

The Point of Triangulation

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***Purpose:** To explore various types of triangulation strategies and to indicate when different types of triangulation should be used in research.*

***Methods:** Reviews included literature on triangulation and multimethod strategies published since 1960 and research books specifically focusing on triangulation.*

***Findings:** Triangulation is the combination of at least two or more theoretical perspectives, methodological approaches, data sources, investigators, or data analysis methods. The intent of using triangulation is to decrease, negate, or counterbalance the deficiency of a single strategy, thereby increasing the ability to interpret the findings.*

***Conclusions:** The use of triangulation strategies does not strengthen a flawed study. Researchers should use triangulation if it can contribute to understanding the phenomenon; however, they must be able to articulate why the strategy is being used and how it might enhance the study.*

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[Key words: triangulation, research methods, mixed methods]

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Many researchers strive to design studies that will not only give a multidimensional perspective of the phenomenon (Foster, 1997) but will also provide rich, unbiased data that can be interpreted with a comfortable degree of assurance (Breitmayer, Ayres, & Knafl, 1993; Jick, 1979). One of the ultimate goals of a researcher is to design a study that has strong internal and external validity and reliability, a comprehensive multiperspective view (Boyd, 2000), and procedures to decrease potential biases within the research (Mitchell, 1986; Shih, 1998). One way to increase the validity, strength, and interpretative potential of a study, decrease investigator biases, and provide multiple perspectives is to use methods involving triangulation (Denzin, 1970). The purpose of this paper is to explore various types of triangulation strategies and to discuss when these different types should be used in research.

Data for this article were obtained from review of the literature on triangulation by conducting a search using ERIC, WebSPIRS, PROQUEST, and EBSCO databases; the dates searched were 1960 to 2000. In addition, various Internet search engines (e.g., Yahoo, WebCrawler, Excite, Mamma.com, Northern Lights) were used to search for key words. The key words that were searched individually and in various combinations included: triangulation, multimethods, mixed methods, multiple triangulation, rigor, credibility, and trustworthiness.

What Is Triangulation?

The lexical definition of triangulation is that it is a process of using trigonometry in determining an unknown point or

location by using the position of two fixed points a known distance apart (Webster's New Collegiate Dictionary, 1980). The triangulation metaphor used in research was derived from construction, surveying, and navigation at sea. The premise was based on the idea of using two known points to locate the position of an unknown third point, by forming a triangle (Britannica, 2000). The intent in research is to use two or more aspects of research to strengthen the design to increase the ability to interpret the findings (Campbell & Fiske, 1959; Denzin, 1970; Polit & Hungler, 1995).

Triangulation is the combination of two or more data sources, investigators, methodologic approaches, theoretical perspectives (Denzin, 1970; Kimchi, Polivka, & Stevenson, 1991), or analytical methods (Kimchi et al., 1991) within the same study. These combinations result in data triangulation, investigator triangulation, methodological triangulation, theoretical triangulation, (Denzin, 1970; Patton, 1990), or analytical triangulation (Kimchi et al., 1991). When more than one type of triangulation is used, for example, two or more data sources along with two or more investigators, the resulting complex triangulation is referred to as multiple triangulation (Denzin, 1970; Polit & Hungler, 1995; Woods & Catanzaro, 1988).

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Types of Triangulation

Data Sources Triangulation

Three types of data sources are time, space, and person (Denzin, 1970). Data sources can vary based on the times the data were collected, the place, or setting and from whom the data were obtained (Denzin, 1970; Mitchell, 1986). Because the purpose of longitudinal studies is to identify changes over a time period, such studies are not considered triangulated. Time triangulation indicates collection of data at different times to determine if similar findings occur (Kimchi et al., 1991). Variance in events, situations, times, places, and persons add to the study because of the possibility of revealing atypical data or the potential of identifying similar patterns, thus increasing confidence in the findings (Fielding & Fielding, 1986).

Investigator Triangulation

Investigator triangulation involves using more than one observer, interviewer, coder, or data analyst in the study. Confirmation of data among investigators, without prior discussion or collaboration with one another, lends greater credibility to the observations (Denzin, 1970).

Methodologic Triangulation

Methodologic triangulation has also been called multimethod, mixed-method, or methods triangulation (Barbour, 1998; Greene & Caracelli, 1997; Polit & Hungler, 1995). Methodologic triangulation as addressed in the literature can be somewhat confusing (Goodwin & Goodwin, 1984) because it can refer to either data collection methods or research designs (Lincoln & Guba, 1985). Some authors have discussed methodologic triangulation in reference to qualitative and quantitative methods, indicating a paradigmatic connection (Barbour, 1998; Greene & Caracelli, 1997). Others have referred to qualitative and quantitative data collection methods, analysis and interpretation—not philosophical stances (Goodwin & Goodwin, 1984). By using multiple methods, the researcher strives to decrease the “deficiencies and biases that stem from any single method” (Mitchell, 1986, p. 19) creating “the potential for counterbalancing the flaws or the weaknesses of one method with the strengths of another” (p. 21).

Methodologic triangulation can further be classified into two types—within-method triangulation and between- or across-method triangulation. Researchers using within-method triangulation use at least two data-collection procedures from the same design approach (Kimchi et al., 1991). For quantitative approaches, the procedures could consist of administering survey questionnaires and using pre-existing information from a database. In qualitative approaches, nonparticipant observations could be combined with focus group interviews. These methods are either qualitative or quantitative, but not both. Researchers using between- or across-method triangulation employ both qualitative and quantitative data collection methods in the same study (Boyd, 2000; Denzin, 1970; Kimchi et al., 1991;

Mitchell, 1986). An example is the combination of participant interviews and questionnaires in the same study (Denzin, 1970), or the use of participant observation with analog or Likert-scale surveys.

Theoretical Triangulation

Theoretical triangulation is the use of multiple theories or hypotheses when examining a phenomenon (Denzin, 1970). The intent is to conduct the study with multiple lenses and questions in mind, to lend support to or refute findings. In theoretical triangulation, the perspectives or hypotheses used in the study may be related or have opposing viewpoints, depending on what the researcher hopes to accomplish (Denzin, 1970). Theoretical triangulation may be used to test various theories by analyzing information from the same data set (Boyd, 2000).

Data-Analysis Triangulation

Data-analysis triangulation is the combination of two or more methods of analyzing data. These techniques can include different families of statistical testing or different statistical techniques to determine similarities or validate data (Kimchi et al., 1991).

Benefits of Triangulation

The benefits of triangulation can include increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem (Jick, 1979). These benefits may pertain to each type of triangulation.

Data Triangulation

The advantage to data triangulation is the nature and amount of data generated for interpretation (Banik, 1993). For example, using both structured and unstructured techniques to collect data longitudinally from different family members of those who had school-age children with chronic illness, Knafl, Breitmayer, Gallo, and Zoeller (1996) identified five family management styles. Questionnaires and interviews were used to gain a more comprehensive understanding of how family members responded to chronic childhood illnesses (Breitmayer et al., 1993).

Burr (1998) used multiple triangulation to obtain a more comprehensive view of family needs in critical care by using multiple data sources and methodologic triangulation, including qualitative and quantitative methods. Through the use of questionnaires and selective participant interviews, this researcher discovered areas of both convergence and divergence. In addition, results showed family members who were interviewed found the sessions therapeutic, but those who were not interviewed could only communicate their frustrations on their questionnaires.

In qualitative research, using multiple methods of data collection has a long history. “Triangulation of data is crucially important in naturalistic studies.... No single item

of information (unless coming from an elite and unimpeachable source) should ever be given serious consideration unless it can be triangulated” (Lincoln & Guba, 1985, p. 283). Combining quantitative records with fieldwork could enhance the research study. For example, adding quantitative data from self-report questionnaires, surveys, or information from police could strengthen results from qualitative field work in family violence and hospital records on family violence (Polit & Hungler, 1995).

Investigator Triangulation

The purpose of using multiple investigators is to decrease the potential of bias in gathering, reporting, coding, or analyzing of the data (Denzin, 1970; Mitchell, 1986) and to contribute to internal validity (Boyd, 2000). Having more than one investigator on the team has the potential for keeping the team honest, therefore increasing the credibility of findings (Lincoln & Guba, 1985). “Analysis of data (particularly qualitative) by multiple analysts serves not only to amplify the findings and increase validity but also add to reliability” (Banik, 1993, p. 49). Cross-checking and verifying the interpretation of data, whether qualitative or quantitative, by more than one researcher can increase the value of the findings.

One of the arguments for investigator triangulation is that few researchers are adept at conducting both qualitative and quantitative research (Polit & Hungler, 1995). If investigators are equally skilled in their respective research approaches, the divergent viewpoints could enhance the study. Connelly and colleagues discussed the difficulty of trying to use both qualitative and quantitative approaches to examine the same phenomenon. However, they stated that researchers knowledgeable in both methods could surmount such difficulties (Connelly, Bott, Hoffart, & Taunton, 1997). Researchers skilled in either qualitative or quantitative methods could conduct different phases of a study (Cobb, 2000; Polit & Hungler, 1995) to allow for both methodological and investigator triangulation.

Duffy (1987) said the use of more than one investigator with different and complementary skills decreased potential bias and prevented the occurrence of the holistic fallacy, in which the researcher inaccurately believed the views of those in the study reflected those who were not in the study. Beck (1997) said that a research program should not be limited by the investigator’s expertise in research methods when collaboration and training are possible. However, she emphasized the investigator’s need to learn the research methods to enhance the study.

To successfully implement investigator triangulation, researchers must be cognizant of and must acknowledge their epistemologic preferences (Porter, 1989). Researchers must collaborate during the entire study to effectively neutralize biases (Streubert & Carpenter, 1999). In addressing issues of epistemology or axiology, Lincoln and Guba (2000) advocated the blending of elements of one paradigm with another, emphasizing the importance of selecting commensurate axiologies.

Methodologic Triangulation

Within the same paradigm, mixing data-collection methods is sensible (Lincoln & Guba, 2000). **Methodologic triangulation can also occur by combining qualitative and quantitative approaches in a single study** (Cobb, 2000; Lincoln & Guba, 2000; Mitchell, 1986). Although some researchers argue that qualitative and quantitative paradigms differ epistemologically and ontologically, the counterargument is that the two approaches are similar in their objectives, scope, and nature of inquiry across methods and paradigms (Dzurec & Abraham, 1993).

Both qualitative and quantitative studies are designed “to understand and explain behavior and events, their components, antecedents, corollaries, and consequences” (Dzurec & Abraham, 1993, p. 76). Therefore, blending elements of one with the other is possible, especially if the approaches have similar axiologies (Lincoln & Guba, 2000). This blending allows the best representation of both worldviews (Lincoln & Guba, 2000).

Qualitative input may help to explain the success of interventions when the numbers fail to answer the question (Polit & Hungler, 1995). In other words, methodologic triangulation has the potential of exposing unique differences or meaningful information that may have remained undiscovered with the use of only one approach or data collection technique in the study.

Similarly, quantitative data can enhance understanding by revealing outliers or unique individual cases (Duffy, 1987). Hinds (1989) said combining qualitative and quantitative methods “increases the ability to rule out rival explanations of observed change and reduces skepticism of change-related findings” (p. 442). In a study of adolescent hopefulness, she incorporated both methods and found the qualitative results obtained from asking structured questions validated the quantitative information gathered from the Hopefulness Scale for Adolescents (HAS). She emphasized that using the two approaches together helped interpret the process of change in adolescent hopefulness (Hinds, 1989). Connelly and colleagues (1997) reported on a study of nurse retention using methodologic triangulation. They cited the benefits of methodologic triangulation to include support for variables in their model, revelations of new aspects of nurse retention, and the ability to offer suggestions on revising questionnaires.

In a unique approach to triangulation, Wilson and Hutchison (1991) argued for the use of two qualitative approaches—Heideggerian hermeneutics and grounded theory—in the same study. They discussed the ways of knowing and data generation from each approach—hermeneutics helped to generate rich narratives of the informants’ truths, while grounded theory helped to generate information on concepts, constructs, and theories. The researchers concluded that the combined approaches provided breadth and depth required in nursing research (Wilson & Hutchinson, 1991).

Floyd (1993) combined methods of semistructured qualitative interviews and self-reported questionnaires to assess sleep concerns of 84 adults. She reported the study

verified the same 50% of the sample had sleep concerns, pointing to the sensitivity of the combined methods in identifying this pattern. Anderson (1997) used within-method triangulation in the form of semi-structured interviews, field diary, and nonparticipant observations in studying staff attitudes and perceptions of introducing ward assistants to the ward culture. Anderson reported the combination of these strategies helped validate interpretations of findings, because the observations reinforced the data obtained from the interviews. The researcher was able to formulate a picture of the developing team by using the interview data in combination with observations of the participants.

Theoretical Triangulation

Using more than one theoretical perspective or hypothesis can decrease alternative explanations for a phenomenon (Mitchell, 1986). One of the greatest benefits of theoretical triangulation is that it provides a broader, deeper analysis of findings (Banik, 1993).

Having rival hypotheses also challenges researchers to look beyond the obvious explanations. Multiple perspectives can help rule out competing hypotheses, prevent premature acceptance of plausible explanations, and increase confidence in developing concepts or constructs in theory development (Banik, 1993).

Disadvantages of Triangulation

The disadvantages of triangulation include: (a) the increased amount of time needed in comparison to single strategies, (b) difficulty of dealing with the vast amount of data, (c) potential disharmony based on investigator biases, (d) conflicts because of theoretical frameworks, and (e) lack of understanding about why triangulation strategies were used.

One source of discontent may be the frequency with which triangulation is employed, even if it does not add to the study. A “more is better” mentality may result in diluting the possible effectiveness of triangulation. Including multiple methods cannot compensate for a poorly designed and poorly conducted study (Sohier, 1988). The potential of increasing error exists if considerable thought has not gone into planning the study (Fielding & Fielding, 1986).

Data Triangulation

The huge amount of data that can be generated as a result of data triangulation can pose a significant problem for researchers. The large amount of data obtained from triangulation may lead to false interpretations of the phenomenon being studied (Porter, 1989).

Difficulties may arise from trying to “fit” qualitative data into a quantitative mold. In an attempt to better understand what processes increased the risk for adolescent substance abuse, Buchanan (1992) administered questionnaires to eighth-grade students, followed by in-depth interviews based on data obtained from questionnaires. Referencing his attempts in this study to place qualitative data into a

quantitative format, the author described the problems he encountered.

One of these problems included what to do with singular responses or single-cases findings. If the qualitative data were analyzed using a qualitative method, the researcher probably would have considered the deeper meaning of the unique response. However, trying to analyze the single case quantitatively opened the possibility of simply dismissing the response as an outlier. The second problem was matching each pattern of judgment with a behavioral indicator. The researcher had difficulty coding dichotomous responses regarding judgment because of instances when the judgment did not fit a designated behavioral code. A third problem was how to code a category for a particular ideal type, when the ideal type was not one identified or did not exist (Buchanan, 1992).

Investigator Triangulation

The intent of having more than one researcher is to compare and counterbalance the effects of bias from each researcher. Measuring and validating bias are difficult (Kimchi et al., 1991). The biases of each investigator might amplify the others; thus, investigator triangulation might increase, rather than decrease, researcher bias.

Researchers might strictly and exclusively adhere to their own epistemology, refusing to consider the merits of other epistemologies (Nolan & Behi, 1995). The majority of researchers are proficient in either qualitative or quantitative methodology, but few are skilled at both. This lack of understanding of another researcher’s viewpoint could ultimately jeopardize the study.

Qualitative research may include instances when an investigator is the only one who interacts with participants (Lincoln & Guba, 1985). The use of more than one investigator during interviews could prove disruptive to the study by stifling participants’ responses. Consider the example of a prolonged study with only one participant, such as a biography or phenomenologic study of one person. The rapport between participant and researcher is key to obtaining the rich, emic perspective of the participant; time is needed to solidify this rapport. In instances of prolonged contact with the same subject, serious consideration should be given to using only one investigator.

Methodologic Triangulation

At the paradigmatic or philosophic level, Polit and Hungler (1995) discussed some of the prevalent problems in methodologic triangulation and cautioned about these various barriers that might impede the use of methodology triangulation: (a) differences in epistemologic stance may cause conflict about the research design; (b) the increased expense of multimethod research may be a strong barrier; (c) investigator expertise may be lacking in either method; (d) difficulty in meshing numerical and narrative data to understand the phenomenon; and (e) reluctance of some editors to publish multimethod works.

Some researchers may be tempted to combine a qualitative and quantitative approach in the same study, hoping the strength of one might offset the weakness of the other. However, the inaccuracies of data from one approach may not necessarily lessen the inaccuracies of the other (Fielding & Fielding, 1986). In methods triangulation, the primary method must be rigorous enough to be able to sustain the study by itself, while the added method contributes to the strength of the research (Morse, 1991).

Theoretical Triangulation

Theoretical triangulation is intended to increase the confidence of the accepted hypothesis or theory, when the data findings are tested against an opposing hypothesis or theoretical framework (Mitchell, 1986). However, if the frameworks are not initially identified, or if concepts within theoretical frameworks are not adequately defined, this type of triangulation can cause confusion (Banik, 1993).

Another argument against theoretical triangulation is that the use of multiple theories in support of the same study may be faulty and epistemologically unsound (Lincoln & Guba, 1985). Findings do not become more valid and credible simply because they were supported by similar theories, which may have interrelated constructs and concepts (Lincoln & Guba, 1985). On the other hand, if the theories selected for triangulation are opposing theories, interpreting the concepts may be difficult because they were poorly differentiated and overlapped with the competing theories (Banik, 1993).

Burns and Grove (1993) predicted triangulation would be the research trend of the 1990s and they cautioned researchers tempted to jump on this bandwagon to assess the fit of triangulation strategies to their studies. They were also concerned that the popularity of triangulation would result in triangulation studies that were poorly conducted. Such studies could occur because some researchers might consider using triangulation if it could make their research findings more credible. The main caveat is to consider triangulation only if strong justification can be made for it, and be clear about what the researcher hopes to gain from this strategy in the study of a phenomenon.

Conclusions

Appropriately used, triangulation might enhance the completeness and confirmation of data in research findings of qualitative research. The use of both quantitative and qualitative strategies in the same study is a viable option to obtain complementary findings and to strengthen research results. "If different philosophic and research traditions will help to answer a research question more completely, then researchers should use triangulation" (Streubert & Carpenter, 1999, p. 307). However, researchers must articulate why the strategy is being used and how it enhances the study.

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