Using Numbers in Qualitative Research

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Joseph A. Maxwell[1]

Abstract

The use of numerical/quantitative data in qualitative research studies and reports has been controversial. Prominent qualitative researchers such as Howard Becker and Martyn Hammersley have supported the inclusion of what Becker called "quasi-statistics": simple counts of things to make statements such as "some," "usually," and "most" more precise. However, others have resisted such uses, particularly when they are requested by reviewers for journals. This paper presents both the advantages of integrating quantitative information in qualitative data collection, analysis, and reporting, and the potential problems created by such uses and how these can be dealt with. It also addresses the definition of mixed methods research, arguing that the use of numbers by itself doesn't make a study "mixed methods."

Keywords

mixed methods, numerical data

The use of numbers in qualitative research is controversial. Particularly since the "paradigm wars" of the 1970s and 1980s, many qualitative researchers have rejected the use of numerical data in their studies and reports for philosophical reasons. Primarily, this is because they have believed that numerical data are incompatible with a constructivist stance for research, as such data imply the existence of a single "objective" reality that can be measured and statistically analyzed to reach generalizable conclusions.

However, the dispute over numbers in qualitative research also has had a political dimension (Lather, 2004; Maxwell, 2004b). Qualitative researchers have often had their work evaluated in terms of a "scientific" frame that sees numbers as a key indicator of valid and generalizable research, and stories of quantitatively oriented journal reviewers insisting that numerical results be added to qualitative papers are common. It is thus understandable that qualitative researchers have resisted the pressure from those outside this community to include quantitative data in their publications.

This political dimension of the debate is not simply a matter of the relative prestige and influence of quantitative and qualitative researchers. Becker (1990) argued that ethnographic work is inherently dangerous to those in power because it is not easily controlled through prior inspection of the questions and methods of the research. Quantitative research necessarily specifies in advance its hypotheses and methods and the types of data that will be collected, so that politically dangerous issues can be removed or permission to conduct the research denied altogether. Qualitative researchers, on the other hand, refuse to limit their questions and methods in advance; as Becker stated,

> There's no telling what they'll ask, what they'll stumble onto, what untoward events will happen when they happen to be there to see and hear the whole thing, what students and subordinates will tell them when you aren't looking. . . . Worse yet, good fieldworkers do not restrict themselves to studying the help but insist on treating administrators and other important people as objects of study, whose actions are to be investigated as critically and objectively as those of their underlings. (1990, p. 234)

When qualitative researchers *do* publish politically uncomfortable results, a common response is to argue that because these results are not numerical, they are, therefore, "anecdotal," and can be dismissed. A relatively extreme, but not atypical, example is provided by a qualitative study of medical research in Belgium by the sociologist Renee Fox (1964). The publication of her results in the journal *Science,* which exposed some of the hidden political aspects of the structure and funding of this research, resulted in a firestorm of debate in Belgium over her findings. A major theme of the critics of her report is that it was not scientific, the concrete proof of this being that it contained no statistics, and that its conclusions were therefore not credible (p. 438).

This charge, that the absence of quantitative methods and numerical data in most qualitative studies prevents these from being fully scientific, has been recently revived by those promoting "scientific" and "evidence-based" research, terms which have often served as code words for randomized

[1]George Mason University

experiments. In the United States, the No Child Left Behind Act of 2001, which provided billions of dollars in federal aid to education, referred to "scientifically based research" or "evidence-based practices" 111 times, and the Congressional bill to reauthorize the agency responsible for funding educational research (renamed the "Institute of Educational Sciences") would, in its original form, have defined into law what constituted "scientifically valid" research methods in education. Officials at the IES explicitly compared educational research to medieval medical practices such as bleeding to cure illnesses and characterized the current state of knowledge in education as "superstition" (Erickson & Gutierrez, 2002, p. 22). Similar attacks on qualitative research occurred earlier in Great Britain, where qualitative inquiry was accused of "being largely irrelevant, weak in validity, and a waste of public funds" (Hammersley, 2008, p. 3).

Even the National Research Council's report on scientific research in education (Shavelson & Towne, 2002), which attempted to provide a broader framework for educational research, was shaped by some of the same underlying assumptions, which led to a prioritizing of experimental and quantitative methods (Maxwell, 2004a). There have also been attempts by some researchers to *make* qualitative research scientific by imposing quantitative standards and ways of thinking (e.g., King, Keohane, & Verba, 1994).

Despite this polarization over the relative legitimacy and value of quantitative and qualitative methods and data, prominent qualitative researchers such as Becker (1970), Erickson (2007), Hammersley (1992), and Miles and Huberman (1984) have supported the inclusion of numerical data in qualitative research practices and reports. Schwandt, in the most recent edition of his Dictionary of Qualitative Inquiry (2007), stated that "qualitative studies can and often do make use of quantitative data" (p. 251). An even stronger claim is made in a recent work on ethnographic research coauthored by a prominent linguistic ethnographer (Heath & Street, 2008). This book contains a section on quantitative analysis, arguing that "sociologists, cultural psychologists, and linguistic anthropologists depend on using key quantitative concepts" and that "every ethnographer needs some level of competence with statistics" (pp. 92-93). The issue of using numbers in qualitative research thus seems to call for more detailed analysis.

In this article, I want to address both the potential advantages of integrating quantitative information in qualitative data collection, analysis, and reporting, and the potential problems created by such uses and how these can be dealt with. In doing so, I also want to problematize the definitions of "qualitative," "quantitative," and "mixed-method" research, arguing that the use of numbers is not in itself a good way of distinguishing these, as well as to argue that there is nothing intrinsically numerical about scientific research.

As the terms *quantitative* and *qualitative* imply, the use of numerical data has typically been the major criterion for distinguishing between quantitative and qualitative research (Creswell & Plano-Clark, 2007, p. 29; Hammersley, 1992, p. 161; King et al., 1994, p. 4; Miles & Huberman, 1984, p. 15). Although most of the debate between qualitative and quantitative researchers during the "paradigm wars" centered on differences in methods and "paradigms" rather than data, some of the methodological differences, such as "observations" versus "measurement," imply a distinction between numerical and nonnumerical data; this distinction is also conveyed by the terms *hard* and *rich* data and is implicit in the charge of "imprecision" that has been leveled against qualitative methods.

Well before the paradigm wars, however, Becker (1970) had challenged this view, arguing that qualitative researchers frequently make quantitative claims in verbal form, using terms such as *many*, *often*, *typically*, *sometimes*, and so on. He argued that numbers have the value of making such claims more precise and coined the term *quasi statistics* for simple counts of things to support terms such as *some*, *usually*, and *most*. He stated, "One of the greatest faults in most observational case studies has been their failure to make explicit the quasi-statistical basis of their conclusions" (pp. 81-82). Sandelowski, Voils, and Knafl (2009) made a similar point about "quantitizing" qualitative data, stating that this is done in qualitative research "to facilitate pattern recognition or otherwise to extract meaning from qualitative data, account for all data, document analytic moves, and verify interpretations" (p. 210).

Hammersley (1992) employed this point as part of a broader argument against a simplistic division between qualitative and quantitative paradigms. He claimed that the use of qualitative or quantitative data is not a valid basis for distinguishing qualitative from quantitative research, stating that "the contrast between words and numbers does not get us very far" (p. 162). Huston (2005), Sandelowski et al. (2009), and many of the contributors to a volume edited by Bergman (2008a) are likewise critical of a simple distinction between the two approaches. Both Hammersley and Bergman (2008b) argued that both qualitative and quantitative research consist of a collection of disparate concepts and strategies that have only a tenuous relationship to one another and that "the conventional divide between [qualitative and quantitative] methods is based on highly questionable premises" (Bergman, 2008b, p. 19). Bergman concluded that the separation of qualitative and quantitative methods is to a considerable degree related to "delineating and preserving identities and ideologies rather than to describe possibilities and limits of a rather heterogeneous group of data collection and analysis techniques" (p. 29).

I agree that there are legitimate and valuable uses of numbers even in purely qualitative research, and I don't see the distinction between numerical and verbal data as a useful way of distinguishing between qualitative and quantitative research. However, this raises the question of what, if anything, *does*

distinguish the two approaches. Neither Hammersley nor Bergman provide any alternative basis for making this distinction, and both argue that the qualitative–quantitative divide is a social construction that has been reified well beyond its legitimacy and usefulness.

Though I agree with much of Hammersley's and Bergman's critiques, I want to emphasize one specific distinction between qualitative and quantitative approaches that I think *is* an important, if not completely defining, feature of the "mental models" of the two communities of researchers, a distinction that is not equivalent to, but is particularly relevant for, the use of numbers. This is the distinction between thinking of the world in terms of variables and correlations and in terms of events and processes. Mohr (1982) labeled these two approaches "variance theory" and "process theory"; similar distinctions have been presented by many other writers, including the distinctions between variable-oriented and person-oriented (Huston, 2005) or case-oriented (Ragin, 1987) approaches, propositional knowledge and case knowledge (Shulman, 1990), and factor theories and explanatory theories (Yin, 2003, pp. 14-22).

Variance theory deals with variables and the correlations among them; it is based on an analysis of the contribution of differences in values of particular variables to differences in other variables. The comparison of conditions or groups in which a presumed causal factor takes different values, while other factors are held constant or statistically controlled, is central to this approach to understanding and explanation and tends to be associated with research that employs experimental or correlational designs, quantitative measurement, and statistical analysis.

Process theory, on the other hand, deals with *events* and the processes that connect them; its approach to understanding relies on an analysis of the *processes* by which some events influence others. It relies much more on a local analysis of particular individuals, events, or settings than on establishing general conclusions and addresses "how" and "why" questions, rather than simply "whether" and "to what extent." This aspect of qualitative research has been widely discussed in the methodological literature but has rarely been given prominence in works on the philosophical assumptions of qualitative research.

The "logic-in-use," although not necessarily the "reconstructed logic" (Kaplan, 1964, p. 8), of most qualitative research is predominantly that of process theory rather than variance theory. In some fields, most notably political science, qualitative approaches (often called case study approaches) typically are described using the language of variables (e.g., Brady & Collier, 2004; George & Bennett, 2005; Mahoney, 2007), but the mental model implicit in actual case studies (as opposed to methodological statements) in these fields is much more process oriented, focusing on specific events and conditions and how these are linked historically in a process leading to a particular outcome. Thus, Brady and Collier state that "case-oriented researchers certainly think in terms of variables, but their attention is strongly focused on detailed contextual knowledge of specific cases and how variables interact within the context of these cases" (p. 275). Such "variable language" does not represent the actual logic of inference employed and is rarely used in case study research in other fields (e.g., Stake, 1995), although the analytic strategies are quite similar across all fields.

This distinction is closely tied to two different views of causation, respectively known as the "regularity" view and the "process" or "realist" view (Maxwell, 2004a, 2008; Maxwell & Loomis, 2003; Maxwell & Mohr, 1999). The regularity view, derived from David Hume's analysis of causality, holds that causality is strictly a matter of regularities in our data; establishing a causal connection is simply a matter of showing that a change in one entity or property is regularly associated with a change in another. As Mohr noted, this conception of causality is "the basis of ordinary quantitative research and of the stricture that we need comparison in order to establish causality" (Mohr, 1996, p. 99). In contrast, the process view, which has received increasing attention and respect in philosophy, sees causality as fundamentally referring to the actual causal mechanisms and processes that are involved in particular events and situations.

Defining mixed-method research as involving the joint use of variance and process approaches relies not on specific features of the data or data collection methods used, which Hammersley and Bergman have shown to be problematic, but on a distinction between two ways of thinking about the phenomena studied, a distinction that has a pervasive influence on the research questions, data collected, and analysis methods used. Sandelowski et al. (2009) stated that the purpose of quantitizing qualitative data sets for integration with quantitative data in mixed-method studies "is to answer research questions or test hypotheses addressing relationships between independent (or explanatory or predictor) variable(s) and dependent (or response or outcome) variable(s)" (p. 211). In contrast, quantitizing in qualitative research is done to "allow analysts to discern and to show regularities or peculiarities in qualitative data they might not otherwise see . . . or to determine that a pattern or idiosyncrasy they thought was there is not" (p. 210).

I have three main reasons for defining mixed method research in this way:

1. Although I am skeptical of the claim that methods are *determined* by, or must be consistent with, ontological and epistemological assumptions, it is clear that these assumptions, as real properties of researchers, *influence* research designs, research questions, conceptual frameworks, methods, and validity concerns. For example, presenting data in

the form of a scatterplot implies assumptions about the *nature* of these data, for example, that they can be presented in terms of the relationship between two variables.

2. This is particularly important because "data" are not simply "given"; they are *constructed* by researchers from their perceptions and experiences in interacting with the phenomena studied (Barad, 2007; Sandelowski et al., 2009). Thus, quantitative and qualitative data are both created by means of the particular conceptual "lens" used by the researcher. Variance theory and process theory are two important, and distinctively different, aspects of these lenses and fundamentally influence the nature of the data that are created.
3. I believe that the main *value* of mixed-method research, as Greene (2007) argued, is in creating a dialogue between different ways of seeing, interpreting, and knowing, not simply in combining different methods and types of data. Greene stated that "the 'great qualitative-quantitative debate' was, at root, about . . . different ways of knowing" (p. xi), and she advocates what she calls a "dialectical" stance toward mixed method research, one that "invite[s] multiple mental models into the same inquiry space" (p. xii). I see this juxtaposing of two different ways of making sense of the world as essential to mixed-method research in its fullest sense and as more distinctive of mixed-method research than simply combining different data collection methods, analysis strategies, or research designs (Maxwell & Loomis, 2003).

Thus, I argue that the systematic (although not necessarily explicit) use of both ways of thinking is what is most distinctive of, and valuable in, mixed-method research. For example, Stanley Milgram's research on the conditions under which individuals will perform unethical actions when directed to do so by a perceived authority (1974) is an exemplary mixed-method study because it makes extensive use of both variance and process approaches (and both qualitative and quantitative data) to understand this phenomenon, even though the combining of these approaches is never explicitly discussed (Maxwell & Loomis, 2003).

Process and variance thinking are not mutually exclusive; some methods and uses of data can be understood in both ways. Counting the number of instances of things in different categories can be interpreted in variance terms, as creating a nominal-scale variable and measuring the frequency in each category. However, it can also be interpreted in process terms. If participants in a study repeatedly make a particular claim or perform a particular action, presenting this fact in numbers isn't necessarily conceptualizing it in terms of variables, but can be seen as simply describing the occurrence and distribution of the claim or action in that setting or set of individuals.

I strongly support the integration, where appropriate, of qualitative and quantitative approaches. However, "There may be many things referred to as quantitative going on within the confines of an empirical study" (Sandelowski et al., p. 209), and not every use of numbers has the same implications for the research design and the classification of the study. In my view, the use of numbers per se, in conjunction with qualitative methods and data, does not make a study mixed-method research. Specifically, numbers in the sense of simple counts of things (Becker's quasi statistics) are a legitimate and important sort of data for qualitative researchers.

In addressing both the valuable and problematic uses of numbers in qualitative research, I want to focus on what it is that numbers do and what value they have. Primarily, as Becker and Hammersley have argued, numbers give precision to statements about the frequency, amount, or typicality of particular phenomena. However, they do this at the cost of stripping away everything but the quantitative information and are thus necessarily complementary to qualitative information rather than substituting for it.

I see several advantages of incorporating numbers in qualitative research:

1. It contributes to what I have called (Maxwell, 1992) the *internal generalizability* of qualitative researchers' claims. This term refers not to the generalizability of conclusions to other settings (what qualitative researchers typically call transferability) but to generalization *within* the setting or collection of individuals studied, establishing that the themes or findings identified are in fact characteristic of this setting or set of individuals as a whole. Internal generalizability is clearly a key issue for qualitative case studies and interview studies; the validity of the conclusions of such a study depend on their internal generalizability to the case or to the collection of participants as a whole. If you are studying the patterns of interaction between a teacher and students in a single classroom, your account of that classroom as a whole is seriously jeopardized if you have selectively focused on particular times or students and ignored others. Providing numerical data about the distribution of observations, or the number of instances of a particular type of event or statement, helps to deal with potential challenges to these conclusions.
2. Complementary to Point 1, quantitative data enable you to identify and correctly characterize the *diversity* of actions, perceptions, or beliefs in the setting or group studied. Both qualitative and quantitative methods contain biases toward seeking uniformity

and overlooking diversity, including an emphasis on finding common themes or patterns (Shulman, 1990, p. 50) and the assumption that similarities are theoretically more significant than differences (Maxwell, 1999). However, quantitative data can constitute an important check on such biases and can provide systematic evidence for diversity that may be overlooked by both the researcher and participants themselves (Maxwell, 1995). Informants often assume greater uniformity than actually exists (Poggie, 1972), and Pelto and Pelto (1975) concluded, "There is often a systematic bias [toward uniformity] in fieldwork data gathered by means of key informant interviewing" (p. 7). Not only must systematic sampling be done to identify the actual variability in a group or setting (Heider, 1972; Sankoff, 1971) but also differences that are found must be analyzed in ways that retain these differences and attempt to understand their significance, rather than imposing uniformity on the basis of unexamined or theoretically based assumptions.

3. To generalize from Point 2, quantitative data can help you to identify patterns that are not apparent simply from the unquantitized qualitative data, as noted previously, or even to participants (James, 1984; Sadker & Sadker, 1995, p. 2). Individuals are often unaware of larger patterns beyond their immediate experience, and quantitative data can thus complement the participants' perspectives in providing a clearer and more in-depth understanding of what's going on in a particular setting or for individuals who belong to a particular category. The use of "etic" concepts and interpretations derived from, or supported by, such numerical results is not incompatible with understanding the participants' own (emic) perspectives and constructions; on the contrary, a strong case can be made that a full understanding of social phenomena requires an attention to both emic and etic perspectives (Bohman, 1991; D'Andrea, 2006, pp. 183-215; Gellner, 1973; MacIntyre, 1967; Menzel, 1978).
4. Finally, quantitative data help you to adequately present *evidence* for your interpretations and to counter claims that you have simply cherry-picked your data for instances that support these interpretations. Becker (1970) argued that numerical data not only allow you to test and support claims that are inherently quantitative but also enable you to assess the *amount* of evidence in your data that bears on a particular conclusion or threat. (An important implication of this point is that you need to present data on *negative* as well as supporting evidence, such as how many discrepant instances exist and from how many different sources they were obtained.) For example, a classic qualitative study of medical students by Becker, Geer, Hughes, and Strauss (1961) presented more than 50 tables and graphs of the amount and distribution of observational and interview data bearing on their conclusions. Miles and Huberman (1984) described the use of matrices and other displays for presenting qualitative data, but they also include examples of such displays for quantitative data.

There are also potential problems with using numbers in qualitative research, which qualitative researchers need to be aware of. Some of these problems are the result of inappropriate inferences that can be made from quantitative data; others are the result of ignoring the limitations on the legitimate uses of such data. Qualitative researchers are well aware that qualitative data are not given but are the result of an interpretive process (e.g., Emerson, Fretz, & Shaw, 1995). However, as Sandelowski et al. (2009) emphasized, this is equally true of quantitative data: "counting is usually take for granted as . . . an objective and transparent process not requiring much scrutiny" (p. 212), but, in fact, it is dependent on how the things counted are distinguished and categorized, a clearly interpretive activity. As a result, the valid use and interpretation of quantitative data, as with qualitative data, requires inquiry into the processes by which these data were created; Sandelowski et al. provided detailed discussions of actual studies in which the quantitizing of qualitative data turned out to be more problematic than expected.

I see several specific problems that can arise as a result of using quantitative data in a qualitative study:

1. Numbers can lead to the inference (by either the researcher or the audience) of greater generality for the conclusions than is justified, by slighting the specific context within which this conclusion is drawn. A particular setting or sample may be unrepresentative, and a facile reading of quantitative results may lead a reader to ignore this limitation. Qualitative research is intrinsically *local,* and any claims for the generality of its conclusions rely on a different kind of argument from that of quantitative research, what Yin (1994) called *analytic* rather than statistical generalization.

   Weiss (1994, pp. 199-200) provided a cogent argument that there are situations in which the use of numbers in reporting frequencies and proportions is inappropriate, mainly for this reason. He gives as an example a study of retirees, some of whom who were volunteers, others who referred by employers, and still others obtained from a

community sample. He says, "It would be more in keeping with this sample of convenience to say 'The great majority of the sample have adult children' than to say 'Eighty-five percent of the sample have adult children'" (p. 200). However, he states, "Notwithstanding these concerns, sample numbers or proportions should probably be reported when an issue is central to a study (p.220)."

2. The use of numbers can lead to a slide into variance ways of thinking, a common pitfall for students who are just learning to do qualitative research and are more accustomed to thinking of "research" in variance terms. Imposing a variance theory mental model on your research undercuts the main strengths of qualitative research and is particularly common when qualitative researchers make (implicitly or explicitly) causal claims. Patton (1990) warned,

   > One of the biggest dangers for evaluators doing qualitative analysis is that, when they begin to make interpretations about causes, consequences, and relationships, they fall back on the linear assumptions of quantitative analysis and begin to specify isolated variables that are mechanically linked together out of context. . . . Simple statements of linear relationships may be more distorting than illuminating. (p. 423)

Recent work on causality has provided considerable legitimacy for making claims about causality that are grounded in qualitative, process-oriented data and arguments, rather than quantitative variance theory (Maxwell, 2004b, 2004c, 2008).

3. In reporting the number of instances supporting a conclusion (addressed under Point 4 in the previous section listing advantages of incorporating numbers), there is a danger of reducing evidence to the *amount* of evidence. There is nothing in the nature of evidence that limits this to quantitative findings (Achinstein, 2001), and the qualitative aspects of the evidence may be critical to drawing the correct conclusions. Numbers can't *replace* the actual description of evidence but can provide a supplementary type of support for the conclusions when it's impossible to present all of this evidence.
4. Finally, numbers can be used rhetorically, to make a report appear more precise, rigorous, and scientific, without playing any real role in the logic of the study and thus misrepresenting the actual basis for the conclusions. One example of this is when numbers are used to suggest greater accuracy or generality of the results than is justified by the actual design and methods of the study, as discussed under Point 1 in the previous section listing advantages of incorporating numbers.

It is also important to keep in mind that precision is not the same as validity. A measurement may be very precise and reliable, yet it may be inaccurate. The biochemist John Platt, in a classic article on scientific inference (1966), argued that the increasing focus on quantitative measurement in science has distracted researchers from the key issue in scientific method—the testing of a claim or interpretation against plausible alternative claims and interpretations. He stated,

> Today we preach that science is not science unless it is quantitative. . . . Measurements and equations are supposed to sharpen thinking, but, in my observation, they more often tend to make the thinking noncausal and fuzzy. They tend to become the object of scientific manipulation instead of auxiliary tests of crucial inferences.
>
> […]
>
> Or to say it another way, you can catch phenomena in a logical box or a mathematical box. The logical box is coarse but strong. The mathematical box is fine-grained but flimsy. The mathematical box is a beautiful way of wrapping up a problem, but it will not hold the phenomena unless they have been caught in a logical box to begin with. (pp. 351-352)

In summary, the use of numbers is a legitimate and valuable strategy for qualitative researchers when it is used as a complement to an overall process orientation to the research. The inclusion of quantitative data does not inherently make the research a mixed-method study. However, it does have some potential dangers and should be used with a clear awareness of these.

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Bio

Joseph A. Maxwell is a professor in the College of Education and Human Development at George Mason University, where he teaches courses on research design and methods. His research and writing have focused on research design, qualitative and mixed methodology, socio-cultural theory, Native American societies, and medical education; see http://cehd.gmu.edu/people/faculty/jmaxwell/. He has a PhD in anthropology from the University of Chicago.