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Scientific steps to follow in doing research

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For a successful career in medical science, one must understand the methodology behind any research and be aware of the correct protocols. Follow the guidelines will prevent your findings from being accepted and taken seriously.

Research is conducted according to the researcher's intention, their purpose, and the paradigm they're operating from within. While many people use the word "research" to loosely mean "gathering information" scientists use this word in a more specific way.

The term "research" in a scientific context usually refers to the entire scientific method from beginning to finish. The information gathering portion of the scientific method is more properly called a "review."

Definition of research

In the broad sense, research includes gathering of data, information and facts for the advancement of knowledge.

Simple explanation of Research is - Re Means Again and Search means calculating results on the basis of your surveys and ideas. In short enhancing an already done work, proving false the work or giving a new innovative idea is research.

The strict definition of scientific research is performing a methodical study in order to prove a hypothesis or answer a specific question. Finding a definitive answer is the central goal of any experimental process.

Research must be systematic and follow a series of steps and a rigid standard protocol. These rules are broadly similar but may vary slightly between the different fields of science.

Scientific research must be organized and undergo planning, including performing literature reviews of past research and evaluating what questions need to be answered.

Actual research process

Research is a systematic and organized process. It is about collecting information that answers a question. Throughout this process the researcher has to ensure that information is gathered in a systematic and accurate manner.

Information gathered must be cross-checked by using other sources and references, even when the researcher is convinced that the information already obtained provides a good answer to the question asked.

Below are the guidelines and steps for a general research process.

Step 1: Identify and define the topic

This step assists in identifying the problem or issue that requires research. For example, South Africa has a high incidence of road death. Research already done shows that around 10,000 people are killed in road accidents each year. Now we need to find out what are the causes and impact of the high incidence of road deaths. We need to know what other facts and evidence already exist so that we can build on that.

Step 2: Focus and refining the question

In this step we set out the aims and objectives of the research. For example, the aim of the research may be to "assess the social and economic impact of road accidents on the South African population". The aim of the research may provide a title for the research, i.e. "The causes of road accidents and the social and economic impact on the South African population".

A clear aim will make it easier to develop objectives for the research, for example:

To investigate the causes of accidents in South Africa.

To ascertain which geographical areas in South Africa experience the most road-accident deaths.

To measure the social impacts of road accidents on the South African population.

To measure the economic impacts of road accidents on South Africa.

To make recommendations arising from the study to interested groups.

The objectives will help you to decide which questions need answers. For example, "What are the three most common causes of road accidents?"

Step 3: Organizing the work plan to answer the questions

This step entails organising the work and choosing the methods that will be used to conduct the research. A terms of reference (ToR) should be drawn up that that spells out the work needed. This is usually given to the researcher who must then prepare a proposal about how they will go about doing the research. A ToR usually has the following sections: background, research objectives, methodology to be used, resources to be used (people, money for travel, etc), and timeframes for completing the project (broken down into phases, e.g. when the fieldwork will be completed, when the report will be written).

Step 4: Collecting information to help answer the question

This step entails the actual collection of information. This may require fieldwork. The research example on "The causes of road accidents and the social and economic impact on the South African population" is a huge and difficult one that will require lots of resources. For example, 80,000 fieldworkers were employed to conduct the 2001 Census. In this case the fieldworkers were called enumerators.

Other research may be conducted on a much smaller scale and may include a team of 5-10 people and the amount of resources required would be less.

Step 5: Data collection and Organization

This phase entails organising and analysing the information gathered in the previous step. To analyse means to make calculations, such as adding up the different responses so as to get a full picture of the situation. For example, after analysis it might be that 70% of those that were interviewed may have been driving over the speed limit of 120km/hr. The analysis may be in the form of tables, graphs, percentages, etc. Similarities may emerge. For example, the incidence of road deaths may be higher during rainy days. Similarly patterns may start to emerge. For example, the occurrence of drunken driving is higher during weekends and at the end of the month when people get paid.

Tools of research

Much of the terminology that researchers use is unfamiliar to others. In this section we explain the terms most commonly used in research.

Mean and median

For each of these terms, we will use the following set of nine numbers to explain the basis of our calculations:

1, 2, 3, 4, 5, 6, 7, 8, 54

Mean -The arithmetic mean is a commonly used term and is also referred to as the average. The mean is worked out by adding the numbers in a series and dividing the total by the number of items in the series. Adding our nine numbers and dividing by nine results in a mean (or average) of 10.

1+ 2 + 3 + 4 + 5 + 6 + 7 + 8 + 54 = 90

90/9=10; **Mean** = 10

Median -The median is the value which lies at the middle of a distribution: that is, 50% of the values are above (7, 8, 9, 54) and 50% (1, 2, 3, 4) below.

1 2 3 4 **5** 7 8 9 54

Median = 5

Sample

The group of subjects (people) from whom the data are collected.

Sampling Error

Maximum Sampling Error (MSE) is the highest possible percentage that the findings could be out by. For example, you might see the following statement in a research report: "Results are subject to a maximum sampling error (MSE) of + 5% at the 95% confidence level." This MSE tells you that the chances are 95 in 100 that the results are within 5 percentage points, higher or lower, of the true percentage for the entire population. The bigger your sample the smaller the MSE will be.

Statistically significant

This means that the research results are not likely to have occurred by chance. For example, research reports show that more people are applying for child support grants in ward 12 Phalaborwa after an education and awareness program run by the local councillor, and that these findings are "statistically significant." This means that the researcher is reasonably sure that increase in the number of people seeking child support grants was influenced by the education and awareness programme. If research findings are not statistically significant, any increase reported may be due to chance, rather than a result of the intervention.

Disaggregate

This means to take a general set of facts and break them into smaller, more meaningful pieces. For example you can find that 40% of people are unemployed in an area. When you break it down into gender you will find that only 20% of men are unemployed, but 60% of women are unemployed. Your approach to dealing with unemployment will change. You can also disaggregate for age, class, educational level, etc.

Extrapolate

This means to take some proven facts and to make a prediction based on them. You could take the track record of Pirates and Chiefs and make a prediction that they will end up in the top half of the results table next year. This is extrapolation.

Step 6: Interpretations

This step entails discussing the findings and drawing conclusions. Findings are often in table, graph, numeric or percentage form. The discussion involves using words to describe the findings. The discussion section is where the researcher gives opinions based on the findings of the research. The researcher then draws conclusions and may make recommendations based on the findings. The conclusion may be that "Road deaths are mainly caused by drunk drivers, drunken pedestrians, un-roadworthy vehicles and poor driver behaviour. The main economic impact is on the productive workforce due to high death rate and the more than 100000 economically active people who are disabled annually. Impact is most severe on individual families affected. "

Step 7: Writing a Summary

The writing of a report is important as it leaves a body of evidence that can be used by politicians, planners, community organizations and future researchers. A report generally has six sections: introduction, literature review, methodology, research results, discussion, and conclusions and recommendations (for more information, see section 5 of this chapter).

Step 8: Write your paper

Begin by organizing the information you have collected. The next step is the rough draft, wherein you get your ideas on paper in an unfinished fashion. This step will help you organize your ideas and determine the form your final paper will take. After this, you will revise the draft as many times as you think necessary to create a final product to turn in to your instructor.

Step 9: Cite your sources properly

Give credit where credit is due; cite your sources. Citing or documenting the sources used in your research serves two purposes: it gives proper credit to the authors of the materials used, and it allows those who are reading your work to duplicate your research and locate the sources that you have listed as references. The MLA and the APA Styles are two popular citation formats. Failure to cite your sources properly is plagiarism.

Step 10: Assessing and Reevaluation

This step entails reflection to decide on what action is needed and what steps should be taken to use the research effectively. This may include a plan for communicating the research results to community members and decision makers. More research may also be needed to answer new questions thrown up by the research done.

Step 11: Proof read

The final step in the process is to proofread the paper you have created. Read through the text and check for any errors in spelling, grammar, and punctuation. Make sure the sources you used are cited properly. Make sure the message that you want to get across to the reader has been thoroughly stated.

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