How to Choose an Appropriate Research Data Collection Method and Method Choice Among Various Research Data Collection Methods and Method Choices During Ph.D. Program in India?

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ABSTRACT

Purpose: *The purpose of this article is to explain the characteristics of data (qualitative and quantitative), secondary data, primary data, various primary data collection methods, data collection method choices, and most importantly the suitability of data collection method choices to enable Ph.D. scholars in India to understand the key difference between research methodology/design and research data collection methods/method choices, in turn, guiding them to choose an appropriate data collection method choice.*

Design/Methodology/Approach: *Postmodernism philosophical paradigm; Inductive research approach; Observation data collection method; Longitudinal data collection time frame; Qualitative data analysis.*

Findings/Result: *As long as the Ph.D. scholars can understand all the available research data collection methods and make mindful method choices of data collection to answer their research question they will be able to determine (on their own) all the other choices in succeeding steps of doctoral-level research such as i) data collection time frame; ii) sample size; iii) sampling technique; iv) data collection instrument; v) data analysis techniques. In addition, scholars will also be able to differentiate between research methodology/design and research data collection methods/method choices.*

Originality/Value: *There is a vast literature about each one of the research data collection methods. However, only a few have explained them together comprehensively. In this article, we have attempted to capture most of the research data collection methods and method choices briefly that would enable Ph.D. scholars in India to glance through and make scholarly data collection method choices.*

Paper Type: *Conceptual.*

Keywords: Research Methodology; Research Design; Research Process; PhD; Ph.D.; Coursework; Doctoral Research; Research Data; Primary Data; Secondary Data; Data Collection Methods; Mono-method; Mixed-method; Multi-method; Archival; Observation; Meta-analysis; Focus Group Discussion; Action Research; Ethnography; Grounded Theory; Case Study; Phenomenology; Survey; Experiment; Postmodernism

1. BACKGROUND :

There is a vast literature about the data collection methods for doing doctoral-level research. Ph.D. scholars get confused with various terminologies about different types of research viz., descriptive research; exploratory research; analytical research; explanatory research; confirmatory research; basic research; applied research; qualitative research; quantitative research; empirical research; experimental research; primary research; secondary research; doctrinal research; non-doctrinal research and so on. We determinedly believe that all these terminologies are related to either stages/phases or the levels of knowledge creation/development/modification/rationalization in a chosen area of research (fact/phenomenon/truth/reality/effect/dependent variable). The reality is a majority of stakeholders in

the research education system have a lower level of clarity about this predisposition. This lower level of clarity is resulting in the designing of unrealizable research data collection method choices by a majority of Ph.D. scholars in India. Scholars must avoid focussing on these terminologies and just understand that research methodology and research data collection methods are not the same. Research data collection methods are just one of the choices scholars need to make during the doctoral-level research process.

Various research studies have identified factors affecting the Ph.D. success rate across the world. "To name a few a) scholar-supervisor/guide relationship; b) mentorship; c) dissertation process; d) role of the department; e) role of peer qualities; f) transformational learning experience provided; g) level of curiosity and interest in reviewing the existing literature; h) planning and time management skills; i) level of creative thinking and writing skills; j) amount of freedom in the research project; k) level of a supportive environment for Ph.D. scholars' well-being; l) higher-education practices; m) supervisors' research capabilities and gender; n) expectations set by the research environment; o) Ph.D. scholars' expectations; p) support network; q) level of Ph.D. scholars' socialization with the research community; r) Ph.D. scholars' navigation system; s) different terminologies for various components of doctoral-level research are given by different disciplines creating undue confusion in scholars' minds; t) data collection methods which just play the role of data collection and it is just one of the steps of the doctoral-level research process being portrayed as the research methodology/design; u) scholars' inability to identify their genuine interest in a fact/phenomenon/reality/truth/dependent variable, intensive review of existing literature, locating an important research gap, and finally formulating a research question; v) a lower level of clarity about the most important and indispensable step of the doctoral-level research process i.e., choosing an appropriate research philosophical paradigm that lays stepping stones toward answering the research question in a scientific and scholarly way; w) a lower level of clarity about the most important and indispensable step of the doctoral-level research process i.e., choosing an appropriate research approach/reasoning that paves path for decision concerning data collection and analysis" [1-51].

Furthermore, in reality, a majority of stakeholders in the research education system have a lower level of clarity about the most important and indispensable step of the doctoral-level research process i.e., choosing an appropriate research data collection method/s to logically answer the research question and the difference between research methodology/design and research data collection methods/method choices. In addition to this lower clarity, a majority of them guide the Ph.D. scholars to begin the journey without educating the scholars about the most important aspect of choosing a data collection method viz., repeatability, generalizability, and suitability. In addition, they also mandate that scholars use certain research data collection methods that are commonly used in a discipline or the one with which they are comfortable. This lower level of clarity and the beginning of the Ph.D. journey without a clear understanding of the essence of research data collection methods is making it difficult for Ph.D. scholars to complete the journey successfully and most importantly if some scholars complete their Ph.D. journey successfully, their awareness about the research data collection method/s chosen to answer their research question is very low. We believe that if the scholars can begin their Ph.D. journey by allocating a higher level of focus and time toward understanding various research data collection methods available and the data type each of the data collection methods produces and choose the one or more that are appropriate to find a generalizable answer to their research question their journey will be with a very lower level of complications and with a higher level of awareness about the data collection method choices they make. But this reality is knowingly or unknowingly, intentionally, or unintentionally suppressed by a majority of stakeholders in the research education system in India. In other words, this *suppressed reality* has resulted in creating humungous confusion about the difference between research methodology/design and research data collection methods/method choices among Ph.D. scholars in India.

One thing Ph.D. scholars must always remind themselves of throughout their Ph.D. journey is the fact that they will be awarded a Ph.D. degree for doing doctoral-level research. Doing doctoral-level research and generating research outputs such as research articles and a thesis determines the probability of success in getting a Ph.D. degree. The first step of the doctoral-level research process is identifying research gaps and formulating a research question, the second one is choosing an appropriate research philosophical paradigm, the third step is choosing an appropriate research approach/reasoning, and the fourth step is choosing the appropriate research data collection method choices that ensure a logical

answer is found to the research question. It is thus inevitable and imperative that Ph.D. scholars understand various research data collection methods/method choices in depth and chose the appropriate one. The doctoral-level research which is the single most important requirement of the Ph.D. program is cognitively demanding and intends to create researchers who can create new knowledge or interpret existing knowledge about reality by using different perspectives, paradigms, and reasoning. Knowledge sharing requires autonomy, good quality time, a stress-free brain for deep thinking, and the freedom to look for more meaningful findings. This is the single most important reason for making doctoral-level research flexible wherein the scientific and scholarly world gives autonomy to Ph.D. scholars to formulate their question and answer it within 3-6 years using an appropriate research approach/reasoning. Nevertheless, only 50% of scholars admitted to Ph.D. in India completed, and that too in ten years whether or not they are aware of the importance of reasoning in doctoral-level research [46-50].

2. OBJECTIVE :

There is humongous confusion among Ph.D. scholars in India about the difference between research methodology/design and research data collection methods. When we ask the scholars, who are in their final stages of the Ph.D. program about what is their research methodology/design, surprisingly we get answers such as 'Survey', 'Experimental', 'Observational', and so on from a significant majority of them. Furthermore, choosing one or more appropriate research data collection methods choices is just one of the choices a scholar needs to make among many choices in the doctoral-level research process. And all the choices a scholar makes across all the steps of doctoral-level research cumulatively become a research methodology/design. *Owing to such confusion the key objective of this article is to explain the characteristics of data (qualitative and quantitative), secondary data, primary data, various primary data collection methods, data collection method choices, and most importantly the suitability of data collection method choices to enable Ph.D. scholars in India to understand the key difference between research methodology/design and research data collection methods/method choices, in turn, guiding them to choose an appropriate data collection method choice*.

3. RESEARCH DATA AND RESEARCH DATA COLLECTION METHOD :

Data in Greek is 'to give'/'given'. It belongs to the family of Information, Knowledge, and Wisdom. Data can be in the form of Numbers, Words, Images, Ideas, Preferences, Opinions, Perspectives, Behaviors, and Attitudes. Data is the lowest unit of information from which other measurements and analyses are done. Data comes from observations made upon variables of the research question. There are two types of data in research as detailed below.

3.1. Secondary Data:

The data which is not collected by the scholars but just gathered by them using existing literature/knowledge is known as secondary data. This type of data is required in research to support or corroborate the background/motivation for formulating the research question. Secondary data can only provide broad information about variables of the research question and they are already published by other researchers or agencies that are open for all to access. However, Secondary data is inexpensive to gather, easily available, and suitable for the Introduction Section/Chapter of the research article/thesis. There are many sources of secondary data. For instance, Census (http://censusindia.gov.in) Electronic repositories (Social Sciences Research Network - SSRN), Public/Government agencies (http://www.dgciskol.nic.in), Private agencies (Mckinsey & Company), Syndicates (Retailers Association of India), Public Limited Company reports (Annual reports), Historical documents (http://nationalarchives.nic.in/), Satellite images (NASA's Earth Data Search), Existing literature/ Research Articles/Books (Google Scholar).

3.2. Primary Research Data:

The data which is collected by scholars or under their supervision/guidance about the variables of the research question is known as primary data. Because this type of data is collected by scholars themselves or under their supervision or their guidance, it is ought to be original, authentic, reliable, objective, valid, and most importantly unpublished before. Collecting primary data is costly and requires a longer duration. However, scholars need to be careful while collecting primary data as there is a possibility of

inaccurate responses knowingly or unknowingly, intentionally, or unintentionally by respondents /subjects/participants/units of analysis/samples and inaccurate recording of responses. We must note that the primary data can only be collected using one of the data collection methods that are approved by the scientific/scholarly community across the globe such as Archival, Observation, Meta-analysis, Focus Group Discussion, Action Research, Ethnography, Grounded Theory, Case Study, Phenomenology, Survey, and Experiment.

Before collecting the primary data, Ph.D. scholars must ensure they are well aware of the units of analysis/samples, independent variables, and dependent variable *(key components of the research question)* of their research question in addition scholars must also be aware that what is the type/characteristic of the data that is available/accessible to them about the key components of their research question. There are two main characteristics of data as illustrated in figure A. Scholars must check whether it is Categorical (Qualitative) such as Nominal Unordered (example: male/female; yes/no); Ordinal/Ordered/Scale (example: ratings; strongly disagree to strongly agree). Or is it Numerical (Quantitative) such as Discrete/Counts (example: number of male students; the number of stores; the number of Covid-19 positive cases); Continuous (example: height; weight; sales value)? Scholars must note that this is the origin of qualitative and quantitative research and they are nothing to do with research methodology/design. They just indicate the type of data used to describe, explain, or claim certain findings about reality/fact/phenomenon/dependent variable.

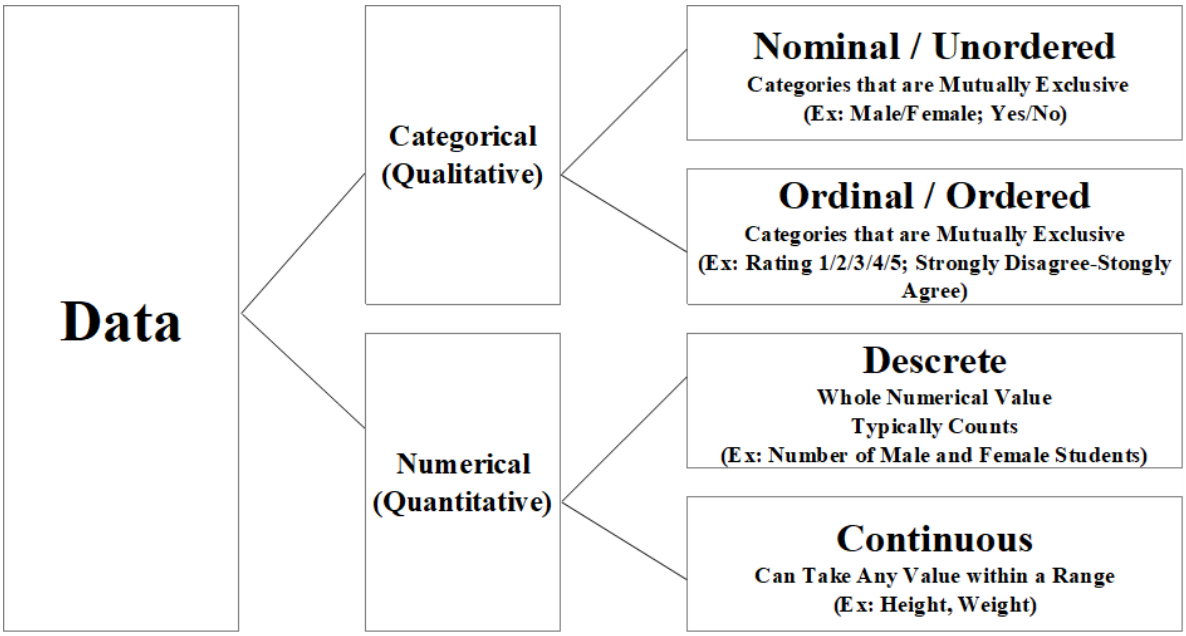

Fig. A: Characteristics of data

Scholars are required to use primary data to conclude their Ph.D. research. However, concluding Ph.D. research work using just the secondary data is also possible as long as the research findings are original and contribute to creating new knowledge or interpreting the existing knowledge in a completely different way. Scholars need to take a quick look at various Ph.D. theses that are available on University Grant Commission's (UGC) Shodh Ganga website (INFLIBNET) and are relevant to their discipline to understand how researchers have used just the secondary data to complete their Ph.D. research work.

3.3. Research Data Collection Methods:

The data collection method is a strategy that is a long-term, actionable, practical, and competitive path, chosen for achieving scholars' research objectives. It is a higher level of decision-making in the Ph.D. research journey that determines the repeatability of research results which is a measure of the ability of the data collection method to generate similar results for multiple preparations of the same sample. It is a scientific/systematic/scholarly way of collecting data from the units of analysis/samples to answer the research question. An appropriate data collection method depends upon i) type of the research question (descriptive; relational; causal) [46] [49]; ii) research philosophical paradigm (positivism;

interpretivism; critical realism; postmodernism; pragmatism) [46] [50] [52-82]; iii) the research approach/reasoning (deductive; inductive; abductive) [46] [51] [83-124]; iv) time available for scholars to collect data [46]; v) resources that are available for scholars to collect data [46]; vi) scholar's competence such as is he/she a good Observer; Communicator; Interpreter; Counsellor; Deep thinker; Creative person; Analyzer; Role player; Thought experimenter; Imaginer; Focussed; Continual questioner; Media grasper (literature review)? [46]. Having all such competencies is an essential requirement of a good researcher. But it is difficult to have all of them during the Ph.D. program. However, we believe that scholars will eventually develop most of these competencies during and post-Ph.D. We recommend Ph.D. scholars not get distracted by their surroundings and others' choice of the data collection method. Others would have chosen a particular method based on their competence, research environment, and support system. Choosing a primary data collection method decision is one of the most important decisions scholars need to make during their Ph.D. journey. We strongly recommend scholars know their competence, research environment, and support system before finalizing a data collection method.

3.4. Primary Data Collection Methods:

We have come across many ways of grouping the available data collection methods in textbooks and literature. However, to eradicate all the confusion about data collection methods, we have made two important groups of primary data collection methods available for Ph.D. scholars to choose as listed below.

- ***Noninteractive*** data collection methods wherein there is no or minimal interaction between the researcher and the units of analysis/samples, viz., Archival; Observation; Meta-analysis.
- ***Interactive*** data collection methods wherein there is an interaction between the researcher and the units of analysis/samples, viz., Focus Group Discussion; Action Research; Ethnography; Grounded Theory; Case Study; Phenomenology; Survey; Experiment.

4. NON-INTERACTIVE DATA COLLECTION METHOD 1 - ARCHIVAL :

The archival data collection method is answering the research question with the use of existing records and without interacting with a single unit of analysis/sample/subject/respondent/group. It facilitates the investigation of documents and textual materials produced by and about organizations (whether a government body, business, family, or other agency). This method relies on looking at records and data sets to identify interesting relationships and patterns concerning key components of the research question. A hypothesis (logical assumption) and areas of interest are determined after data collection (an inductive approach/reasoning). Conclusive cause-and-effect claims are not possible if the data is collected using Archival. However, it is not secondary research. It is more complex and time-consuming than secondary research. Scholars must be aware that archives have varying degrees of access and discoverability [124-132]. To name a few sources of archival data a) Records in the Libraries; b) Museums; c) Novels; d) Sacred Texts of Religions; e) Newspaper Articles; f) Advertisements; g) Censuses; h) Sports Statistics; i) Speeches by Public Figures; j) Tweets/Social Media Communications; k) Digital Repositories.

The archival data collection method is suitable for Historical Research; Literary Studies; Archaeology Studies; Sociology; Human Geography; Anthropology; Psychology; Organizational Studies. For example, a Psychologist looking at NIMHANS (The National Institute of Mental Health and Neuro-Sciences a medical institution in Bangalore, India.) case records from the 1900s to determine the prevalence of depressive symptoms in patients at the time.

There are many merits in using the Archival as the primary data collection method such as i) minimal response bias as there is no interaction between you and the Units of Analysis / Samples, ii) data is readily available, iii) cost-effective, and most importantly iv) helps to confirm theories derived from experiments. However, the Archival data collection method also has some demerits such as i) there is a chance of existing records being selectively deposited, ii) records might be biased, and most importantly iii) mistakes are possible in the data entered in archives.

5. NON-INTERACTIVE DATA COLLECTION METHOD 2 - OBSERVATION :

In the observation data collection method, the data is collected by simply observing the units of analysis /samples/subjects/respondents/groups. The process of observation can take place over weeks or months

and it is a time-consuming method of data collection. It requires scholars to be well-trained. Unlike other methods, the observational method is very limited, as it presents some problems to be reproduced again by other researchers [133-145]. The observational data collection method allows studies that cannot be carried out with other primary data collection methods. By executing this method of data collection, scholars can avoid problems related to ethics or difficulties presented by a large-scale project.

5.1. Criteria for Observation Method :

There are three main criteria when adopting an observation data collection method such as i) Structure of observation; ii) Identity of the observer; iii) Environment of observation. Scholars must know beforehand that the quality of data collection using the Observation method depends on these three criteria. The quality of data collected in turn determines the repeatability and generalizability of research findings.

- ***Structured Observation:*** Scholar will specify in detail what is to be observed and how the measurements are to be recorded. An auditor performing inventory analysis in a Retail store is an example.
- ***Unstructured Observation:*** Scholar as the observer monitor all aspects of the phenomenon involving your Dependent Variable that seems relevant to your research question. Observing children playing with new toys is an example.
- ***Disguised Observation:*** The units of analysis/Samples of research are unaware that they are being observed. Disguise may be achieved by using hidden cameras, one-way mirrors, or hidden mechanical devices. Walking into a Retail store as a mystery Customer to observe the behavior of Sales Personnel is an example.
- ***Undisguised Observation:*** The units of analysis/samples of the research are aware that they are under observation. Informing Sales Personnel in a Retail store upfront about the installation of a CCTV Camera to observe their body language while they are interacting with the Customer is an example.
- ***Natural Observation:*** This involves observing the behavior of the units of analysis/samples as it takes place in the environment. Scholars could observe the behavior of their units of analysis/samples eating at a fast-food Restaurant to capture their facial expressions when different types of food items were served could be the example.
- ***Contrived Observation:*** The behavior of the units of analysis/samples is observed in an environment that is artificially created. A test kitchen or one-way mirror is an example.

5.2. Types of Observation Method :

There are six types of data collection methods using Observation as listed below. Scholars are free to choose any one of them for collecting data to answer their research question. Each of these types has a different level advantage over the criteria as shown in table 1.

- ***Personal Observation:*** In this type, scholars will observe and record actual behavior as it occurs.
- ***Mechanical Observation:*** In this type, scholars will take the help of a mechanical or electrical, or electronic device/instrument to observe and record actual behavior as it occurs. A few examples of such devices are the AC Nielsen Audiometer; Turnstiles (record the number of people entering or leaving a building); On-site cameras (still, motion picture, or video). Optical scanners in supermarkets; Eye-tracking monitors (to see things from the perspective of participants/subjects); Pupilometers (TV/Digital advertisements); Psychogalvanometers (lie detectors/advertisements – emotional arousal); Voice pitch analyzers (advertisements - analyzing a subject's voice during their responses to understand feelings and attitudes about the ad); Devices measuring response latency (a measure of attitude accessibility, which is the ease or swiftness with which an attitude comes to mind).
- ***Audit Analysis Observation:*** Scholars shall collect data by examining available records or performing a random inventory analysis. The data is collected personally by the scholar or supervised/guided by the scholar. Here, data are based on counts.
- ***Content Analysis Observation:*** This is appropriate when observing communication, rather than behavior. For example, observing words used in newspapers to evaluate how Women are portrayed in advertising over the years.

- ***Trace Analysis Observation:*** Data collection is based on physical traces, or evidence, of past behavior. For example, analyzing the erosion of tiles or carpets to measure traffic patterns or analyzing fingerprints on the magazine to gauge ad popularity, or analyzing internet users' traces of websites visited.

Table 1: Observation method and observation criteria matrix

Observation Criteria	Observation Method: Personal Observation	Mechanical Observation	Audit Analysis	Content Analysis	Trace Analysis
Degree of Structure	Low	Low to High	High	High	Medium
Degree of Disguise	Medium	Low to High	Low	High	High
Ability to Observe in Natural Settings	High	Low to High	High	Medium	Low
Observation Bias	High	Low	Low	Medium	Medium
Analysis Bias	High	Low to Medium	Low	Low	Medium
General Remarks	Most Flexible	Can Cause Disruption	Expensive	Limited to Communications	Method of Last Resort

There are many merits in using the Observation data collection method such as i) it is capable of measuring the actual behavior of your units of analysis/samples, ii) does not have any interviewer bias as there is no or minimal interaction, and most importantly iii) it is useful when your unit of analysis/samples are unaware or unable to communicate feelings. However, the Observation data collection method also has some demerits such as i) little is known about the underlying preferences, attitudes, beliefs, and motives of your units of analysis/samples, ii) it is time-consuming and expensive, and most importantly iii) it borders on being unethical in certain contexts.

6. NON-INTERACTIVE DATA COLLECTION METHOD 3 – META-ANALYSIS :

The basic meaning of Meta is *'self-referential'.* That is referring to itself or the conventions of its genre. A meta-analysis is a statistical analysis that combines the results of multiple scientific studies. Meta-analyses can be performed when multiple scientific studies are addressing the same question (remember, the same research question and not the research topic), with each study reporting measurements that are expected to have some degree of error. The fundamental objective is to apply statistical methods to derive a pooled estimate that, based on how this inaccuracy is viewed, is closest to the unidentified shared reality. The evidence-based medical literature regards meta-analytic findings as the most reliable source of proof. Meta-analyses are frequently, but not always, significant steps in the process of a systematic review [146-162]. To better understand how effectively a medical treatment works, for instance, a meta-analysis of numerous clinical studies may be performed. Meta-analysis does have certain methodological issues, though. The meta-analytic assessment of the overall treatment effect might not accurately represent the efficacy of a treatment if individual studies are systematically biased as a result of dubious research techniques or publication bias at the journal level. Potential advantages of meta-analyses include the following.

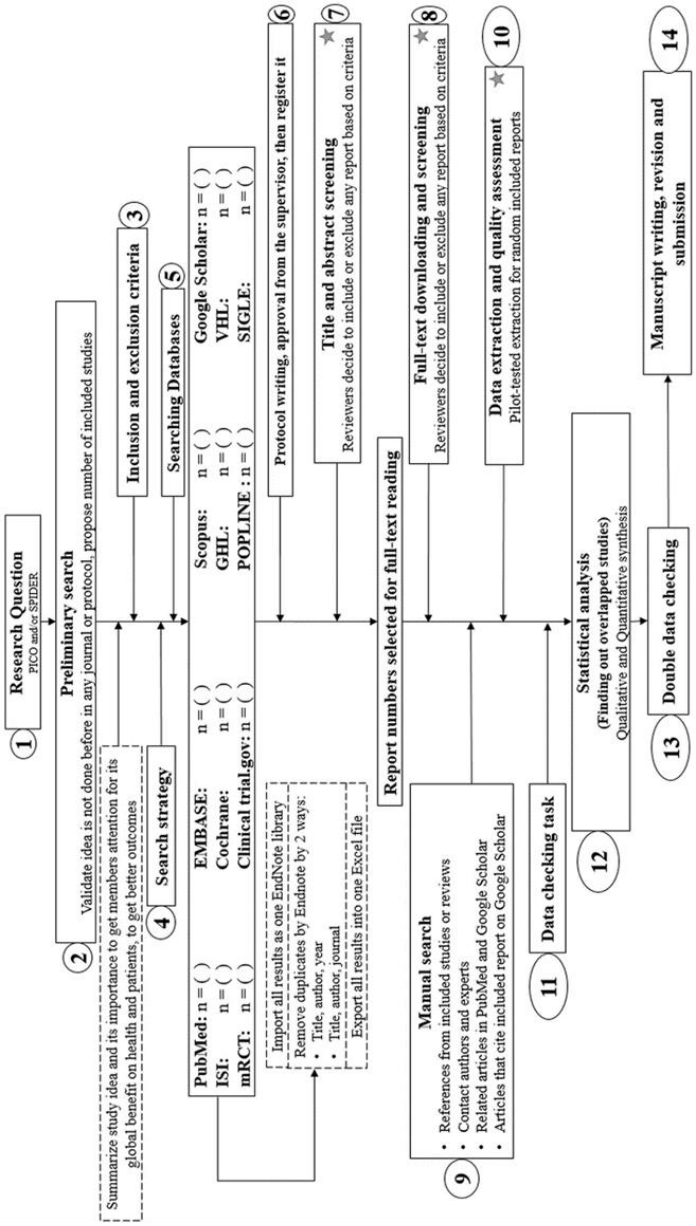

Fig. 1: Steps for meta-analysis [146]. Note: Star icon refers to 2–3 reviewers' screens independently.

- Improving precision. Numerous studies are too small to offer solid support for the isolation of intervention effects. When estimation is based on more data, it typically performs better.
- Answering questions not posed by the individual studies. Primary studies frequently use a certain participant type and well-specified interventions. Investigation of the consistency of effect over a larger range of groups and interventions can be done by choosing studies in which these features vary. If applicable, it might also make it possible to look into the causes of discrepancies in effect estimates.
- Settling disputes resulting from studies that appear to be at odds with one another or developing new theories. The degree of conflict can be formally examined using a statistical synthesis of the data, and the causes of various results can be investigated and quantified.
- Compare the findings of many research and look for trends, reasons why the findings differ, or other intriguing connections that may emerge from several investigations.
- Adoptability for research questions across disciplines that require quantitative analysis of existing evidence (deductive research approach).

Figure 1 illustrates a step-by-step process of the meta-analysis data collection method. The key stage of meta-analysis has been highlighted in the figure using an arrow mark [146].

7. INTERACTIVE DATA COLLECTION METHOD 1 – FOCUS GROUP DISCUSSION :

Focus Group Discussion (FGD) is a Primary data collection method for gathering data that involve a small group of participants who are carefully chosen and who participate in honest discussions on the key components of the research question. In this method, scholars shall carefully select participants for the research to represent the larger population they are attempting to target. The group might look at new products, feature updates, or other topics (remember, topics and not the question) of interest to generalize the entire population's reaction. FGD method includes a moderator whose job is to ensure legitimate results and reduce bias in the discussions. Usually, a group of 6-10 people, meet to explore and discuss the select Variable of your research question. The group shares their feedback, opinions, knowledge, and insights about the topic at hand. The participants in the group openly share opinions and are free to convince other participants of their ideas. The responsibility of the mediator is also to take notes on the discussion and opinions of group members. Be aware that the right group members affect the results of your research findings, so it is vital to be picky when selecting members for FGD. However, the purpose of the focus group is not to arrive at a unanimous agreement on the topic. Instead, it seeks to identify and understand participants' perspectives and perceptions about one or more components of the research question [163-173]. The FGD data collection method needs to be carried out using the steps listed below.

- **FGD Step 1:** First and foremost, determine the key components (variables and unit of analysis) of your research question and the goals/objectives of the focus group.
- **FGD Step 2:** Identify potential participants for the focus group.
- **FGD Step 3:** Prepare a script/discussion guide that outlines the focus group questions.
- **FGD Step 4:** Choose a location for the focus group discussion.
- **FGD Step 5:** Recruit 6-12 participants and ensure incentivized participation.
- **FGD Step 6:** Finalize the moderator.
- **FGD Step 7:** Conduct 90 to 120 minutes sessions.
- **FGD Step 8:** Make notes of the discussion.
- **FGD Step 9:** Categorize the discussion points.
- **FGD Step 10:** Check if there is any consensus among the participants of the focus group on any one particular viewpoint.
- **FGD Step 11:** Prepare the FGD report.

FGD can also be conducted in many different ways based on your objective, convenience, competence, and infrastructure as listed below.

- ***Dual-moderator FGD*** - This event will be moderated by two people. One guarantees efficient operation, while the other ensures that each question will be discussed.
- ***Two-way FGD*** - A two-way focus group consists of two separate groups having discussions on the topic at different times. As one group conducts its study, the other group observes the discussion. In the end, the group that observed the first session performed their conversation. The second group can use insights gained from watching the first discussion to dive deeper into the topic and offer more perspective.
- ***Mini FGD*** - This type of focus group restricts the number of participants to 4-5 members instead of the usual 6-10.
- ***Client-involvement FGD*** - Use this group when clients who are part of your research ask you to conduct a focus group and invite those who ask.
- ***Participant-moderated FGD*** - One or more participants tentatively take up the role of moderator.
- ***Online FGD*** - These focus groups use online mediums to gather agreements, opinions, and feedback. There are three categories of people in an online panel i) observer, ii) moderator, and iii) respondent. The observer is mandatory for Online FGD as someone is required to ensure all the participants are focused.
- ***Delphi FGD*** – The participants of this FGD are experts in their field. For instance, academicians, scientists, researchers, area specialists, managers, employees, practitioners, and so on.

FGD data collection method is common in situations such as i) when the population of study cannot read or write, ii) they are reluctant to be interviewed on their own and feel they have nothing to say, iii) initial stages of your research study (Inductive research approach), iv) while creating a plan of action during your research designing stage, and v) after the completion of your research to establish results (Deductive research approach).

8. INTERACTIVE DATA COLLECTION METHOD 2 – ACTION RESEARCH :

Action research is a data collection method in which you will a) collaborate with a client/group/ organization to diagnose a problem/issue, b) develop a solution, c) implement the solution, d) reflect on the results after implementation, e) improvise/modify the solution, f) reimplement, and g) finalize the solution (Abductive research approach). Scholars must be aware that Action research and consulting are different, it is pursuing action and data collection at the same time. Scholars must detach themselves from what is being researched, be scientific, stand outside the events, and record the readings diligently as they shall be the controller of the data gathering. The units of analysis/samples are partners and not just subjects/respondents. Scholars need to be aware that respondents/subjects are passive, and they may or may not know that someone is collecting data. Action research is simply the practice of theory. It assumes that the social world is constantly changing and both you (scholar) and research are one part of the change. It also improves specific practices, introduces improvements in relevant practices, and most importantly focuses on specific situations and contexts [174-189]. A simple flow of Action research is illustrated in figure 2. There are many merits in using Action research such as i) the data collection method has a high level of practical relevance, ii) it allows to collect of both quantitative and qualitative data, iii) allows gaining in-depth knowledge about key components of the research question, and iv) has higher field-level validity of research findings. However, the Action research data collection method also has some demerits such as i) it lacks repeatability, ii) scholars may find difficulties in distinguishing between action and research and ensuring the application of both, and iii) has limited accessibility of the research output in case the data collected is confidential and only a few select audiences are allowed to access the research output.

We strongly recommend Part-time Ph.D. scholars consider choosing Action research as one of their key primary data collection methods during the Ph.D. program. Rather than looking for primary data to answer your research question outside their day-to-day work environment, it is a smart decision to look at formulating a research question limited to part-time Ph.D. scholars' area of work and collect data using Action research. This consideration might help them integrate their employment and Ph.D. program seamlessly as long as their area of research and area of employment is the same. For instance, if the part-time Ph.D. scholar is a;

- Teacher, Faculty Member, Institute Administrator, or an Education Counsellor and he/she is pursuing a Ph.D. program in the area of Education.
- Nurse, Physiotherapist, Doctor, or Hospital Administrator and he/she is pursuing a Ph.D. program in the area of Health Sciences/Medicine.
- Clinical Psychologist, Psychological Counsellor, Social Worker, Archaeologist, Public Administrator, Lawyer, Advocate, Journalist, or Librarian and he/she is pursuing a Ph.D. program in the area of Social Sciences.
- Business Executive, Business Manager, Entrepreneur, Business Owner, Business Advisor, Business Consultant, Chartered Accountant, Company Secretary, or Accountant and he/she is pursuing a Ph.D. program in the area of Management or Commerce.
- Designer, Writer, or Artist and he/she is pursuing a Ph.D. program in the area of Fine Arts.
- Laboratory Technician and he/she is pursuing a Ph.D. program in the area of Basic Sciences.
- Engineer or Technologist and he/she is pursuing a Ph.D. program in the area of Engineering or Technology.

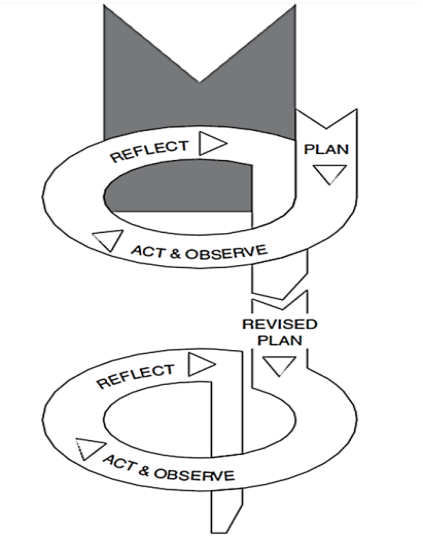

Fig. 2: The Action research process flow [189].

9. INTERACTIVE DATA COLLECTION METHOD 3 – ETHNOGRAPHY :

An Ethnography type of primary data collection method is almost similar to action research, but it is without any action from the researchers' end (scholars). Scholars shall be engaged with the units of analysis/samples and they will get first-hand data about the key components of the research question. Scholars shall become as much a part of the group being studied. They will be observing changes in the independent and dependent variables in their natural environments concerning the units of analysis/samples. Ethnography is an in-depth study of people, cultures, habits, behaviors, and mutual differences. Scholars shall also act as the data collection instrument and collect the data by interacting with the units of analysis/samples and continuous observation. However, the Ethnography data collection method can only provide a 'thick description' of a phenomenon/fact/reality/truth/effect concerning the dependent and independent variables of the research question [190-202].

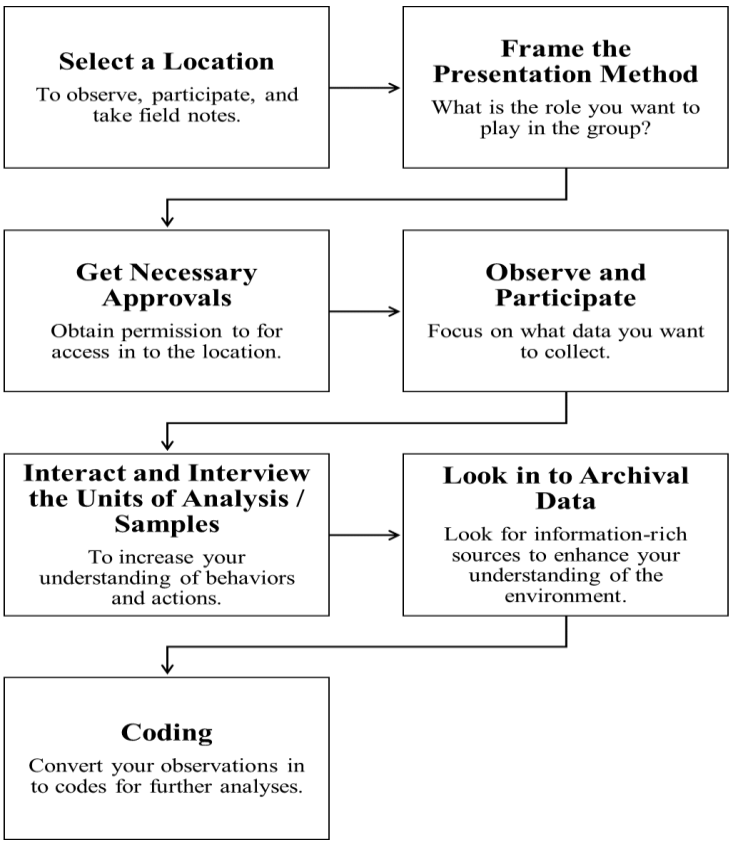

Fig. 3: Ethnography process flow [190].

Ethnography can also be performed to collect data using online platforms that are known as Netnography. Netnography allows the collection of data about online communities and social communication patterns. The ethnography data collection method is appropriate for i) early stages of user-focussed systematic investigations, ii) gaining first-hand insights from people/groups/ organizations, iii) Variables that are complex to understand, and iv) examining social behaviors and interactions. Ethnography should not be used in research that requires statistically valid analysis, test runs, or group comparisons. A simple process flow of data collection using Ethnography is illustrated in figure 3.

10. INTERACTIVE DATA COLLECTION METHOD 4 – GROUNDED THEORY :

Simply put, the Grounded Theory method of primary data collection is an Ethnography made more analytic, a Survey made more in-depth, and content analysis (observation) made more focussed. This method is useful and appropriate in developing scholars' theory about the relationship between dependent and independent variables of scholars' research questions from qualitative data and helps them move from specific to more general (Inductive approach). The Grounded Theory method of data collection uses open-ended and general questions such as 'what is going on?' or 'What is happening?' It is a systematic way of thinking about the conceptualization of qualitative data about variables of the research question concerning the units of analysis/samples. It is methodologically dynamic rather than a complete primary data collection method. Grounded Theory facilitates scholars in constructing data collection methods to better understand situations human finds themselves. This method of data collection is a discovery by Glasser (positivism) & Strauss (interpretivism) while carrying out their research on dying patients at hospitals [203]. It is a fine mixture of Positivism which makes it rigorously analytical, and Interpretivism which makes it richer in throwing some light on social processes and the complexity of social life. For instance, A Human Resource (HR) Manager in a company might study why employees are frustrated by their work profile. Employees can explain what they feel is lacking. HR Manager then gathers this data, examines the results to discover the root cause of employees' problems, and presents solutions. When scholars are interested in understanding the interrelationship between meaning in the perception of their respondents/subjects and their actions Grounded Theory is the most suitable data collection method. It can also help understand the socially-shared meanings that underlie individuals' behaviors and the reality of respondents/subjects being studied. The most important aspect of the Grounded Theory data collection method is that we do not aim for the 'truth' rather, we try to conceptualize what has been taking place in the lives of study participants/respondents/subjects and the key units of analysis/samples is the 'incident' and not the persons/participants/respondents/subjects. Unlike Ethnography, this method will yield a "thin description" of the variables of the research question concerning the units of analysis/samples [203-219]. We have listed below the steps for collecting data using Grounded Theory.

- **Step 1:** Collection of qualitative data through observation or in-depth interviews using open-ended questions.
- **Step 2:** Looking for apparent ideas/concepts from the data collected.
- **Step 3:** Coding & sorting of ideas/concepts. These codes will help succinctly summarize ideas/concepts. A literature review is only done after the sorting. You might become sensitized to concepts in the existing literature. The literature review is treated as more data to code and compare with what has already been coded and generated.
- **Step 4:** Collection of more data.
- **Step 5:** Re-review of codes.
- **Step 7:** Grouping of codes into higher-level concepts.
- **Step 6:** Grouping of concepts into categories.
- **Step 8:** Creation of hypothesis based on categories.

Be aware that before the theory is written up, scholars should refrain from discussing it. They should only discuss the Grounded Theory with those who can assist them without letting it affect their conclusions.

11. INTERACTIVE DATA COLLECTION METHOD 5 – CASE STUDY :

The Case Study method of primary data collection is suitable when scholars are looking for a piece of evidence before starting new mega research (large-scale). A case study is very helpful in finding patterns between multiple instrumental reports in addition to finding differences in similar types of cases. It will also enable scholars to gain a deeper understanding of a complex phenomenon concerning one or more components of the research question in addition to helping them understand a phenomenon from diverse contexts. Within the Case Study data collection method, there are six types as explained below [220-233].

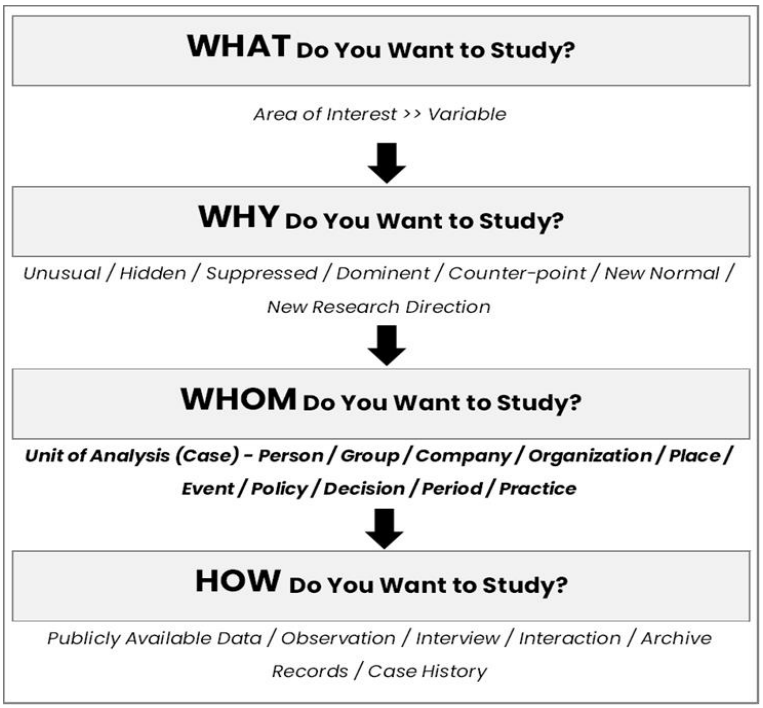

Fig. 4: Single Case Study process flow

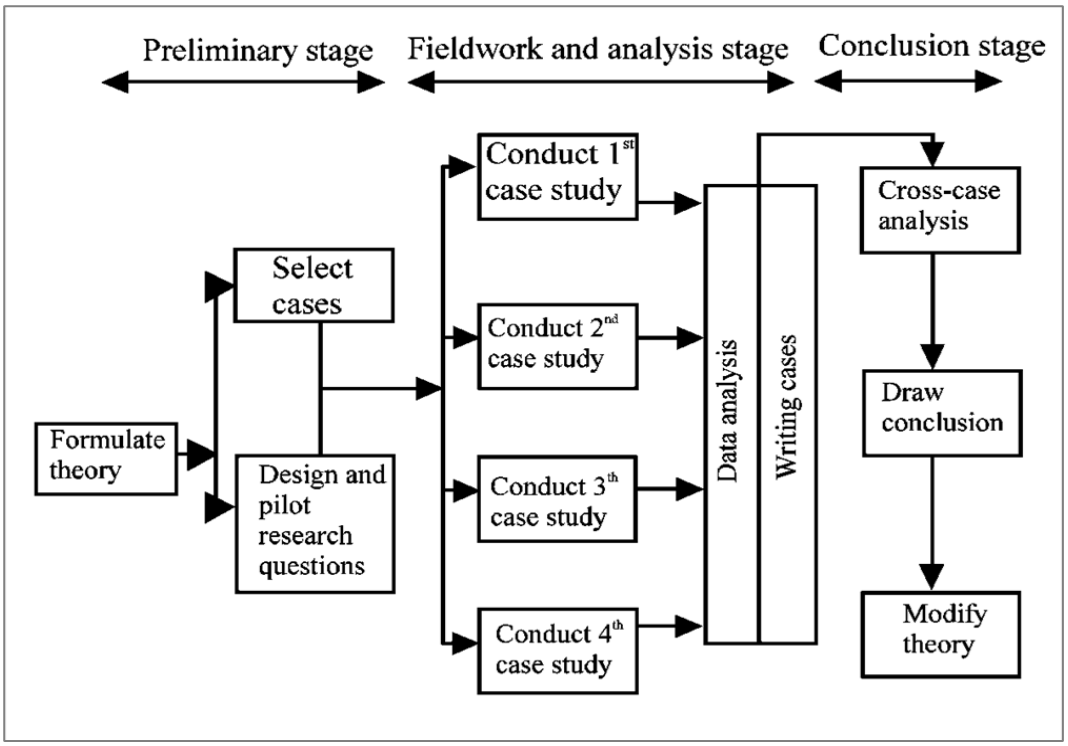

Fig. 5: Multiple Case Studies process flow [220].

11.1. Exploratory Case Studies :

It is a self-contained document and only the beginning of an investigation that is usually conducted as a precursor to large-scale investigations. It suggests why further investigations are needed and can also be used to suggest methods for further examination. For example, scholars can conduct a Case Study to explore the relationship between online teaching mode (Independent Variable) and learning outcome (Dependent Variable) by just doing an in-depth interview of a select person (Unit of Analysis/Sample / Case).

11.2. Descriptive Case Studies :

This method is suitable when scholars have an existing hypothesis/logical assumption about the relationship between the Variables of their research question. This type of study starts with a description. The aim is to find connections between the subject (Unit of Analysis/Sample/Case) being studied and a theory. For example, if a scholar is interested in describing emotional intelligence (Independent Variable) & successful leadership (Dependent Variable) he/she might want to choose a Descriptive Case Study method to collect primary data from one of the chosen successful leaders (Unit of Analysis/Sample/Case). Once the scholars can find connections between the variables of their research question, the research can conclude. The results of this type of study will usually suggest how to develop a theory further.

11.3. Explanatory Case Studies :

An explanation is needed when an incident takes place in a field. An explanatory case study looks into what caused the incident. It will provide justifications for that reason. The study will also provide information on how the incident affected people. The majority of the time, this study will use data to forecast future events. The explanatory study's findings are undisputed. Be aware that there is no space for interpretation in this situation. For example, if we are interested in understanding what causes (Independent Variables) Ph.D. scholars (Unit of Analysis/Sample/Case) to become inactive (Dependent Variable), then this method is appropriate.

11.4. Intrinsic Case Studies :

Intrinsic studies are more commonly applied in the Psychology disciplines. The intrinsic case studies can also be conducted in Social Work or Healthcare disciplines. This type of Case Study focuses on a unique subject, such as a subject/patient. Scholars can sometimes study with subjects/patients/samples/ Units of Analysis/groups close to the scholar. Such studies aim to understand the subject (Unit of Analysis/Sample/Case) better. This requires understanding their past. Scholars shall also examine how they interact with their environment. For example, if scholars are interested in understanding the impact (Dependent Variable) of Online Classes (Independent Variable) on Kids, they might choose a Kid (Unit of Analysis/Sample/Case) better whom they know personally. Jean Piaget (Swiss psychologist) established theories on Cognitive Development by conducting an Intrinsic Case study on his children.

11.5. Instrumental Case Studies :

This is another type of case study used in the Psychology and Health Science disciplines. Instrumental case studies are created to examine more than just the Unit of Analysis/Sample/Case. When research is carried out for an instrumental study, it serves as the foundation for a more significant phenomenon. The subject/patient/sample/unit of analysis is usually the best example of the phenomenon. This is why it is being studied. For example, people who have studied in their mother tongue (Independent Variable) till 10^{th} standard and their career growth (Dependent Variable).

11.6. Collective Case Studies :

The collective Case Study is based on Instrumental Case Study findings. These types of studies examine findings from multiple intrinsic case studies related to a phenomenon about variables of the research question. There are several reasons why Collective Case Studies are done such as it helps you collect large amounts of data/information, frame/formulate hypotheses (inductive research approach), construct/build the case for further research, discover new insights into a subject/patient/sample/unit of analysis, and most importantly it does not require statistical sampling as just the theoretical sampling is sufficient. However, there are a few demerits of Collective Case Study such as responses from interviews are subjective, subjects may tailor responses, cannot always be replicated, in certain

industries, analyses can take time and be expensive, and most importantly, there is a risk of generalizing the results among a larger population.

We have illustrated the process of a Single Case Study (One Unit of Analysis/Sample/Case) in figure 4 and the process of Multiple Case Studies (Many Units of Analysis/Samples/Cases) in figure 5. Scholars must follow the process flow to ensure the data collection is systematic.

12. INTERACTIVE DATA COLLECTION METHOD 6 – PHENOMENOLOGY :

The phenomenological method of primary data collection is a magnificent way to understand personal experiences that can be based on a single case or multiple cases. It provides insights into individual actions and motivations by examining predispositions. Phenomenology data collection is a way to understand individual situations in depth. The theories are developed transparently, with the evidence made available. In addition to new policies, theories, and plans of action can be developed on this basis. If respondents are unable to communicate because of difficulties related to age, cognition, language, or other factors, this data collection strategy will be inefficient. To analyze results objectively and while being mindful of these constraints, scholars must be smart [234-244]. A few examples are listed below.

- Every war veteran or survivor has had a different experience. Research can shed light on their mental health and how they intend to survive in a new world.
- It has not been easy losing family members to Covid-19. Understanding coping processes and lifelong traumas can be aided by a thorough study of survivors and those who have lost loved ones.
- What is it like to hear a cancer diagnosis after becoming a parent? Although it is impossible to generalize about the struggle between life and death, research can record feelings and experiences.

Table 2: Difference between Case Study and Phenomenology

Case Study	Phenomenology
A Detailed Investigation of the Development of a Single Person, Event, or Situation Over a Period.	Designed to Understand the Subjective, Lived Experiences and Perspectives of Participants/Subjects.
Data is Collected through Observations, Interviews, Questionnaires, etc.	Interviews are the Main Method of Data Collection.
Focus on a Single Person, Event, or Situation	Focus on Various Individuals and Their Experiences over a Phenomenon.
Generalization of the Research Findings is Lower.	Generalization of the Research Findings is Higher.
Introduced in 18th Century (Frederic Le Play)	Introduced in 20th Century (Edmund Husserl - Descriptive; Martin Heidegger - Interpretive)

At this moment, scholars might think that Case Study and Phenomenology methods of primary data collection are similar. But do note that they are completely different methods. The unit of analysis/sample/case is the focus of Case Studies whereas Phenomenology focuses on the phenomenon concerning variables of the research question. We have captured a few key differences between these two data collection methods in table 2.

13. INTERACTIVE DATA COLLECTION METHOD 7 – SURVEY :

The survey method of primary data collection is quantitatively describing specific aspects of a specific population of the research question. Data collected using surveys are subjective as they are collected from a portion of people from the overall population. Research findings from a small portion of the population are generalized back to the population with help of statistical techniques. The survey is useful in gathering information on a large group of people, about their Characteristics, Behaviors, Actions, Opinions, Needs, Wants, Demands, and Impacts. A survey requires minimal investment of time, effort, and infrastructure. Findings of research using the Survey method can only provide an estimate of the true population, not exact measurements and hence it is not suitable for understanding

the historical contexts of a phenomenon concerning the key components of the research question. A survey is also useful when scholars want to describe and evaluate people, places, and events; measuring responses to ideas, analyses, knowledge, policies, and proposals. Scholars need to be careful as there are chances of inaccurate (intentional/unintentional) responses and inaccurate recording of responses is higher [245-251]. The survey method can be used in two different ways as detailed below.

13.1. Written Surveys :

This can be used suitable for obtaining confidential information from the units of analysis/samples and in the absence of direct contact between the interviewer (scholar) and respondent/subject/participant/ units of analysis/samples. Written Surveys are useful as they require minimum resources, have minimal sampling errors, have minimal inaccurate responses/readings, the questionnaire can be distributed using either offline or online mode, provides immediate results, and allows respondents to respond at their place. However, there may be response biases, and some questions are missed (intentionally/ unintentionally).

13.2. Verbal Surveys :

This method of Survey is useful when scholars require face-to-face interviews because in addition to responses they might also intend to capture the Gestures, Verbal inflections, and Body language of the respondents/participants/subjects/units of analysis/samples. However, scholars must be aware that some findings from face-to-face interviews are difficult to incorporate into data analyses. Scholars can also get the responses to their questionnaire through Telephone or Online media. This method requires maximum resources and is suited for complex and lengthy questionnaires and ensures reaching the correct respondent.

One of the key elements of the Survey data collection method is a questionnaire (instrument) that consists of many questions (Items/Inventory). Scholars shall be using the questionnaire to collect data to measure one or more variables of their research question. Scholars are free to design questions in two ways as detailed below.

13.3. Open-ended Questions :

These questions are suitable if scholars are still exploring and trying to understand the variables of their research question better (Inductive approach) and their familiarity with the phenomenon concerning variables is limited. This is also useful when scholars intend to get answers from respondents in their own words and seek additional insights. Open-ended questions require greater levels of thought and contemplation on the scholars' part. It is more time intensive and difficult to analyze the results.

13.4. Closed-ended Questions :

These questions are suitable if the existing knowledge about variables of the research question is better and evolved over a period (Deductive research approach). As a rule, scholars' questions will be presented to respondents/participants/subjects/units of analysis/samples with standard/allowed answers like Multiple Choice Questions (MCQ) and hence, it is easier for respondents to answer. Qualitative responses collected using Closed-ended questions are easier to convert to quantitative data that making it easier for data analysis. There are three types of Closed-ended questions such as i) Ordered choices (strongly disagree to strongly agree); ii) Unordered choices (multiple choice questions); iii) Partial closed-ended (additional option as 'others please specify').

Scholars are allowed to choose any one of the following ways of finalizing a questionnaire to Survey method of data collection as detailed below:

13.5. Instrument Adoption :

In situations when there is an existing questionnaire that is appropriate to measure variables of the research question then taking all the questions from an existing questionnaire is allowed and this is known as Instrument Adoption. Scholars are not allowed to change any questions/items, and this is feasible only when the context/environment of the research study/population is the same.

13.6. Instrument Adaption :

Taking most of the questions from an existing/proven/reliable questionnaire is known as Instrument Adaptation. Scholars are allowed to make changes to a few existing questions to make them appropriate and match the context/environment of their research study/population.

13.7. Instrument Development :

In situations wherein, scholars are unable to Adopt or Adapt an existing questionnaire then creating/developing a new questionnaire with all the questions in it being new is the right way and this is known as Instrument Development. Using a questionnaire developed by scholars makes the questionnaire appropriate and matches the context/environment of the research study/population. In case scholars are in this situation, we suggest they follow the below steps for developing a new instrument. Do note that the only chance for research scholars of Social Sciences, Economics, Management, and disciplines other than Basic Sciences, Engineering, and Technology to own a Patent is to develop a new questionnaire/instrument themselves that is capable of measuring one or more directly unmeasurable variables (also known as Latent variables).

- **Step 1:** Clearly define the dependent variable under study.
- **Step 2**: Identify independent variables we intend to study and frame each question of the instrument to ensure they shall measure the response.
- **Step 3:** Define the population and determine the sample size statistically.
- **Step 4:** Design a questionnaire and while designing questions ensure;
  - Words used in the questions must be in line with the education and maturity level of respondents.
  - Questions and answer options must be clear.
  - Avoid using words that could lead to alternate and misinterpretations of answers.
  - Avoid unethical questions; not feasible; personal; objectionable; or biased words and contexts.
  - Avoid lengthy questions; undefined short forms; difficult words.
  - The number of questions must be balanced between positive and negative responses.
- **Step 5:** Do a Delphi (expert opinion) or full-fledge FGD to get a consensus on the quality of questions.
- **Step 6:** First pilot testing of the instrument.
- **Step 7:** Initial test of the instrument based on pilot responses for validity and reliability.
- **Step 8:** Add, delete, modify, or improvise the questionnaire based on the initial pilot test.
- **Step 9:** Second pilot testing of the questionnaire.
- **Step 10:** A final test of the questionnaire based on the second pilot's responses for validity and reliability.
- **Step 11:** Add, delete, modify, or improvise the questionnaire based on the second pilot.
- **Step 12:** Final distribution of questionnaires to respondents and collection of responses.

Furthermore, irrespective of Instrument Adoption, Adaption, or Development scholars must ensure the questionnaire/instrument is checked for reliability and checked for validity in the case of Instrument Adaptation and Development with the help of statistical techniques before using the questionnaire/instrument to collect responses from respondents/participants/subjects/units of analysis/ samples. We strongly recommend scholars attempt developing a new questionnaire/instrument during their Ph.D. program and obtain a Patent. Generating an intellectual property right in the form of a patent indicates that a scholar has conducted and delivered high-quality research.

14. INTERACTIVE DATA COLLECTION METHOD 8 – EXPERIMENT :

An experimental method of primary data collection is used to infer causality (Causal type of research question) where scholars will actively manipulate one or more independent variables and measure their effects on the dependent variables of the research question. An experiment is a scientific procedure/method of data collection designed to test or support or refute a hypothesis/logical assumption about the relationship among variables of the research question. Experiments can be adopted to develop new theories (Inductive research approach) or test existing theories (Deductive

research approach), or update existing theories (Abductive research approach). Experimental data collection is probably the only method of data collection that is suitable for all three types of research approaches/reasoning. Experiments always provide logical hints toward the structure/mathematical form of a theory and examine cause-and-effect relationships. One of the interesting facts about this method is Experimentation is done without a 'fear of failure' or 'expectation' of outcome and it guarantees high levels of repeatability. Experiments ideally require more than one manipulatable/ controllable independent variable and you need to ensure that the variables of your research questions are Directly Measurable [252-262].

We have witnessed that a majority of Ph.D. scholars have a predisposition in their minds about Experiments. That it is carried out in a laboratory, that it is carried out within four walls, and it is only for scholars belonging to Basic Sciences, Engineering, Technology, and Health Sciences. However, scholars must know that Experiments can be carried out by scholars belonging to any discipline. The experiment method of data collection provides a relatively high level of validity and reliability of the research output, provides a high level of control, strong evidence of causality (well-controlled experiments), specific conclusions, and allows cause and effect to be determined. There is no limit to the subject matter or industry involved. Natural settings can be replicated at faster speeds. Most importantly, Experiments can be easily combined with other data collection methods. However, whenever scholars choose Experiment as the primary data collection method, they must ensure that all the necessary approvals for Experimentation are obtained beforehand from appropriate authorities irrespective of their discipline.

Experiments can be grouped into three categories such as i) Controlled Experiments, ii) Field Experiments, and iii) Natural Experiments.

(i) Controlled Experiments: In this category, scholars shall be comparing the results obtained from experimental samples against control samples. Scholars need to ensure that experimental and control samples are practically identical in their characteristics. These experiments are conducted in a controlled environment and hence provide higher internal validity, and the possibility of contamination is minimal. A majority of experiments conducted by the scholars of Basic Sciences, Engineering, Technology, and Health Sciences are Controlled Experiments.

(ii) Field Experiments: These are almost the opposite of Controlled Experiments as these are conducted in a natural setting of the environment. If scholars' research question demands collecting data about Variables in their natural settings Field Experiments are suitable. They provide higher external validity but there is a possibility of higher contamination. A majority of experiments conducted by the scholars of Management and Social Sciences are Field Experiments.

(iii) Natural Experiments: Whenever scholars are unable to conduct Controlled or Field Experiments then they might explore Natural Experiments. These experiments are also known as Observational Experiments, Uncontrolled Experiments, and Quasi-experiments. In this category, scholars can determine the relationship among the Variables of your research question through just observation. A majority of the scholars of Economics, Human Geography, Archaeology, Sociology, Cultural Anthropology, Geology, Palaeontology, Ecology, Meteorology, and Astronomy are Natural Experiments.

Whenever scholars choose an Experiment as their primary data collection method they must ensure that they have designed the experiment well in advance. Figure 6 illustrates a circular flow of designing an Experiment. There are Four types of Experimental designs such as i) Pre-experimental designs, ii) Quasi-experimental designs, iii) True-experimental designs, and iv) Statistical experimental designs. Let us now discuss these designs structurally.

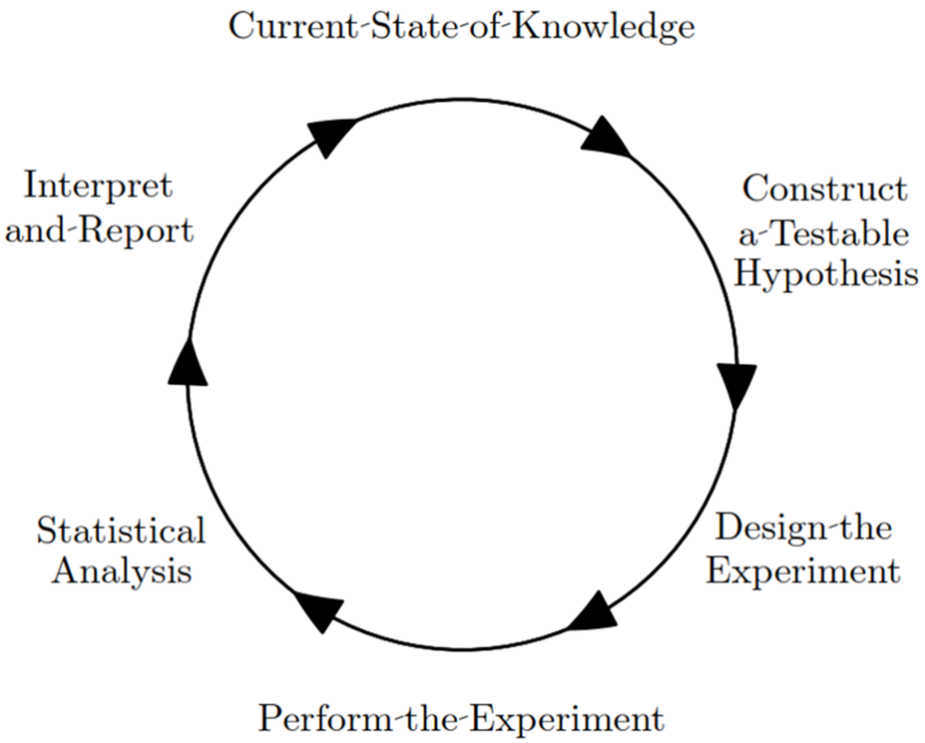

Fig. 6: The circular flow of Experimental design [252]

14.1. Pre-experimental Designs :

These are suitable for the exploratory phase of research. There are three Pre-experimental designs such as i) One-shot Case Study, ii) One-group Pre-test Post-test Study, and iii) Static Group Comparison Study. In these designs, there will not be any control groups and no randomization. In the case of One-shot Case Studies, a single group is observed on a single occasion after experiencing some event, treatment, or intervention. Because there is no control group against which to make comparisons, it is a weak experimental design, and any changes noted are merely presumed to have been caused by the event. In the case of a One-group Pre-test Post-test design, the impact of your experiment/treatment/ intervention is measured two times. One before the treatment and another after exposing a non-random group to a certain intervention/treatment. In the case of Static Group Comparison design, the impact of your experiment/treatment/intervention is measured only once that is after exposing a non-random group to a treatment/intervention and comparing the treatment effect to another group.

14.2. Quasi-experimental Designs :

These are suitable for the descriptive phase of the research. There are two Pre-experimental designs such as i) Time Series Design and ii) Multiple Time Series Design. Time Series Design is an experimental design that involves the observation of units of analysis/samples over a defined period. A single non-random group is selected for the treatment/experiment/intervention. A series of readings are taken before the experiment and are compared with a series of reading taken after the experiment. In the case of Multiple Time Series Design, one experimental group and one control group are observed over a defined period. A single non-random group is selected for the treatment/experiment/intervention (Experimental Group) and another group shall not go through any treatment/intervention/experiment (Control Group). A series of readings are taken before the experiment and are compared with a series of reading taken after the experiment between the experimental and control group to understand the real treatment/experiment effect.

14.3. True-experimental Designs :

These are suitable for the explanatory phase of the research. True-experimental designs use a statistical approach to establish a cause-and-effect relationship between different variables of the research question. This is one of the most accurate forms of Experimental design which provides a significant backing to support the existence of relationships among variables. One of the key requirements for

carrying out True-experimental designs is that scholars must have a control group and the units of analysis/samples/respondents/participants must be randomly assigned to both control and experiment groups.

14.4. Statistical-experimental Designs :

These are suitable for the explanatory phase of your research. Three of the most widely used Statistical-experimental designs are i) Latin Square Design, ii) Factorial Design, and iii) Randomized Block Design. The name Latin Square was inspired by mathematical research articles by Leonhard Euler, who used Latin characters as symbols. The Latin Square Design addresses sources of systematic variation other than the intended treatment/intervention. It assumes that one can characterize treatments/interventions, whether intended or otherwise, as belonging clearly to separate sets. These categories are arranged into two sets of rows. The Latin square design applies when there are repeated exposures/treatments and two other extraneous variables. In a completely randomized experimental design, the treatments are randomly assigned to the experimental units. In this design, any difference among experimental units receiving the same treatment is considered an experimental error. Factorial experiments are designed to conclude about more than one factor or Variable. The term factorial is used to indicate that all possible combinations of the factors are considered. For instance, if there are two factors (F1 & F2) with three levels each (F1a, F1b, F1c, F2a, F2b, F2c) the experiment will involve collecting data on all the nine treatment/intervention combinations. The factorial design can be extended to experiments involving more than two factors and experiments involving partial factorial designs.

15. HOW TO CHOOSE APPROPRIATE RESEARCH DATA COLLECTION METHOD? :

By now you might be thinking that how will I choose the best method for collecting Primary data. There are three scholarly ways of choosing the best Primary Data collection method as discussed below [56].

15.1. Mono-method Choice :

Using just a single method of data collection to answer the research question is known as the Mono-method choice. In this type, scholars are choosing any one of the eleven Primary Data collection methods discussed in this article.

15.2. Mixed-method Choice (+) :

The use of two or more data collection methods simultaneously/concurrently to answer one research question is known as a Mixed-method choice. Here the combined methodology generates one data set and most importantly the data collection period shall be the same. For example, using Survey and Experiment at the same time to understand the attitudes of Customers and Retailers toward Discounts.

15.3. Multi-method Choice (→) :

In this type, a wider selection of data collection methods is used to answer just one research question. Here scholars shall be dividing their research into separate segments/stages/phases (exploratory, explanatory, confirmatory, and application), with each sequentially producing a specific data set, and the data is collected in different collection periods. For example, using a Case Study to first understand the variables of the research question, then a Meta-analysis to understand the known relationship among variables, and finally conducting an Experiment to compare/accept/refute the relationship between the variables of the research question. Simply, scholars would want to collect data using different data collection methods sequentially to be able to confidently claim their research findings.

Do note that we cannot rank the above three method choices in any order of preference. All of them have their merits and demerits. What is important is the level of evidence that is required to defend/justify scholars' hypotheses and research findings. In addition to the level of confidence, other factors that play an important role in choosing one of these methods choices are the stage/phase of the research; Research question (Descriptive; Relational; Causal); Time available; Resources available; Research philosophical paradigm; Research approach; scholar's competence; The level of authenticity, validity, reliability, and generalizability required to claim scholars' research findings/conclusion [46]. To enable scholars, to choose appropriate primary data collection methods we have listed a few options purely based on the phase of the research. Scholars need to be aware of the stage/phase of their research. Scholars are suggested to break their Ph.D. research into different stages/phases and collect the data

using different data collection methods. This will ensure a clear understanding of each component of the research question (dependent variable, independent variable, and units of analysis) in depth before claiming their research findings.

Exploratory/Identification Phase: To understand how important the variables are, scholars can use Archival; Observation; Meta-analysis; Focus Group Discussion; Grounded Theory; Case Study; Phenomenology.

Descriptive Phase: To understand the existence of variables, scholars can use Observation; Focus Group Discussion; Ethnography; Grounded Theory; Case Study; Phenomenology.

Explanatory Phase: To understand the direction of the relationship among variables, scholars can use Archival; Meta-analysis; Action Research; Survey; Experiment.

Confirmatory Phase: To understand the magnitude of the relationship among variables, scholars can use Action Research; Surveys; Experiments.

***Application Phase*:** To understand the practical significance of the relationship among variables, scholars can use Action Research or Experiment.

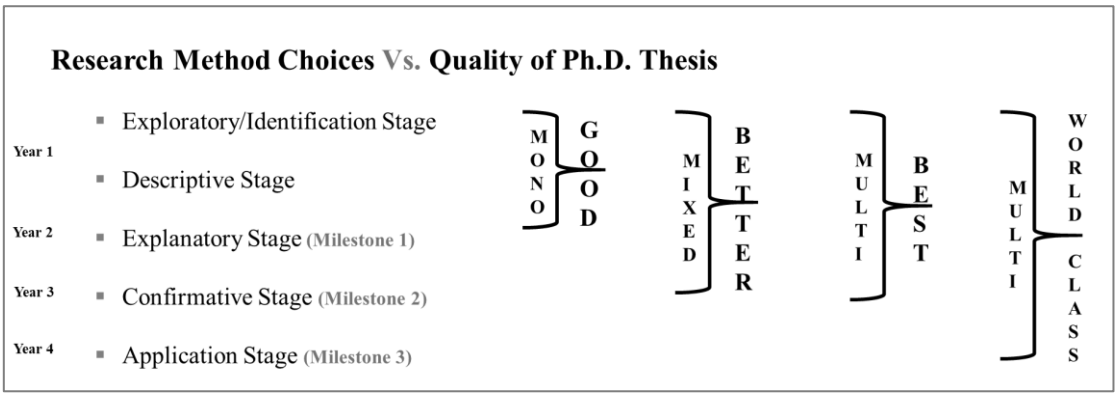

Fig. 7: Primary data collection method choice vs. Ph.D. thesis quality

The quality of a Ph.D. thesis is determined by the type of method choice scholars have made during their Ph.D. research work. We have illustrated the same in figure 7. *"It is thus the duty of a researcher who studies the writings of scientists, if learning the truth is his goal, to make himself an enemy of all that he reads, and, applying his mind to the core and margins of its content, attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency" (*Hasan Ibn al-Haytham - The Father of Modern Optics).

16. CONCLUSION :

Scholars are recommended to use primary data to conclude their Ph.D. research work. However, concluding Ph.D. research work using just the secondary data is also possible as long as the research findings are original and contribute to creating new knowledge or interpreting the existing knowledge in a completely different way. Among all the eleven primary data collection methods Experiments are the most preferred primary data collection methods among scholars belonging to the Basic/Natural Science, Engineering, and Technology disciplines and Surveys are the most preferred primary data collection method for scholars belonging to other disciplines in India. We understand the Ph.D. program is time-bound and hence using a Mono-method choice during the Ph.D. program is acceptable. But knowingly or unknowingly, intentionally, or intentionally a significant majority of researchers in India use the Mono-method choice even after the completion of the Ph.D. program. The fear among Indian researchers is that Mixed-method choice and Multi-method choice of data collection require a lot of time investment and most importantly the research output in the form of research article publications will slow down drastically. The mere pressure on Ph.D. scholars and Ph.D. holders in India to publish a certain number of research articles which is connected to their performance measurement is also one

of the key reasons for this. However, there are a few Institutes in India that motivate their Ph.D. and Post-doc researchers to make Mixed and Multi-method choices of data collection. Ph.D. scholars and Ph.D. holders must be aware that description, explanation, or claim about a reality/fact/truth/effect /dependent variable and a piece of complete knowledge about reality is complete only when they are derived from collecting and evaluating data using different data collection methods.

It is the responsibility of every stakeholder in the research environment and system to ensure that the scholars are made aware of every step involved in carrying out doctoral-level research in addition to the purpose, objective, and key deliverables of various available data collection methods for them to choose an appropriate one to achieve their key research objective during the Ph.D. journey. Designing robust coursework that is intended to create awareness about the essence of characteristics of data, secondary data, primary data, and the repeatability, generalisability, and suitability of each data collection method is an appropriate way of fulfilling this responsibility. As long as the Ph.D. scholars can understand all the available research data collection methods and make mindful method choices of data collection to answer their research question they will be able to determine (on their own) all the other choices in succeeding steps of doctoral-level research such as i) data collection time frame; ii) sample size; iii) sampling technique; iv) data collection instrument; v) data analysis techniques.

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