Research Methods & Technical Writing

Lesson 2 - Week 2

Defining a Research Problem

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Flashback from Lesson 1

- Research is simply the process of arriving at a dependable solution to a problem through the planned and systematic collection, analysis and interpretation of data.
- Some key words that define research: process, understanding of facts, problem-centered, validity and verifiability of results, new knowledge.
- Types of research include qualitative, quantitative, descriptive, analytic, empirical, applied, fundamental, and conceptual.
- Approaches to research include quantitative (inferential, experimental, simulation) and qualitative (focus groups, projective, depth interviews).
- Research methods or techniques, thus, refer to the methods the researchers use in performing research operations.
- When we talk of research methodology we not only talk of the research methods but also consider the logic behind the methods

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- Introduction
- What is a research problem?
- Identifying and selecting the problem
- Import of problem definition
- How to define a problem
- Examples

Part 1

Introduction

Introduction

- In lesson one the research process was introduced.
- It follows that one can only research based on a topic that is of interest to them; indeed this is the case in most areas of life. One can only pursue to conclusion things that are of interest to them, otherwise the 'fire' dies before reaching the end.
- As you gain more experience in research it becomes clearer that the topics of interest are the ones which will give you the zeal to investigate to some logical conclusion. Indeed, if you choose to pursue a PhD degree in an area of interest your supervisor(s) will constantly remind you to choose a topic that you are ready to spend sleepless nights on! I should know as I spent many sleepless nights working on my PhD thesis.
- There are several steps in research as described in lesson 1; however, in this lesson we begin the journey beginning with the first step.
- The first step is to choose the topic that you wish to research about. Figure 1 shows where this stands in the overall research process.

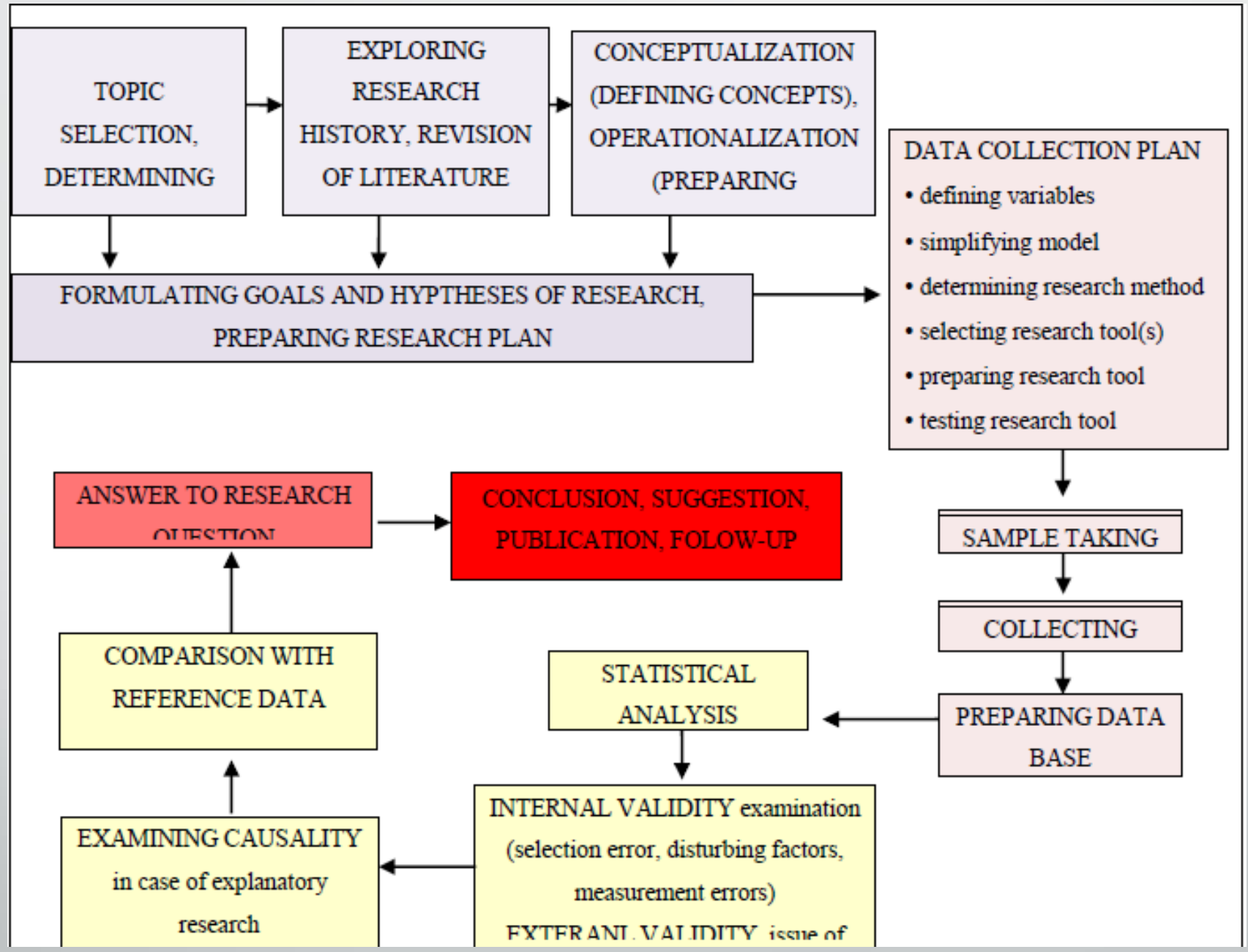

Fig 1. Stages of scientific research (Boncz, 2015)

Introduction (cont'd)

- When choosing the topic of research it is important to bear in consideration the following:
  - The topic must be of interest to you based on either education, past experiences, or both. Remember the analogy to life? You can only pursue to logical conclusion that which you have an interest in.
  - Who do you know who is a subject matter expert in this area, or how much literature is there available on this topic?
  - Do you have the budget and the time to pursue research in this topic?
  - A well defined scope will contribute significantly to the success of the research.
  - Synergy between and among the researchers is also important.
- Once the topic has been selected, then the question of what problem or question that needs to be answered, can be addressed.

Introduction (cont'd)

- A key requirement in the determination of the research problem (question) is clarity in the research objectives and a precise definition of the problem.
- According to the identified research problems one may speak of are exploratory, comparative, diachronic and explanatory researches.
- Table 1 describes the questions associated with each type of research together with a suitable example in each case.
- The rest of the lesson delves into the details of defining a research problem; from the definition, to selecting it, the importance of defining problems in research, how to define research problems, and lastly some examples of research problems.

Table 1. Research types (Boncz, 2015)

Research type	Main questions	Example
Exploratory research	What happened …? What are the main characteristics …? Under what conditions does it occur …?	What are the typical infant mortality data in European societies?
Comparative research	Does it occur elsewhere …? How…? Under what conditions does it occur …?	To what extent do infant mortality data differ in European societies?
Diachronic research	How did it happen earlier …? What were the characteristics earlier …? How often does it occur …?	How has the extent of infant mortality changed in European societies over the last 100 years?
Explanatory Research	How is it related …? What are its effects …? What are the consequences …?	What are the causes of infant mortality in European societies?

Part 2

What is a research problem?

2.1 Introduction

- Before defining what a research problem is, let us examine it's place in the broader context of research.
- Parlindungan (2018) defines it as follows: "Research field refers to the whole areas of research undertaken in a specific scientific discipline. A research area is a specific part or section of a research field. A research area covers many topics researchers can study in the context of a scientific discipline. A research topic is "the broad subject matter addressed in a study" (Creswell, 2012, p. 60). A research problem, as mentioned previously, is the issue being addressed. It helps in narrowing the topic down to something that is reasonable for conducting a study."
- Creswell (2012, as cited by Parlindungan, 2018) defined the research problem as "a general educational issue, concern, or controversy addressed in research that narrows the topic".
- Fig 2 demonstrates the relationship between these three concepts.

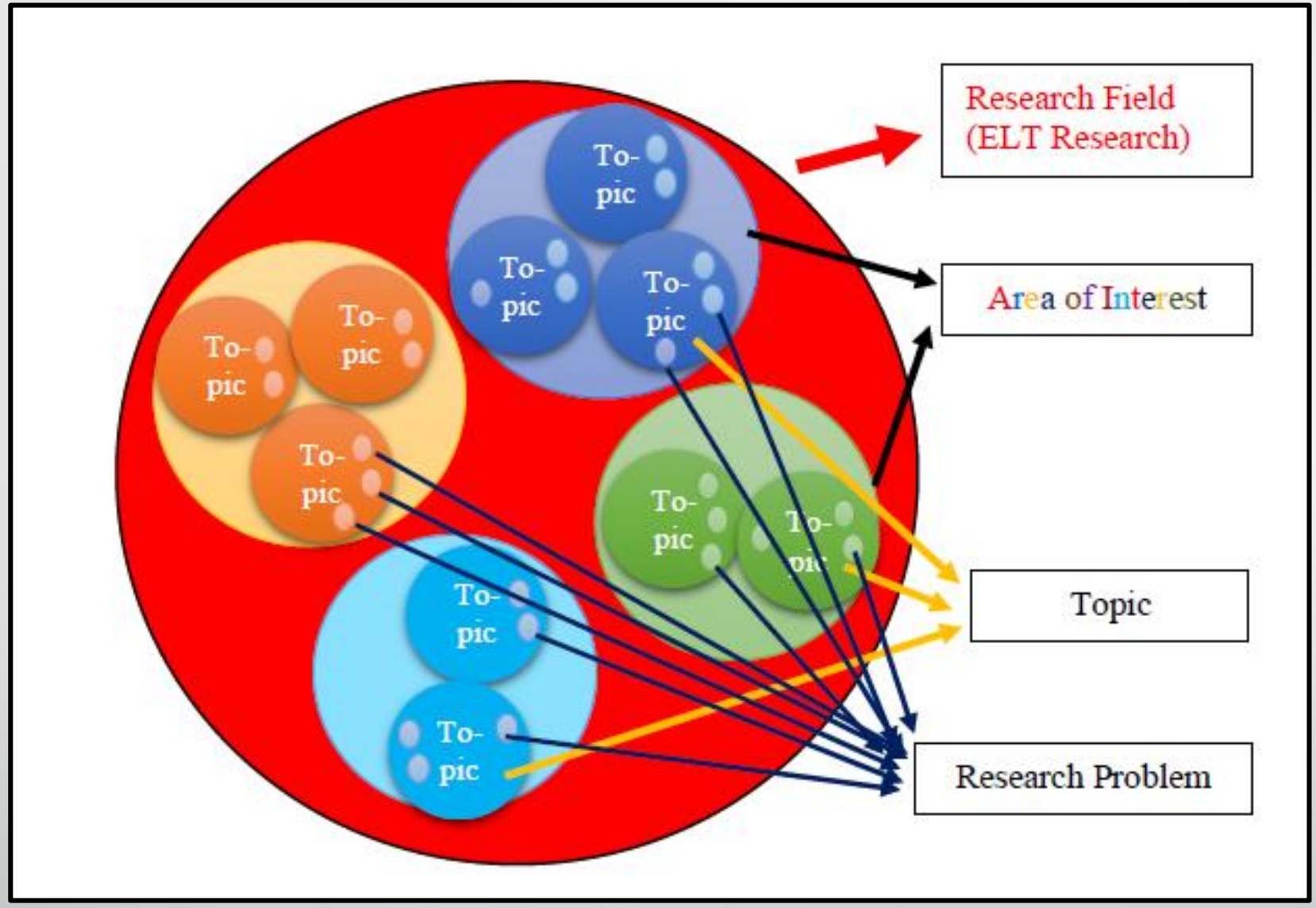

Fig 2. Relationship between Research Field, Research Area, Topic, and Research Problem (Parlindungan, 2018)

2.2 Research Problem criteria

- The research problem is the challenge that the researcher experiences in a given situation, and would like to obtain a solution to it. In research we acknowledge that a problem exists if the following criteria are met (Kothari, 2004):
  - There must be a target group (T) to whom the problem can be ascribed to. The group (T) must be in environment (E) defined by some uncontrolled variables V_U
  - There must be at least two courses of action say, A_1 and A_2 . A course of action is defined by one or more values of the controlled variables. For example, the number of items purchased at a specified time is said to be one course of action.
  - There must be at least two possible outcomes, say O_1 and O_2, of the course of action, of which one should be preferable to the other. In other words, this means that there must be at least one outcome that the researcher wants, i.e., an objective.
  - The courses of action available must provides some chance of obtaining the objective, but they cannot provide the same chance, otherwise the choice would not matter. In simple words, we can say that the choices must have unequal efficiencies for the desired outcomes

2.2 Research Problem criteria

- Kerlinger (1973, as cited by Marcyzk, DeMatteo, and Festinger, 2010) posited that good research problems must meet three criteria:
  - The research problem should describe the relationship between two or more variables.
  - The research problem should take the form of a question
  - The research problem must be capable of being tested empirically (i.e., with data derived from direct observation and experimentation).
- Thus it can be inferred that when a group (or individual) is presented with a problem whereby there are two or more courses of action available to achieve a desired outcome, it is only researchable when they don't know which course of action will give them the optimum desired result!
- Kothari (2004) sums it up thus: "an individual or a group of persons can be said to have a problem which can be technically described as a research problem, if they (individual or the group), having one or more desired outcomes, are confronted with two or more courses of action that have some but not equal efficiency for the desired objective(s) and are in doubt about which course of action is best."

2.2 Research Problem criteria

- Ecomblus.com also assert that the criteria for evaluating a research problem should be SMART, i.e.: “
- **S-pecific.** The research problem must be specifically stated.
- **M-easurable.** The research problem should be quantifiable or observable. This may include interviews, surveys, or recorded observations such as videos and audio recordings. There should be instruments that will help the researchers gather data from their respondents.
- **A-ttainable.** A research problem should be easily achieved, solved, or answered by the researcher after all valid procedures had been carried out.
- **R-ealistic.** It should be possible for the researchers to perform the experimentations or observations needed to solve their problems.
- **T-ime-Bound.** Researchers should also consider the time allotment for their research. They should think of a research problem that could be carried out in the given time period.

(Source: https://www.elcomblus.com/research-problem-definition-characteristics-and-criteria-for-evaluation/)

2.3 Elements of Research Problems

- Kothari (2004) summarizes the elements (constituents) of research problems as follows:"
  - There must be an individual or a group which has some difficulty or the problem.
  - There must be some objective(s) to be attained at. If one wants nothing, one cannot have a problem.
  - There must be alternative means (or the courses of action) for obtaining the objective(s) one wishes to attain. This means that there must be *at least two means* available to a researcher for if he has no choice of means, he cannot have a problem.
  - There must remain some doubt in the mind of a researcher with regard to the selection of alternatives. This means that research must answer the question concerning the relative efficiency of the possible alternatives.
  - There must be some environment(s) to which the difficulty pertains. "

2.4 Research Problem characteristics

- According to readingcraze.com the following are the characteristics of a good (thesis) research problem: "
- 1 The problem can be stated clearly and concisely.
  2 The problem generates research questions.
  3 It is grounded in theory.
  4 It relates to one or more academic fields of study.
  5 It has a base in the research literature.
  6 It has potential significance/importance.
  7 It is do-able within the time frame, budget.
  8 Sufficient data are available or can be obtained.
  9 The researcher's methodological strengths can be applied to the problem.
  10 The problem is new; it is not already answered sufficiently."
- Source: https://readingcraze.com/index.php/characteristics-good-research-problem/

Part 3

Identifying and selecting the problem

3.1 Introduction

- At this point we know the criteria, elements and characteristics of a research problem.
- The next question is how to identify and select a research problem to work with.
- As discussed earlier in this lesson if the solution to a problem is already known, including how to obtain the solution, then there is no need to do any research on it; after all what would we be researching on?
- As an example let us say we wish to know whether a certain mix of food contains proteins. The reason for this is that there are certain proteins you are allergic to. We also know that to test for protein one needs to add copper sulfate and sodium hydroxide to the sample; if it turns purple then we know it contains proteins (see https://www.cheshamprep.co.uk/wp-content/uploads/2020/03/Food-tests.pdf). So can I say that I have a problem of trying to determine whether this food contains proteins? Of course not. I know what result to expect (purple color), and how to obtain the outcome (copper sulfate followed by sodium hydroxide). So the only two possible outcomes O_1 and O_2 are either purple or not.
- Thus as mundane as the above example appears to be, the process of identifying and selecting a problem in a given research domain is not as easy as it appears to be.

3.2 Problem identification

- As we recall from fig 2, research problems arise from topics of interest in different areas of a research field or domain. Therefore, in order to identify a problem worth investigating one has to use a "top-down" approach so to speak.
- This means first having interest in a certain research domain (top) and then narrowing down to a more specific area of interest, and then even more specifically to a topic of interest (down).
- It is from this topic of interest that you may begin to notice different gaps in literature or in simple observation, or even by asking experts or users in that domain. This will open the door to creation of a problem statement, which in turn will kick start your research journey.
- It is imperative for the researcher to follow a well thought approach in identifying a problem that requires further research.
- This will help the investigator to recognize and define the problem.

3.2 Problem identification (cont'd)

- (Singh, 2006) suggested the following steps to be followed in identifying a research problem:"
- **Step 1 :** Determining the field of research in which a researcher is keen to do the research work.
- **Step 2 :** The researcher should develop the mastery on the area or it should be the field of his specialization.
- **Step 3 :** He should review the researches conducted in area to know the recent trend and studies in the area.
- **Step 4:** On the basis of review, he should consider the priority field of the study.
- **Step 5:** He should draw an analogy and insight in identifying a problem or employ his personal experience of the field in locating the problem. He may take help of supervisor or expertee (sic) of the field.
- **Step 6 :** He should pin-point specific aspect of the problem which is to be investigated."

3.2 Problem identification (cont'd)

- Further, Rienecker and Jørgense (2015, as cited in Ezeogu, n.d) provide a list of how to identify a real research problem:"
- A gap in the field's knowledge
- Something the field has not or should not have finished researching
- An unexplained observation, an observation that sticks out
- Something that has not yet been categorized, analyzed (with these particular methods/ theories; this systematism; this degree of detail or from this particular angle)
- Something that does not seem right…(cont'd)

3.2 Problem identification (cont'd)

- …(cont'd) …Contrasts that can still be discussed
- Something that is currently being debated in the field
- Something that can and should be argued for (or against, i.e. all representatives of the field are not already familiar with or agree with the argumentation)
- Something that is in conflict with the general view
- Something that must be (re)evaluated, changed, transformed, constructed or needs new designs."
- All these point to promising areas where potential problems can be identified.
- The list of course is not exhaustive, but assuredly ticking these off one by one from your list will result in some exciting prospects.

3.3 Problem selection

- After exhausting the problem identification list, the researcher will most likely come up with more than one potential problem worth investigating.
- The question that consequently arises is which problem(s) to choose and which one(s) to drop? This is not as easy a task as one might imagine at face value.
- However, Kothari (2004) suggested a guideline to follow in selecting a research problem; the guidelines provide some do's and don'ts that can help the researcher select the best problems to analyze and investigate. These guidelines are shared in the next few slides:

3.3 Problem selection (cont'd)

- Guidelines for selecting research problems (Kothari, 2004):"
  - Subject which is overdone should not be normally chosen, for it will be a difficult task to throw any new light in such a case.
  - Controversial subject should not become the choice of an average researcher.
  - Too narrow or too vague problems should be avoided.
  - The subject selected for research should be familiar and feasible so that the related research material or sources of research are within one's reach.
  - The importance of the subject, the qualifications and the training of a researcher, the costs involved, the time factor are few other criteria that must also be considered in selecting a problem.
  - The selection of a problem must be preceded by a preliminary study."

3.3 Problem selection (cont'd)

- Further, Good and Scates (as cited in Singh, 2006) offer the following criteria for selection of the problem:"
  - 1. Novelty (newness) and avoidance of unnecessary duplications.
  - 2. Importance for the field represented and implementation.
  - 3. Interest, intellectual curiosity, and drive.
  - 4. Training and personal qualifications.
  - 5. Availability of data and method.
  - 6. Special equipment and working conditions.

3.3 Problem selection (cont'd)

- Good and Scates (as cited in Singh, 2006) offer the following criteria for selection of the problem:"
  - 7. Approachability of the sample.
  - 8. Sponsorship and administrative cooperation.
  - 9. Hazards, penalties and handicaps.
  - 10. Cost and returns.
  - 11. Time factor."

3.3 Problem selection (cont'd)

- Hildreth Hoke McAshan (as cited in Singh, 2006) suggested the following guide to decide on the suitability or worthiness of investigating a potential research problem:"
  - 1. Is the problem really important?
  - 2. Is the problem interesting to others?
  - 3. Is the chosen problem a real problem?
  - 4. Does the problem display originality and creativeness?
  - 5. Am I really concerned with finding the solution?
  - 6. Am I able to state hypotheses from the problem in a testable form?

3.3 Problem selection (cont'd)

- Hildreth Hoke McAshan (as cited in Singh, 2006) suggested the following guide to decide on the suitability or worthiness of investigating a potential research problem:"
  - 7. Will I learn something new from this problem?
  - 8. Do I understand the relationship of this specific problem to the broader problem area?
  - 9. Will be able to select a sample from which I can generalize to some population?
  - 10. Will some other intelligent person be able to replicate the study?
  - 11. Will my proposed data-gathering instruments actually give the Information which I want?
  - 12. Is the study, including the application of its results, practical? The number of affirmative answers should be required for a suitable problem."

Part 4

Import of problem definition

Why problem definition?

- It may have crossed your mind by now that a lot of time has been spent on defining the problem, how to go about it, applicable criteria, and so on. So the key question is what's the significance of problem definition, i.e., a well defined problem? This writer posed this question to ChatGPT, an openAI tool and this is the response received:
  - Focus: A clear problem statement helps the researcher to focus on the specific issue that needs to be addressed. It provides a clear understanding of what needs to be studied and why it is important.
  - Scope: The problem definition helps to define the scope of the study, which is important for determining the research design, methodology, and data collection techniques. This ensures that the study remains manageable and feasible.
  - Relevance: A well-defined problem statement ensures that the research is relevant to the current needs and interests of the research community and stakeholders. This can increase the impact and usefulness of the study.
  - Objectivity: A clear problem statement helps to ensure that the research is objective and unbiased. It provides a framework for the research that is based on facts and evidence rather than personal opinions or biases.
  - Funding: A well-defined problem statement can help to secure funding for the research project. Funding agencies and sponsors are more likely to support research that addresses an important and clearly defined problem.

Part 5

How to define a problem

5.1 Need to define the problem

- Once a problem is defined it becomes much easier to solve. It is important, consequently, to clearly define the problem in a way that can be comprehended, and which is concise; thus leaving no doubt as to what the exact problem is. Singh (2006) describes the purposes which definition of the problem serves:
  - It sets the direction of the study
  - It reveals the approach (methodology) of the study
  - Helps the investigator control his/her bias or subjectivity
  - Specifies the variables that need investigation since they will be included in the problem definition
  - Makes the research work practicable.

5.2 Precautions in problem identification

- Singh (2006) also suggests the following precautions be taken when identifying the problem:
  - All words used in defining the problem should be unambiguous; that is, they should only have one meaning.
  - The problem statement must be brief and compact (concise)
  - All assumptions should be clearly stated
  - Problem should have practical importance/relevance to the domain being investigated.
  - The statement should have logic.

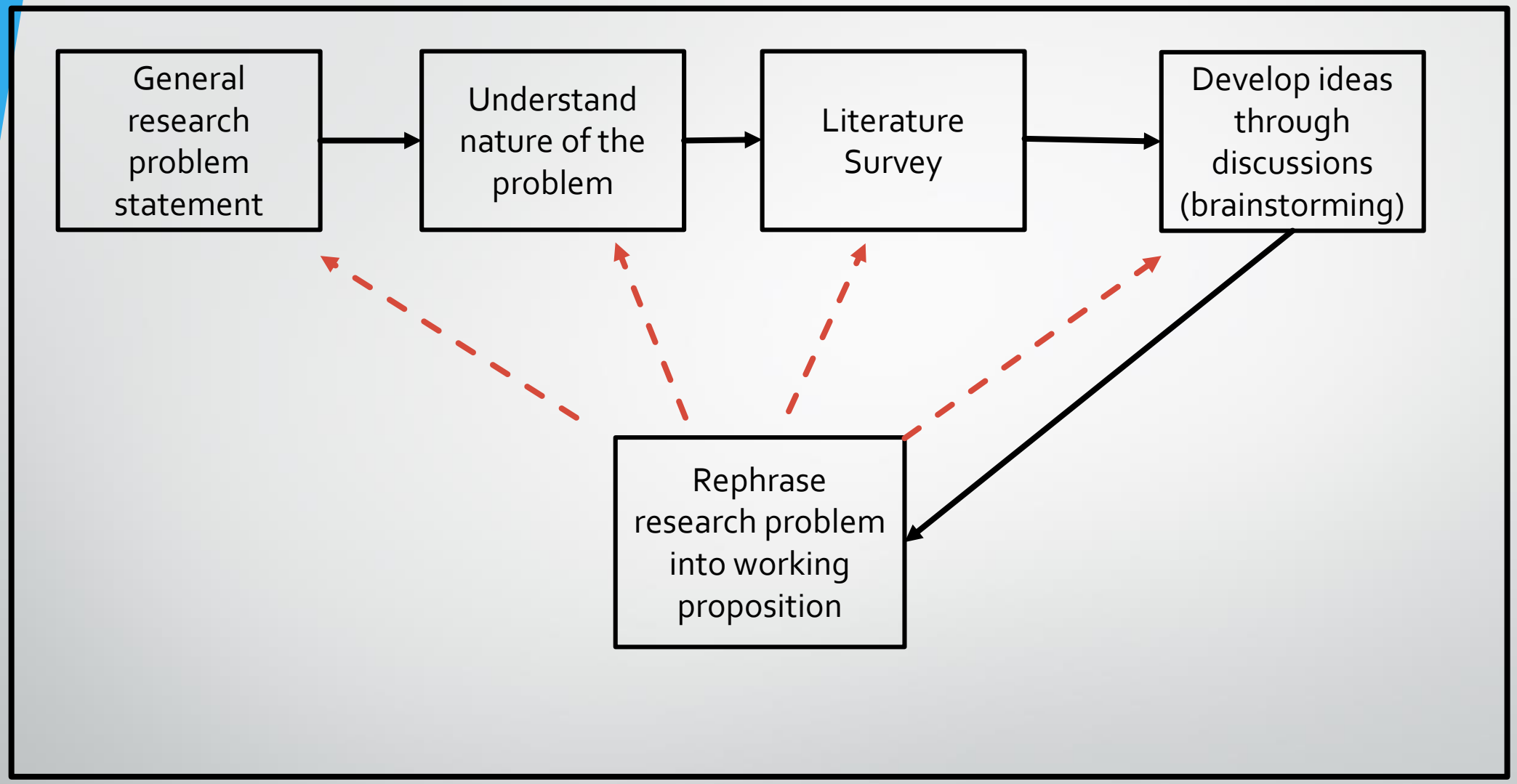

Fig 3. Research problem definition cycle (adapted from Kothari, 2004)

5.3 Research problem definition cycle

- Fig 3 illustrates the research problem definition cycle adapted from Kothari (2004). The cycle illustrates the five steps to producing a working problem definition. The steps are followed progressively as indicated by the black arrows. In the final step the researcher is free to refer back to any of the previous steps in order to get any clarification in any areas that may still appear gray. The steps in order are:
  - General research problem statement
  - Understand nature of the problem
  - Literature survey
  - Develop ideas through discussions (brainstorming)
  - Rephrase research problem into working proposition

5.4 Defining research problem

- Kothari (2004) also suggests the following additional points when defining a research problem:"
  - Technical terms and words or phrases, with special meanings used in the statement of the problem, should be clearly defined.
  - Basic assumptions or postulates (if any) relating to the research problem should be clearly stated.
  - A straight forward statement of the value of the investigation (i.e., the criteria for the selection of the problem) should be provided.
  - The suitability of the time-period and the sources of data available must also be considered by the researcher in defining the problem.
  - The scope of the investigation or the limits within which the problem is to be studied must be mentioned explicitly in defining a research problem."

Part 6

Examples

Examples

- In this last part of the lesson we shall examine a couple of problem statements from different sources, in order to illustrate how a good research problem should be formulated:
- Kothari (2004):
- Initial statement: "Why is productivity in Japan so much higher than in India"?
- In this form the question has a number of ambiguities such as: What sort of productivity is being referred to? With what industries the same is related? With what period of time the productivity is being talked about? In view of all such ambiguities the given statement or the question is much too general to be amenable to analysis. Rethinking and discussions about the problem may result in narrowing down the question to:
- "What factors were responsible for the higher labor productivity of Japan's manufacturing industries during the decade 1971 to 1980 relative to India's manufacturing industries?"
- In this form this is definitely better but it can still be improved further; especially on operational basis:
- "To what extent did labor productivity in 1971 to 1980 in Japan exceed that of India in respect of 15 selected manufacturing industries? What factors were responsible for the productivity differentials between the two countries by industries?"

This is now succinct to the desired extent.

Examples (cont'd)

- ***Operationalization** is the process of making something measureable. Operationalization involves procedures and processes that allow the empirical study and ***measurement of the variables in the research*** (Boncz, 2015).**
- Are the quiz scores of students who study early in the morning higher than those who study at night? (https://simplyeducate.me/2012/10/22/examples-of-research-questions/)
- **Bad**: How do artificial sweeteners affect people?
- **Good**: How does aspartame affect post-menopausal women who suffer from migraines? (https://examples.yourdictionary.com/examples-of-good-and-bad-research-questions.html)

Summary

- The research problem can be defined as "a general educational issue, concern, or controversy addressed in research that narrows the topic".
- A key requirement in the determination of the research problem (question) is clarity in the research objectives and a precise definition of the problem.
- According to the identified research problems one may speak of exploratory, comparative, diachronic and explanatory researches.
- The definition of the problem sets the direction of the study, reveals the approach (methodology) of the study, helps the investigator control his/her bias or subjectivity, specifies the variables that need investigation since they will be included in the problem definition, and makes the research work practicable.
- The steps in order of defining a research problem are: General research problem statement, understand nature of the problem, literature survey, develop ideas through discussions (brainstorming), and rephrase research problem into working proposition

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