

Methodological Triangulation in Educational Research: Pros and Cons

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Abstract: *Many scholars are still skeptical of the value of triangulation over a single method of research, such as quantitative or qualitative. Besides, qualitative and quantitative research methods are compared for superiority instead of being combined to overcome the shortcomings of each. Therefore, this paper explained the concept of triangulation, triangulation in educational research, triangulation outcomes, the pros and cons of triangulation, and the implications of triangulation in educational research. It concluded that methodological triangulation in educational research is an approach for increasing confidence about the validity and reliability of educational research findings as opposed to a single method (say, qualitative or quantitative). Combining the merits of qualitative and quantitative methods, the adoption of triangulation in educational research improves the validity, reliability, and generalizability of the result. Methodological triangulation, although very useful, is time-consuming, energy-intensive, and requires expertise on the part of the researcher. It is advised that methodological triangulation be used in educational research under the supervision of an experienced mentor.*

Keywords: research, triangulation, methodology, education, pros and cons.

Introduction

The constant practice of discovering new things or improving on existing situations has transformed the traditional world into the modern world we know today. Since time immemorial, man has been curious to find out why things are the way they are. What was the missing link that caused certain things not to work as they should? What should be done to improve the existing situation? Theoretically, the early man was doing research. Research, as defined by Qamar (2018), is any form of careful consideration of a study concerning a problem that aims to contribute to a body of knowledge or theory by means of scientific methods. Research cuts across all disciplines, such as engineering, medicine, environmental science, social sciences, and education, with varying peculiarities and is often described by such a discipline.

For instance, educational research is the application of research ethics and principles to finding solutions to educational problems. Based on nature of data collected and analyzed, educational research is classified into quantitative and qualitative research (Ary *et al.*, 2010). Where qualitative research uses objective measurements to gather numeric data that is used to answer questions or

test predetermined hypotheses, it generally requires a well-controlled setting; in contrast, qualitative research focuses on understanding social phenomena from the perspectives of human participants in a natural setting. It does not begin with formal hypotheses, but it may result in hypotheses as the study unfolds (Ary *et al.* 2010). Educational research uses both qualitative and quantitative methods for data collection.

Qualitative researchers seek to understand phenomena by focusing on the whole picture rather than breaking it down into variables (Tracy, 2019; Ormston, 2014). The goal is a holistic picture and deep understanding rather than a numeric analysis of data. Qualitative methodology studies variables in great detail through observation and in-depth interviews (Queiros *et al.* 2017). Qualitative research uses different approaches, namely: case studies, surveys, narrative inquiry, and phenomenological studies (Ary *et al.* 2010). Kumar (2013) asserted that qualitative research is associated with phenomena like reasons for human behaviour. It aimed at discovering the reasons for motivation, feelings of the public, among others. Qualitative research uses techniques like word association tests, sentence tests, and story competition tests.

However, quantitative research is one in which systematic investigations with quantitative properties and phenomena are considered. Quantitative studies can be experimental, casual-comparative (quasi experimental), correlational, or descriptive (Andre *et al.* 2017). The method can measure or quantify phenomena and analyse them numerically. Statistics derived from quantitative research can be used to establish associative or causal relationships among the variables. Agricultural experiments relating to the measurement of quantitative characteristics and their correlational activities are examples of quantitative research (Kumar, 2013).

Both qualitative and quantitative research are bedeviled by weaknesses, especially where they are solely used (Andre *et al.*, 2017). The use of qualitative research methods has limited interpretations; personal knowledge influences observations and conclusions. As the research method is open ended, participants have more control over the content of the data collected. The qualitative method is labour-intensive, as it requires categorization and recording, among others. Because qualitative research is not statistically represented, the responses given cannot be mathematically measured, whereas quantitative research is associated with an incorrect representation of the target population, which may impede the researcher's ability to achieve his or her desired aims and objectives. The various weaknesses associated with only using one method can negatively affect the validity of findings (Queiros *et al.* 2017). To achieve certainty and validity of findings, both qualitative and quantitative methods ought to be used together as a complementary approach to studying the same problem (triangulation), especially in education as a social science related discipline.

Despite the contentious argument about the qualitative-quantitative dichotomy that exists among scholars, the adoption of qualitative methods has recently kept on gaining ground. The two research approaches, however, are being seen with equal value as complementary rather than substitutes (Alkali, 2022). This can be done by using triangulation to reinforce the weak spots of each approach and the strengths of each other. By combining multiple observers, theories, methods, and empirical materials, researchers can hope to overcome the weaknesses or intrinsic biases and the problems that come from single method, single-observer, and single-theory studies (Kaur, 2016; Jack & Raturi, 2006; Jakob, 2001). Often, the goal of triangulation is to corroborate findings by bringing together many viewpoints. It is believed that reality begins at the point where the views merge. Therefore, the purpose of this paper was to explain the concept of triangulation, triangulation in educational research, triangulation outcomes, the pros and cons of triangulation,

and the implications of triangulation in educational research. To accomplish the objective of this review, the researchers conducted an extensive electronic search strategy on some databases such as Google scholar, Web of Science, Educational Resources Information Center (ERIC), etc. Journal articles, conferences proceedings, books and abstracts synthesized in this paper were electronically retrieved from the selected databases including other reputable sources.

Concept of Triangulation

The term "triangulation" refers to the use of multiple sources of data or multiple strategies for analysing data to increase the credibility of a research study. Arising from navigational and surveying contexts, triangulation aligns multiple approaches and leads to a more comprehensive understanding of a particular phenomenon (Neil, 2010). According to Olsen (2004), triangulation in social research refers to the combination of data or methods so that various perspectives cast light on a particular topic. The combination of data types known as triangulation is often seen as helping to validate the findings that might arise from an initial pilot study (Bulsara, 2015). The mixing of methodologies, e.g., using survey data with interviews, is a more profound form of triangulation. In education, triangulation takes different forms, namely: data triangulation, investigator triangulation, theory triangulation, environmental triangulation, and methodological triangulation, among others (Mondai *et al.*, 2021).

In data triangulation, the researcher investigates whether the data collected with one procedure or instrument confirms the data collected using a different procedure or instrument (Ary *et al.*, 2010). The researcher wants to find support for the observations and conclusions in more than one data source. Any convergence of a major theme or pattern in the data from these various methods lends credibility to the findings (Patton, 1999).

However, investigator triangulation involves using several different investigators in the analysis of the process (Lisa *et al.*, 2011). Typically, this manifests as an evaluation team consisting of colleagues within a field of study wherein each investigator examines the programme with the same qualitative method (interview, observation, case study, or focus groups) (Lisa *et al.*, 2011). The findings from each evaluator would then be compared to develop a broader and deeper understanding of how the different investigators view the issue (Lodico, 2010). If the findings from different evaluators arrive at the same conclusion, then our confidence in the finding would be heightened (Lisa *et al.* 2015).

Furthermore, theory triangulation considers how the phenomenon under study might be explained by different theories (Jillian *et al.*, 2020). Theory triangulation considers different theories, or viewpoints, to interpret a single set of data. This approach often involves working with experts outside of a given field of research, unlike investigator triangulation. Bringing theory or people from various disciplines together is a common strategy, although people within disciplines can also be utilised as long as they are in distinct status positions (Carter & Little, 2007). It is theorised that people with diverse backgrounds or occupations can contribute viewpoints from various angles. As a result, validity is proven if the information is interpreted the same way by all of the evaluators from the various disciplines.

On the other hand, environmental triangulation uses a variety of settings, locations, and other crucial elements that are connected to the environment where the study was conducted, such as the time of day, weeks, months, or season, to estimate the validity of the result (Ary *et al.* 2010). The trick is figuring out which external factors, if any, could affect the data collected throughout the study. To determine if the results are consistent across settings, these environmental elements are

altered. Validity is established if the results hold true under many environmental circumstances (Campbell, 2017).

Out of the five types of triangulation, the most frequently used is methodological triangulation, especially in educational research (Yeasmin & Rahman, 2012). Methodological triangulation is the utilisation of multiple qualitative and/or quantitative methods to study a dataset (Guion, 2011). It involves the use of different research techniques to handle the same question, such as observation and interviewing to collect data, history interviews, and documentary analysis (Sonja *et al.*, 2020). David (2010) maintained that methodological triangulation is the use of different methods to study a given situation. For instance, it might be possible to compare survey, focus group, and interview results to see if they are consistent. Validity is established if the results of all the methods, such as qualitative and/or quantitative, are the same (Campbell, 2017).

However, the type of "triangulation" used for a study depends on its goals, and multiple types of "triangulation" might be utilised in a single study (Denzin, 2001). Each strategy undoubtedly has advantages and disadvantages of its own. According to Johnson (2017), a single research method cannot sufficiently shed light on a phenomenon. Using different methods can help foster deeper understanding. By combining different observers, theories, methods, and empirical resources, researchers can hope to overcome the weaknesses or intrinsic biases and shortcomings associated with single research methods, single-observer, and single-theory studies (Kaur, 2016; Jack & Raturi, 2006; Jakob, 2001). However, not every mixed methods study aims to triangulate their findings as part of their strategy or purpose. Some studies using mixed techniques could also have additional objectives, such as complementarity, development, expansion, or initiation (Turner, 2017).

Methodological Triangulation in Educational Research

To check the consistency of findings in educational studies that are obtained from different methods of data collection, it is common to have both qualitative and quantitative data in a study. This elucidates complementary aspects of the same phenomenon. Often, the points at which these data diverge are of great interest to qualitative educational researchers and provide the most insights (Johnson, 2017). In methodological triangulation, different forms of data are used. For instance, a teacher may be given a questionnaire to fill out about his teaching, and at the same time, data would be collected from him through observation while he taught. The questionnaire data is compared to that from the observations made. The assumption is that the respondent, even an honest one, may have biases, intentionally or unintentionally; hence, sound conclusions can only be drawn from evidence that is collected using different data collection methods. The aim is to reduce the shortcomings and biases that are associated with any single method. In other words, the strengths of one method may complement the weaknesses of another (David, 2010). Methodological triangulation is one of the most commonly used mixed-method approaches in social science and educational research, where the findings from one method are used to strengthen, increase, and clarify the results of another.

The main strength of methodological triangulation is its ability to unearth unique disputes or meaningful information that may have remained undiscovered with the use of a single method or data collection instrument in the study. David (2010) further stressed that mixing quantitative and qualitative methods strengthens the ability of analysts to rule out varying explanations of change and ameliorates the validity and reliability of change-related findings. For example, qualitative findings may assist in explaining the success of an intervention when quantitative data does not

provide any outcome information. Many experts in education (Frank & Daminabo, 2014; Hussein, 2009) maintain that across-method and within-method triangulation supply far better findings than relying on a single method. The cost of deploying multiple or mixed methods, the difficulties in tying quantitative and qualitative findings together, and the varying quality of different studies using different methods are all flaws in method triangulation. It is critical to remember during method triangulation analysis that data shortfalls from one method do not necessarily minimise or offset data deficiencies from another method. This is simply why it is so important to use proven methods for both quantitative and qualitative work.

Triangulation is primarily used to assess the validity or trustworthiness of an interpretation (Taber, 2008). Even though researchers like David *et al.* (2010) affirm that the application of triangulation in educational research does not guarantee the validity and reliability of the results obtained. This is because every situation has its own strengths and weaknesses, which are capable of invalidating the results if not well handled in any of the triangulation outcomes in educational research. The application of triangulation ensures a more thorough, comprehensive, and contextual depiction of the research units (Klein & Olbreich, 2011). In a similar vein, educational reality and human nature can both be comprehended, especially when they are intertwined (Elo *et al.*, 2014b).

Triangulation Outcomes

Figure 1 below shows research objectives, qualitative methods, quantitative methods, triangulation, and triangulation outcomes. In the triangulation research method, there is normally an expected outcome that comes from the interpretation of the results from the qualitative and quantitative methods in relation to the target objectives. It is the outcome in Figure 1 that differentiates the triangulation outcome from both qualitative and quantitative methods. The triangulation outcome explains the nature of the interpreted results from the qualitative and quantitative approaches to the target objectives or research questions. According to Neil (2010), the triangulation approach usually produces three outcomes. The first is convergence, which is commonly used among others. Convergence is obtained when data from different sources is collected using different methods. A second and probably more often occurring result of a "triangulation" strategy is inconsistency among the data. The data gathered through 'triangulation' may be contradictory. A third outcome is contradiction. Data can be inconsistent but not always contradictory, leading the researcher to incomparable conclusions.

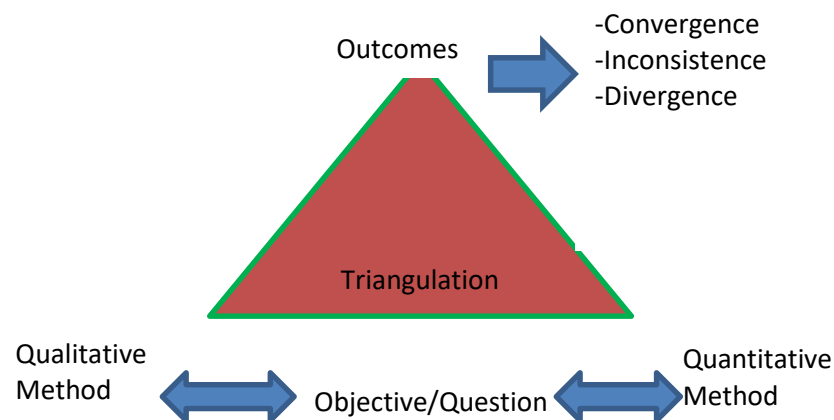


Figure 1: Triangulation Outcome

Pros of Methodological Triangulation

In every research project, there are strengths and weaknesses; methodological triangulation is no exception. Triangulation is a crucial tool in educational research as it helps to ensure the validity and reliability of the findings by combining different methods and perspectives, leading to a more comprehensive understanding of the phenomenon under study (Hayashi *et al.*, 2019). By using multiple sources and methods, educational researchers can cross-check their results and gain a more comprehensive understanding of the phenomenon being studied. Additionally, it can also help overcome the limitations of individual methods and provide a more nuanced interpretation of the data. Methodological triangulation makes researchers more positive about their findings (Choi, 2014). It can spark the development of novel methods and new approaches to problem solving and provide a counterbalance to traditional data collection methods. This may aid in revealing a problem's divergent dimensions. It can also serve as a litmus test for competing theories due to its breadth. Methodological triangulation reduces the deficiencies of single-method research (Bekhet *et al.*, 2012). The two methods complement and check one another, which minimises the impact of bias. This provides better and more balanced information because humans share more honestly with an independent third party than they do with someone they know or think they know. Therefore, the use of both methods can lead to a more accurate understanding of a situation or phenomenon. It also helps to reduce the influence of personal biases and increase the reliability of the collected data.

Cons of Methodological Triangulation

The methodological triangulation approach is not without some setbacks. First of all, if the research is not clearly focused theoretically or conceptually, it will not yield a satisfactory outcome (Rahman, 2012). Secondly, it can be time-consuming and resource-intensive to collect data from multiple sources and analyse it, which may not be feasible for researchers with limited time and budget (Pan *et al.*, 2022). Additionally, the integration of different methods can be challenging and may require specialised expertise (Amershi *et al.*, 2019). There are potential drawbacks, such as the need for a clear theoretical focus, the time- and resource-intensive nature of collecting and analysing data from multiple sources, and the requirement for specialised expertise in integrating different methods (O'Connor *et al.*, 2022). Overall, the decision to use methodological triangulation should be based on the research question and available resources. More so, it should not be used to prioritise a dominant, personally chosen method. That is, if either quantitative or qualitative methods become mere window dressing for the other, then the design is poor (David, 2010). Each method should be symbolised in a significant way. This does, however, pose the question of whether the various instruments may be seen as equally sensitive to the problem being studied. One method may, in fact, be more substantial or more appropriate, but this needs to be judiciously rationalised and made clearer. Otherwise, the essence of methodological triangulation is sabotaged. Methodological triangulation is a strategy that may not be appropriate for all research purposes. Various constraints, like time and cost, may prevent its effective application (Johnson, 2017).

Implications of Triangulation in Education

1. Both quantitative and qualitative research approaches are complementary to each other rather than being equated for superiority in educational research.
2. Educational researchers can overcome the weaknesses or intrinsic biases and problems that come from single method (qualitative or quantitative), single-observer, and single-theory studies.
3. It is the outcomes of the two methods that are triangulated for validity or reliability in education, rather than the methods themselves.
4. The outcome of any triangulation is either convergence, inconsistency, or divergence, never both at once.
5. Triangulation is used to achieve high validity or reliability of results rather than being used for window dressing.
6. When applied effectively, methodological triangulation can enhance the validity and reliability of research findings in education. It allows for a more comprehensive understanding of complex phenomena and can lead to more informed decision-making in educational practice.
7. It is not every mixed methods study aims to triangulate their findings as part of their strategy or purpose

Conclusion

The methodological triangulation approach makes use of both qualitative and quantitative methods to complement each other and give birth to valid, more reliable, and dependable findings. As educational research is descriptive in nature, the attitudes, behaviours, interests, and perceptions of the subjects, among others, tend to vary. To achieve confidence about the validity of findings among educational researchers, different methods ought to be used together to study a given problem. Though methodological triangulation is thought to be superior to a single method, it is energy- and time consuming, and it may confuse researchers, particularly inexperienced ones, when it produces inconsistent or contradictory results.

Suggestion

In view of the above, this study made the following suggestions:

1. Since findings from a single research method cannot equalise the confidence, validity, dependability, and others associated with findings from multiple methods, the use of methodological triangulation should be encouraged, especially in educational research.
2. Though methodical triangulation in research takes time and energy, its use can be encouraged when articles produced through triangulation receive higher ratings.
3. While triangulation is encouraged among young educational researchers, it should only be used under the guidance of an experienced supervisor or mentor to avoid confusion and frustration.

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Declaration of Conflict of Interest

There researcher here declare that there was no conflict of interest.

References

- Alkali, I. A., Kawuwa, A. S. & Khalil, I. S. (2022). Use of triangulation for valid and reliable PhD research: a case study of the Architecture Department at the University of Technology Malaysia. 2018 AARCHES National Conference, Zaria 21-22 Feb.
- Amershi, S., Begel, A., Bird, C., DeLine, R., Gall, H., Kamar, E., ... & Zimmermann, T. (2019, May). Software engineering for machine learning: A case study. In *2019 IEEE/ACM 41st International Conference on Software Engineering: Software Engineering in Practice (ICSE-SEIP)* (pp. 291-300). IEEE.
- Ary D., Cheser L., & Soresen C. (2010). *Introduction to Research in Education*. Wadsworth, Delmont, USA.
- Bekhet A. and Zauszniewski J. (2020). *Methodological Triangulation: An Approach to Understanding Data*. Nurse Researcher. 20, 40-43.
- Bulsara, C. (2015). Using a mixed methods approach to enhance and validate your research. *Brightwater group research centre*, 16, 1-82.
- Campbell, D. T. (2017). Factors relevant to the validity of experiments in social settings (pp. 243-263). Routledge.
- Carter, S. M., & Little, M. (2007). Justifying knowledge, justifying method, and taking action: Epistemologies, methodologies, and methods in qualitative research. *Qualitative health research*, 17(10), 1316–1328.
- Choi L. (2014). The Strength and Weakness of Research Methodology: Comparison and Complimentary between Qualitative and Quantitative Approaches. *IOSR Journal of Humanities and Social Science*. 19, 99–104
- David H. (2010). *An introduction toTriangulation*. UNAIDS: Joint United Nations Programme on Aids. Jeneva
- Denzin, N. K. (2001). *Interpretive Interactionism*. SAGE Publications.
- Frank, O. L., & Daminabo, F. F. (2014). The role of architects in ensuring sustainable maintenance of public buildings in Nigeria.
- Guion, L. A., Diehl, D. C., & McDonald, D. (2011). Triangulation: establishing the validity of qualitative studies: FCS6014/FY394, Rev. 8/2011. *Edis*, 2011(8), 3–3.
- Hayashi Jr, P., Abib, G., & Hoppen, N. (2019). Validity in qualitative research: A processual approach. *The Qualitative Report*, 24(1), 98-112.
- Hussein, A. (2009). The use of triangulation in social sciences research: Can qualitative and quantitative methods be combined? *Journal of comparative social work*, 4(1), 106–117.
- Jack, E. P., & Raturi, A. S. (2006). Lessons learned from methodological triangulation in management research. *Management research news*, 29(6), 345–357.
- Jakob A. & Alexander C. (2001), On the Triangulation of Quantitative and Qualitative Data in Typological Social Research: Reflections on a Typology of Conceptualising 'Uncertainty' in the Context of Employment Biographies, *Forum: Qualitative Social Research*, 2(1).
- Jillian F., Nicolette M. and Julie R. (2020). Triangulation in industrial Qualitative Case Study Research: Widening the scope. *Industrial Marketing Management*, 87 (6), 160–170.
- Johnson H., (2017). Understanding the role of triangulation in research. *Scholarly Research Journal for Interdisciplinary Studies*. 4(31), p. 91–95

- Kaur, M. (2016). Application of a mixed-methods approach in public health research. *Indian Journal of Community Medicine: Official Publication of the Indian Association of Preventive and Social Medicine*, 41(2), 93.
- Kumar P.S. (2013). *Research Methodology: A Guide for Researchers in Agricultural Science, Social Science and Other Related Fields*. Springer, New Delhi, Heidelberg, New York.
- Lisa A.G., David C.D. & Debra M. (2011). *Triangulation: Establishing the Validity of Qualitative Studies*. Adapted from www.google scholar advanced search.com on January 27, 2021.
- Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice*. John Wiley & Sons.
- Mondai S. and Samaddar K. (2021). Issues and Challenges in Implementing the Sharing Economy in Tourism: A Triangulation Study. *Management of Environmental Quality*, 32 (1), 64–81. <https://doi.org/10.11108/ME0-03-2020-0054>.
- Neil J.S. (2010) *Encyclopedia Of Research Design*. Adapted from <http://dx.doi.org/10.4135/9781412961288.n469> on 15/02/2021 on January 27, 2021
- O'Connor, M., Spry, E., Patton, G., Moreno-Betancur, M., Arnup, S., Downes, M., ... & Olsson, C. A. (2022). Better together: Advancing life course research through multi-cohort analytic approaches. *Advances in Life Course Research*, 100499.
- Olsen, W. (2004). Triangulation in social research: qualitative and quantitative methods can really be mixed. *Developments in sociology*, 20(1) 103-118.
- Ormston, R., Spencer, L., Barnard, M., & Snape, D. (2014). The foundations of qualitative research. *Qualitative research practice: A guide for social science students and researchers*, 2(7), 52–55.
- Pan, R., Bagherzadeh, M., Ghaleb, T. A., & Briand, L. (2022). Test case selection and prioritization using machine learning: a systematic literature review. *Empirical Software Engineering*, 27(2), 29.
- Patton, M.Q. (1999). Enhancing the Quality and Credibility of Qualitative Analysis. *Health Services Research*, 34 (5 pt. 2), 1189–1208.
- Qamar A. (2018). Research Ethics. *Pakistan Armed Forces Medical Journal*, 68 (8), 150–154
- Queirós, A., Faria, D., & Almeida, F. (2017). Strengths and limitations of qualitative and quantitative research methods. *European journal of education studies*.
- Quiro A., Faria D., and Almeida F. (2017). Strengths and Limitations of Qualitative and Quantitative Research Methods. *European Journal of Education Studies*, (S.I., Sept., 2017. ISSN 250111111. Retrieved from <https://oa.org/edu/uder.php/ejes/article/view/1017> on 10th July, 2021.
- Sonja T.S. (2020). *A mixed-methods case study investigating the correlation between technology integration and students achievement and teacher perception of technology at North Central University*, Proquest Dissertations Publishing.
- Taber K.S. (2008) Models, Mermaids, and Methods: *The Role of Analytical Pluralism in Understanding Student Learning in Science*. Nova Science Publishers.
- Tracy, S. J. (2019). *Qualitative research methods: collecting evidence, crafting analysis, communicating impact*. John Wiley & Sons.
- Turner, S. F., Cardinal, L. B., & Burton, R. M. (2017). Research design for mixed methods: A triangulation-based framework and roadmap. *Organizational Research Methods*, 20(2), 243-267.
- Yeasmin, S., & Rahman, K. F. (2012). Triangulation research method as the tool of social science research. *BUP journal*, 1(1), 154-163.