

Scientific research approaches and methodologies: important details for researchers

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Abstract:

Scientific research is one of the pillars of human progress. The scientific works done today demonstrate the importance of scientific research in solving many social, psychological, sporting, and health problems and crises, while also providing the necessary possibilities and requirements in a variety of fields. Through this article, we seek to present some basic concepts associated with scientific research. Then we review the scientific research approaches and the components of research, science, and philosophical paradigms on which approaches are based. This is followed by presentation of methodologies emanating from each approach, and then presentation of illustrative examples.

Keywords: scientific research approaches; scientific research methodologies; philosophical sciences.

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1. Introduction:

Scientific research at this time is a high priority in various countries, making continuous efforts and spending excessive funds for its development. Those countries have come to view scientific research as the main driver of social, cultural, and economic development.

In the last two decades, scientific research has undergone a remarkable development, and its methods have varied considerably. This has provided researchers with several areas of choice, including in line with their objectives on the one hand, and its orientations, which varied, which were determined in two main directions: quantitative research and qualitative research on the other. Both approaches seek access to scientific knowledge (Al-Moussa, 2019, p. 2).

This determination prompted most researchers in the past to bias towards quantitative research, with the Amar Study (2021) singling out some evidence of bias towards quantitative research, as the ratio of qualitative research published between 1981 and 2002 accounted for only 11% of all published research. However, published quantitative research accounts for 80%. In another analysis of 216 research in the field of special education, including university theses and research published in Arab and foreign journals between 2000 and 2010, the study found only three research studies using the qualitative approach. (P. 41).

As research continues to evolve, it is still not limited to one of the two directions (quantitative and qualitative). Rather, this development has led to a broader view, aimed at balancing quantitative and qualitative research rather than choosing one. A type of research has recently emerged that combines them; it is called mixed research that integrates in the same research between quantitative and qualitative research methodologies (Abo Allam, 2013, p. 15). As noted by the Khalifi study (2022), “the combination of quantitative and qualitative approaches gives scientific research a positive dimension aimed at deepening and discovering what is

complete to social realities, with more credibly and in integrated ways” (p.1128).

This article will not address a superiority or preference for a particular approach over the other, but will examine the philosophical premises of the three approaches. The relationship between qualitative, quantitative, and mixed research should be seen as an integrative rather than divisive relationship. It will also address methodologies of each approach and how the researcher chooses the appropriate methodology for his research.

After clarifying some of the basic concepts in scientific research, we review the scientific research methods, sciences, and philosophical models that underpin them, then the components of the scientific research method, followed by the methodologies emanating from each method, and finally we provide illustrative examples.

2.Basic concepts in scientific research

2.1 Scientific research: “a scientific activity of data collection and analysis with a view to responding to a particular research problem” (Angers, 2004, p. 70).

2.2 Research methodology: it is what the researcher actually does once he combines different research elements (Leavy, 2017, p.16).

3. Scientific research approaches

The research approach is “the way in which a scientific researcher investigates scientific facts in any branch of knowledge and in any field of theoretical and scientific sciences” (Anaya, 2014, p. 19). According to Abo Allam (2013), al-Adsani (2021) classifies research approach into quantitative, qualitative, and mixed.

- **Quantitative approach:** It is the approach based on the quantization of phenomena by measuring and using numbers and statistics. Its results make it objective away from interpretations that can be unintentionally understood (Ben Azwao, 2020, p. 357).

- **Qualitative approach:** It is the approach based on the



understanding and interpretation of human phenomena and behavior without using digital data.

- **Mixed approach:** It is the approach based on the integration of quantitative and qualitative approaches (Chinar et al., 2021).

Following our presentation of the scientific research approaches, it is now necessary to clarify the components of the research approach as well as the philosophical sciences and models on which these approaches are promoted.

*** Components of scientific research approach:**

Choosing a research approach depends on the nature of the research problem, the personal experiences of researchers, and the research community. Quantitative, qualitative, and mixed research approaches as Creswell (2014) referred to consist of philosophical perspectives or models (post-positivist, constructive, transformative, pragmatic), research designs (quantitative, qualitative and mixed), methods and means of research (data collection, data analysis... etc.).

3.Philosophical sciences underpinning scientific research approaches

Al Qahtani et al. (2021) states that for a good understanding of scientific research and its methodologies, the foundations and the science underpinning research practices should be understood. (Beins, 2017, as reported in Al-Qahtani et al., 2021) emphasized that students with the most understanding of research entrances (approaches) and methodologies are more empowered during scientific discussions and are distinguished in choosing appropriate research tools and methodologies.

To classify research approaches and research methodologies, the following philosophical sciences must be addressed:

- **Ontology:** It is the researcher's view of the nature of the problem or the research gap, and here the ontological question must be asked: "What is the nature of the truth that the researcher seeks?"

- **Epistemology:** It is the way the researcher exercises to obtain knowledge, and here the epistemological question must be asked: “What is the nature of the knowledge and the relationship between the researcher and what is required to know?”

- **Axiology:** It is the role of the researcher during the conduct of the research at all stages, and here the axiological question must be asked: “What is the character of the researcher in the research?” (p. 31).

In addition to the methodological question: “How can a researcher start getting knowledge?” (Guba and Lincoln 2005, as reported in Mertens, 2015) identified these questions because they help the researcher identify the appropriate model. Researchers should, therefore, be able to identify philosophical perspectives (worldview) that come closely close to their own perspectives (pp. 57-58).

4. Philosophical paradigms underpinning scientific research approaches

Perspectives or philosophical paradigms according to Creswell (2014) include the following:

- Post-positivist Worldview
- Constructivist Worldview
- Transformative Worldview
- Pragmatic Worldview

5. Scientific research methodologies

5.1. Quantitative approach methodologies:

Pre-experimental methodology: It is based on data collection with the provision of treatment or intervention of the researcher by non-random appointment of only one group (Al Qahtani et al., 2021, p. 34).

Quasi-experimental methodology: It is based on data collection with the provision of treatment or intervention of the researcher with a non-



random appointment of more than one group (Al Qahtani et al., 2021, p. 35).

Experimental methodology: It is based on data collection with the provision of treatment or intervention of the researcher with a random appointment of more than one group (Al Qahtani et al., 2021, p. 35).

Survey methodology: It is used in research aimed at measuring and knowing the prevalence of a phenomenon (New Researcher, 2017, 16:59), related to demographic characteristics, social environment, activities, orientations, and opinions of a group of people (Bill, 2016, p. 19).

Correlation methodology: This methodology is based on the collection of data and the search for relationships between them without providing treatment or interference (of opinions, reality, levels of the research environment, or scientific knowledge) and with a random or non-random designation of one or more groups (Al Qahtani et al., 2021, pp 35-36).

Causal-comparativemethodology: The researcher in this methodology tries to determine the reasons for the differences existing in a case or a behavior of a group of individuals. In other words, the researcher notes that there are differences between certain groups concerning a variable and tries to identify the main factor that led to this difference (Abo Allam, 2013, p. 273).

Content analysis methodology: It is based on data collection without providing processing or intervention by random or non-random assignment of one or more groups of audio or visual materials (Al-Qahtani et al., 2021, p. 36).

5.2. Qualitative approach methodologies:

Case study methodology: Focus on an in-depth description and analysis of a case or group of cases so that the case study is within its life conditions and the context in which it exists for a certain period of time (Al-Adsani, 2022, 12:00).

Grounded theory methodology: This methodology is based on a qualitative and structured procedure used to build a theory that is

intended to explain a process or act, or interact on a detailed subject at a broad conceptual level (Abo Allam, 2013, p. 317). It differs from other qualitative research methodologies in the fact that it is based on the development of a theory (New Researcher, 2020, 15:12). This methodology is unique because data collection and analysis go together and are methodologically repeated until the theory is reached. Data analysis goes through three phases: open coding, central coding, then selective coding (Al-Adsani, 2022, 19:16).

Phenomenology methodology: Studying people's expertise and shared experiences, and developing a description so that the focus on the phenomenon is studied; In the sense of what experience did individuals experience? How did they live it? (Al-Adsani, 2022, 13:45).

Ethnography methodology: This methodology is based on the collection, description and interpretation of qualitative data on the culture of groups (Al-Qahtani et al., 2021, p. 37) to understand the common social and cultural life, values and behaviors of a particular society (Al-Adsani, 2022, 21:28).

Narrative methodology: This narrative methodology, or as known as the storytelling methodology, is based on the collection of data about an individual's life and experience and analyze it qualitatively, or several individuals in the form of stories (Al-Qahtani et al., 2021, p. 37). It relies on the written or chronological account of events according to the chronology of their occurrence. The research tells stories about an individual, a number of individuals, or the researcher himself. It has three conditions: chronology, emotions and feelings, and communicating a temporal message (Al-Adsani, 2022, 15:43).

Content analysis methodology: This methodology is based on the collection of qualitative data on the content of visual or audio materials (Al-Qahtani et al., 2021, p. 38).

5.3. Mixed approach methodology:

The mixed approach uses quantitative and qualitative methodologies simultaneously to understand phenomena and better



answer the questions of the study. This mixing varies from one design to another, and thus we can identify in this regard the most prominent research designs for the mixed approach as stated in Al-Ghamdi's study (2022):

The triangulation design: It is a mixed design based on the integration of quantitative and qualitative approaches so that quantitative and qualitative data are collected in parallel and analyzed separately, and then compare and link their results to examine aspects of agreement and disagreement (p. 339).

The exploratory design: It is one of the main mixed designs based on the integration of quantitative and qualitative approaches, which leads to the employment of qualitative data and the results of their analysis in interpreting the results received in the quantitative study stage (p. 339).

The explanatory design: One of the main mixed designs based on the integration of quantitative and qualitative approaches, leading to the exploration and conclusion of modern factors, elements and variables from the analysis of qualitative study data and the use of those factors and variables in the construction and design of the quantitative study and the dissemination of its results to a larger sample (p. 339).

6. Examples of approaches and methodologies

Example No 01: If the researcher wants to study the levels of critical thinking among Algerian university students and used a closed questionnaire to measure the levels of critical thinking, here the quantitative approach is the appropriate approach and the survey methodology is the most appropriate.

Example No 02: If the researcher wants an in-depth and detailed study of the master's training program at the Institute of Sciences and Techniques of Physical and Sports Activities at the University of Constantine 2, and in order to describe the modules and their topics, the pattern of evaluation, teaching methods, professors, administration, the theoretical and practical aspect of teaching, study time, the qualitative approach is suitable using the case study

methodology.

Example No 03: If the researcher wants a mixed study on the obstacles to conducting mixed research in the field of science and techniques of physical and sports activities and the perceptions of professors about expanding the culture of its application, then the mixed approach is the appropriate approach and the exploratory design is the most appropriate.

7. CONCLUSION

A good understanding of scientific research elements, approaches and methodologies leads to clear and accurate research steps, including reliable results. In this article, we have tried to remove confusion from some of the key terms in scientific research, such as approach and methodology. In addition, we adopted the common tripartite division of scientific research approaches in social sciences; some literature reflects other divisions such as experimental, descriptive, analytical... and other names that may confuse the researcher because description, analysis, and prediction are all characteristics of scientific research. We summarized the research methodologies emanating from each approach in ways consistent with the philosophical foundations of methodologies, supported this with illustrative examples. Therefore, the researcher should mention the philosophical premises (science and philosophical paradigms) he adopts to illustrate his relationship with his research in terms of his view of the research problem, the way he will use to reach knowledge, and his role during the different research stages.

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