way. So, the software should be an extension of that." Participant 40 was more cautious and increasingly concerned: "with the high-stakes "sales" focus in the QDAS world, which seems more important than the quality of the product sometimes. I'm a bit disappointed in the capitalistic focus overall (I understand that developers need to make a profit, but there are many ways to make profit that do not entail win-lose scenarios)".

Participant 323 "worked with three other researchers on a Dedoose project. We were all over the world but able to get our work done because of the tool. Loved it." Whereas Participant 449 pointed out that they were more likely to answer these questions as they were "tech savvy" and they were concerned about how to reach those less tech savvy "who may reluctantly use QDAS due to institutional requirements?" The final comment from Participant 276 makes an important point: "I think it is often difficult for quantitative researchers to understand what QDAS is. They think it is qualitative SAS or SPSS and it is not. It is a data organization tool; it does not do the analysis for you! It does not necessarily make the work more rigorous -- you have to do that!"

In summary, findings to question #1 identify and describe interesting similarities between the two rather different groups of users of data analysis technology; expert participants and a large sample of self-identified users (n=355). Both the expert participants and self-identified users were older, highly educated researchers. Somewhat surprisingly both groups reported technology adoption limitations. 39% of the experts expressed discomfort using web-based services and were more neutral regarding the maturity of cloud-based research technology. Of the self-identified users, only 15% reported having more than 10 years' research experience with technology. As expressed in the open response quotes, adoption readiness is high but a knowledge gap remains among both user groups regarding large scale QDAS adoption.

Finding for Question #2: What can be learned by knowing who these researchers are?

An interesting point of consideration was identified showing that users with high methods confidence and less than a doctoral degree are the most at risk of failing to pass through

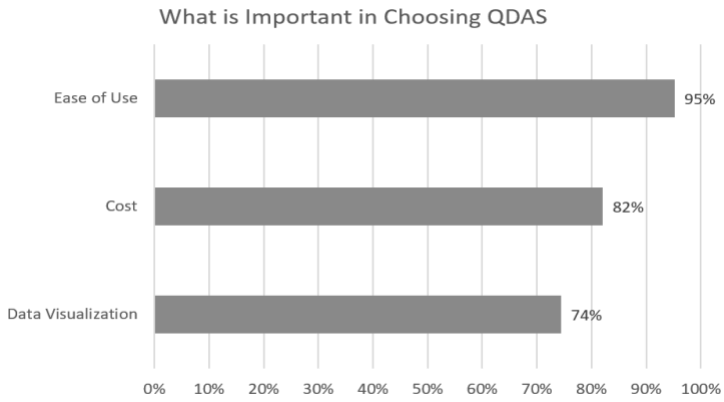
barrier two successfully by demonstrating methodological competence with the research process. In essence, this group expressed high confidence and concerns with competence. Chi-square analysis test of independence results shows this group to be significantly distinct, $F(5,350) = 2.59$, $p < .05$. Given the research questions focused on barrier 2, delving further into this group's qualitative responses exposed consistent differences in this groups reporting on perspectives on QDAS that raise concerns about how they are adopting technology. Although this limitation to adoption may be attributed to a lack of advanced research training, an equally important issue requires further consideration. Methodological transparency where the researcher can conceptualize the research and understands the technology suggests a need for advanced training. Connecting this advanced training to the challenge of acknowledging the perception that technology is simply a tool to assist in the research remains. This is highlighted by Participant 339 "I feel that sometimes "too much" technology is a siren song: Some technology is very helpful; some is no more effective than a less tech-driven process (and can even take longer and be less flexible). The key is to be able to find and use technology that makes sense, given the project, and not have the technology drive the process to a disproportionate extent."

Participants raised concerns about a lack of foundational knowledge when using digital tools. Participant 324 explains that the "use of technology sometimes is substituted for use of one's creative thinking -- it is the idea that technology somehow "solves" the problem of explaining how you got from point A to point B". Participant 334 supports this: "when students don't have an existing foundation knowledge of traditional content analysis done by hand, their view of the technology and its role can be very damaging of their own understanding and the mistaken ideas that are put out into the world."

The final point takes these tensions a little further with thoughts on different background training for the researcher. Participant 95 suggests we "study how/why people go in this direction and with what consequences. Connect their background/training in qual/quant methods to their studies and the genuineness of their results. Many of the people using QDAS don't really get authentic qualitative methods as such: their findings become either divorced from social context or subservient to quantitative, logico-deductive thinking, or both."

Study participants reported that ease of use and cost are huge factors in their decision process when selecting QDAS (see Figure 2). It is interesting to consider people's perceptions and how they frequently report having made those decisions because, 'my colleague uses it,' 'it's the one my department gives me,' 'my advisor made me use this one'. This disengagement from adoption decision making suggest an important gap in buy-in. Perhaps our best advice to potential users is to test drive software before adoption.

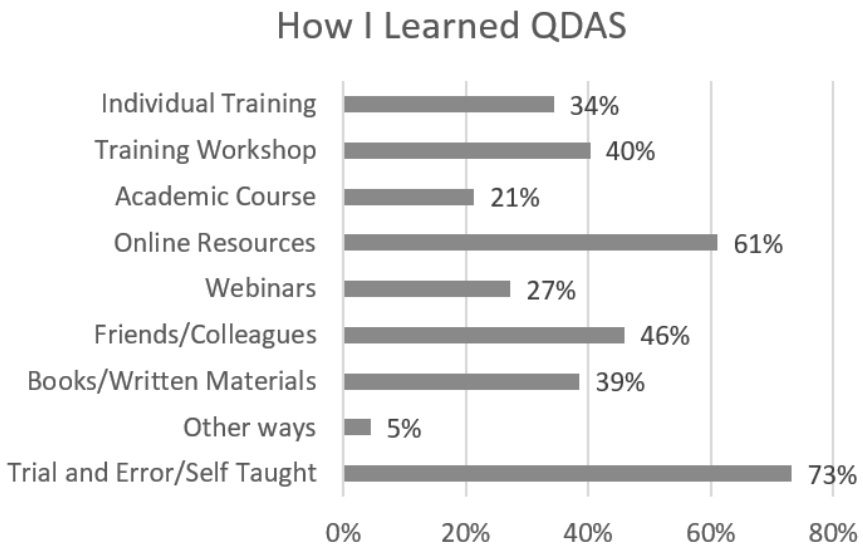
Figure 2. Choosing QDAS



Ease of use, cost and data visualization were given as the most important reasons for choosing QDAS. Other reasons included: having a way to manage and organize large amounts of data, the QDAS available at their own institution, suitability to the analysis, web-based for ease of access and collaboration, recommendations from colleagues, robustness, platform independence (i.e., could use on Mac, PC or Linux),

Of particular note is an overall finding that, while not mutually exclusive, over 70% of participants reported having learned QDAS by themselves or by trial and error (see Figure 3). This suggests a lack of available (real or perceived) support for researchers in the digital tool learning process.

Figure 3. Learning QDAS



Finding for Question #3: How might current perceptions inform improvements in future research practices?

A main theme from this study was the identification of a critical need for the combination of technological and methodological support at universities. University based support was considered seriously lacking by respondents as 73% reported they learned through trial and error, or were self-taught; and only 21% reported receiving training through an academic course (see Figure 3). As such, the lack of support was perceived as a hindrance to the appropriate adoption of data analysis technology. The contention here is that greater on-

campus support will promote technological adoption which in turn will benefit research quality and dissertation completion rates.

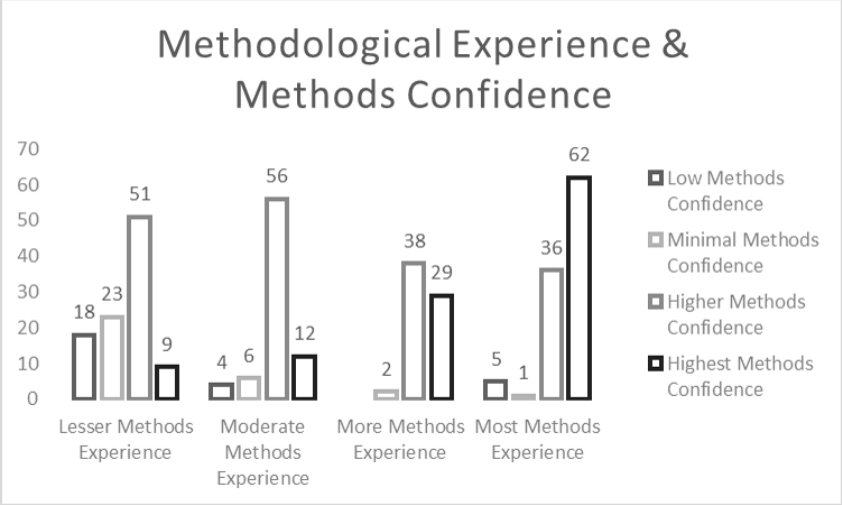
Findings for question #3 further explored how people with different levels of methodological expertise currently adopt QDAS. Both self-reported levels of confidence and years of reported methodological experience served as proxies for 'Expertise.' Examining the distributions of users across these categories, the next step was to recode Experience with Qualitative or Mixed Methods research into fewer categories by:

a. Combining years of methods experience 0, <1, and 1-3 years into 'Lesser Methods Experience,' 4-7 years into 'Moderate Methods Experience,' 8-10 years into 'More Methods Experience,' and 11+ years into Most Methods Experience' and

b. For level of agreement with Qualitative Methods Confidence the following categories were combined: Strongly Disagree and Disagree into 'Low Methods Confidence,' Not Sure into 'Minimal Methods Confidence,' Agree into 'Higher Methods Confidence,' and Strongly Agree into 'Highest Methods Confidence.'

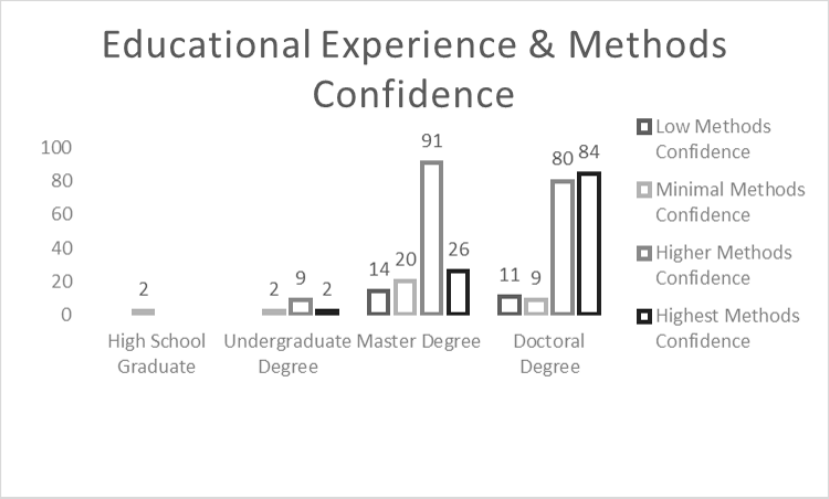
Not surprisingly, a statistically significant association between methodological experience and qualitative methods confidence ($X^2_{(9)} = 113.08$, $p < .001$) was found. By visualizing this relationship (see Figure 4), the pattern for most confidence groups is as expected, and that more experience is associated with higher levels of confidence. However, the pattern for the 'Higher Methods Confidence' group appears reversed.

Figure 4. Qualitative methodological experience and qualitative methods confidence



Examining the 'Higher Methods Confidence' group, surprisingly shows that more than half report having master's degree or lesser education (see Figure 5). This indicates that perhaps having less formal education may lead to more confidence in adopting QDAS.

Figure 5. Educational experience and qualitative methods confidence



The remainder of question #3 findings now considers this sub-group of participants who reported 'Higher Methods Confidence' along with less than a doctoral degree in order to expose the nature of the methodological transparency barrier among those adopting QDAS without sufficient methods mastery. This level of reported confidence along with somewhat lesser educational experience raises concerns about the methodological transparency barrier if these individuals seek to adopt QDAS. In general, a key to overcoming this barrier is a sufficient level of methods expertise and experience to properly reflect on how data analysis technology can be used without undue influence on the research itself. As such, this issue requires attention and action where those expressing a strong sense of confidence in research methods without a sufficient level of experience are adopting QDAS.

The characteristics of the 109 participants in this subgroup is largely reflective of the full sample, being largely female (66.1%), well educated (83.5% with a Master degree, 14.7% with an Undergraduate degree, and 1.8% with a high school degree), older (43.2% older than 40 years of age and 43.1% being between 31 and 40 years), and fairly technology ready (43.1% of participants fall into the Higher or Very High readiness groups, 31.2% in the Lower readiness group, and 25.7% in the Very Low readiness group). However, they are markedly less experienced with qualitative or mixed methods research (48.6% with 3 or fewer years' experience, 37.6% with between 4-10 years' experience, and 13.8% with more than 10 years' experience), and very inexperienced with QDAS (70.6 with 3 or fewer years' experience, 22.9% with between 4-10 years' experience, and 6.4% with more than 10 years' experience).

These participant characteristics reflect whether or not vulnerabilities exist within this sub-group of participants who reported 'Higher Methods Confidence' along with less than a doctoral degree. From this, a better description can be given about this group, their perceptions of technology, and potentially how they manage to traverse successfully both barriers to software adoption. Analysis shows this sub-group is the most vulnerable to the barriers. They are least prepared to evaluate the use and usefulness of data analysis technology and even though technologically ready, they are vulnerable to falling victim to methodological flaws discovered while confronting the second barrier of methodological competence.

To gain a general understanding of how this second barrier of methodological transparency into the research process is perceived, the survey included a question asking participants to explain the 'Meaning of Transparency' in QDAS with reported themes including: the ability

to demonstrate and explain processes; data and process visibility; replicability; and verifiability. Qualitative open responses to the concern that those expressing a strong sense of confidence in research methods may lack a sufficient level of experience in adopting data analysis technology and QDAS shows those Higher Methods Confident participants consider '…sometimes I have to check to make sure I am not allowing the technology to drive the decisions' Participant 425. Another commented that, 'It hasn't hindered my work. But when students don't have an existing foundation knowledge of traditional content analysis… their view of the technology and it's role can be very damaging…' Participant 334

There are many frustrations in this group with participants noticing sometimes novice researchers allow technology to drive the process. 'Argh! people at my workplace use QDAS instead of carefully reading through their data. I've heard someone say that QDAS means they don't have to think about their data. I think QDAS has enabled more mediocrity. Now anyone with a program can be a qualitative researcher' Participant 284. The finding here shows that participants perceive allowing the software to take over the research process weakens the research outcomes by keeping the researcher distant from their data.

In this mixed methods study we have presented qualitative and quantitative data to better understand RQ3: How might current perceptions inform improvements in future research practices? The findings indicate that current users have different perceptions about using QDAS and that the level of formal education may affect their success in demonstrating methodological competence. The following section discusses these issues of self-perceptions of confidence and competence in the adoption of QDAS and achieving successful outcomes.

Recommendations to Inform Future Practice

In this study the authors investigated how users perceive the benefits of data analysis technology while confronting and overcoming barriers to adoption. The findings clearly demonstrate that participants with more experience and confidence in both research methodology and a general use of data analysis technology are more likely see value in the adoption of technology in management and analysis of qualitative and mixed methods data. In this context, higher techno-readiness is expressed through greater levels of mastery in both research methodology and a general use of data analysis technology. With increased experience and confidence users strengthen their commitment to not only using qualitative and mixed methods data analysis technology but also finding creative benefits to enhancing their methodological research design thinking. This, in turn, can promote advanced research training designed to expand our understandings that technological confidence should not be confused with methodological competence.

This study addressed the importance of stakeholder buy-in to the adoption decision making process relating to barrier one perceptions of ease and usefulness of technology. Additionally, findings support the importance of determining a researchers' competence with qualitative methodology especially when adopting the use of qualitative data analysis technology. Determining whether the early-majority technology adopters are methodologically competent is not the function or role of technology as addressed in the second barrier. A key implication from this research is the critically important need to improve instruction and support in mixed-method and qualitative data analysis. Instructional improvements are intended to enhance advanced academic dissertation research, graduate coursework and applied industry-based research. A call for such advances will involve the combination of greater technological and methodological support from universities. This call

for greater higher education training in the appropriate methodological use of digital tools is intended to benefit educational research quality and the teaching of higher education research.

Outcomes of this research can contribute to a broader understanding about how to engage researchers in understanding and conceptualizing user-friendliness and appropriate use of QDAS. As research professionals, such knowledge can improve our ability to work with QDAS users as technology is increasingly integrated into social science methodology. Further, it is anticipated that this study's outcomes will benefit a broader understanding about how to engage researchers in understanding and conceptualizing data analysis technology training. Through the promotion of scaffolding learning and reforms in teaching practices improvements in the delivery of technology can take place. The challenge remains to further consider at what stage scaffolding is introduced to the adult learner. An important contention of this study is that earlier is better with appropriate exercises in the training to minimize the demands of mastery of technology. This in turn provides adult learners time to give more attention to methodological mastery.

Findings also suggest an increasing shift promoting greater mixed methods inquiry. As reported earlier, (Gilbert, Jackson & Di Gregorio, 2014; Talanquer, 2013; Salmona, Lieber & Kaczynski, 2020; Salmona & Kaczynski, 2016; Richards, 2015; Silver & Lewins, 2014) future trends indicate seamless technology integration driven by saturation of technology into broad social science research practices. Future research is recommended into this shift as these trends will further drive methodological practices supporting socially relevant high-quality inquiry beyond traditional qualitative or quantitative designs.

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Appendix – Open-Ended Survey Questions

36. How did you come to make your decision about whether to use qualitative or mixed method data analysis software/technology (QDAS)? Please specify the key features you were looking for and how they were important.
37. What was your approach to learning to use the software/technology? Check all that apply: (YES/NO as data points in SPSS)
    - Individual training
    - Training workshops
    - Part of an academic course
    - Online videos or other resources
    - Webinars
    - Friends/Colleagues
    - Books or other written tutorials
    - Trial and error--taught myself
    - Other (open ended)

QDAS Challenges and Benefits (all remaining questions are open ended)

38. Describe the biggest challenges/difficulties you faced when learning to use QDAS.
39. What were some of the strategies you developed to overcome these challenges/difficulties?
40. Please describe, if at all, how using QDAS was helpful in your work?
41. Please describe, if at all, how using QDAS hindered your work?

QDAS Technology Perspectives

42. What general concerns do you have about using QDAS in your qualitative and/or mixed methods work?
43. What general concerns do you have about using cloud-based technologies? Please give specific examples.
44. People talk about 'Transparency' when using QDAS in the research process, what does that mean to you?

QDAS Uses, Wishes, and Final Thoughts

45. Describe some of the ways you collaborate using QDAS or have shared your work with others?
46. What would be helpful or valuable to you if it were added to existing QDAS solutions?
47. Given the primary purpose of this project, to better understand the characteristics and perceptions of how people consider the use of QDAS in their qualitative and/or mixed method work/research, besides what we have asked, is there anything else you can share to help us on our mission?