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1. **Natural versus Social science**

**Natural sciences** are studies of the natural world. This generally involves life forms, but also geology and weather. The occur naturally and are physically observable. It is quantitative study (referring to quantities and measurable characteristics).

**Example**: - Physics, Chemistry, Biology.

**Social sciences** are the study of interactions between life forms, most commonly focusing on the dynamic interface between people, their societies, or their cultures. These are not observable as physical objects but are instead a study of behaviors and action. It is a qualitative study, as in the examination of qualities.

**Example**: - Geography, History.

**Difference between Natural Science and Social Science**

**Natural Science:** Natural science is a branch of science that deals with the physical world.

**Social Science:** Social science is the study of human society and social relationships.

1. **Scientific method versus arbitrary method**

**The scientific method at** the core of biology and other sciences lays a problem-solving approach called the scientific method.

**Example**: - The scientific method has five basic steps, plus one feedback step:

1. Make an observation.
2. Ask a question.
3. Form a **hypothesis**, or testable explanation.
4. Make a prediction based on the hypothesis.
5. Test the prediction.
6. Iterate: use the results to make new hypotheses or predictions.

**Arbitrary method** existing or coming about seemingly at random or by chance or as a capricious and unreasonable act of will

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1. **Science versus religion versus astrology versus fortune telling**

 **Science** is a collection of tools and techniques for modeling the natural world and for using models to make predictions. It involves testing falsifiable hypotheses against rigorous observations of either naturally-occurring events or events created in the lab.

**Example**: - ***Medicine***

**Religion** isn’t a single system. It's a body of human practices that serve various purposes in various cultures. Most often, it's used for community building, a rough form of psychotherapy, an ethical systems, a means of tying people (through ritual) to a body of narratives, a welfare system, a way of motivating or crafting political and social systems and/or hierarchies, and as an impetus for creating art.

**Example**: - Islam, Christianity

**Astrology** is a form of divination that holds that the stars, the moon, and the planets significantly influence the lives of people on earth. Astrologers claim that the position of these celestial bodies at the time of one’s birth shapes his or her personality and future.

**Example**:- Ficino uses the principles of election astrology and Hermetic and Neo-Platonic philosophy to create a talisman of the planet Venus.

**Fortune telling Consider** the issue of consistency. The predictions of differing fortune-telling methods often contradict one another. Even when the same method is used, forecasts vary. For example, if a person asks two fortune-tellers the same question about the future based on the “reading” of the same cards, logically the answers should be the same. But often they are not.

**Example: -** It was a time for prophesying, weather prediction and fortune-telling.

1. **Research versus common sense**

**Research** is a learning process. This is when we try to define the ways that things work and truly understand them. This is the time for wide open questions.

**Example: -** Research in Essays and Reports

**Common sense** is about people behaving in certain way in certain societies at certain time.
Not worrying about being openly homosexual in San Francisco is common sense, while in some other places on our planet it yields death penalty as of today.

**Example**: - “Get the facts first, and then stretch them as you please.” [Mark Twain]

1. **Applied research versus Basic research**

**Applied Research** can be defined as research that encompasses real life application of the natural science. It is directed towards providing a solution to the specific practical problems and develop innovative technology

**Example**: - Ways to market products

**Basic Research** deals with generalization and formulation of theory about human behavior. It is aligned towards collecting information that has universal applicability. Therefore, basic research helps in adding new knowledge to the already existing knowledge.

**Example**: - Provide Energy from Fusion

|  |  |  |
| --- | --- | --- |
| **Basis for Comparison** | **Basic Research** | **Applied Research** |
| Nature | Theoretical | Practical |
| Utility | Universal | Limited |
| Concerned with | Developing scientific knowledge and predictions | Development of technology and technique |
| Goal | To add some knowledge to the existing one. | To find out solution for the problem at hand. |

1. **Deductive versus Inductive reasoning**

**Inductive reasoning** alludes to the logical process, in which specific instances or situations are observed or analyzed to establish general principles. In this process, the multiple propositions are believed to provide strong evidence, for the truth of the conclusion. It is used to develop an understanding, on the basis of observing regularities, to ascertain how something works.

**Example**: - My father was loud when he was angry. All fathers are loud when they are angry.

**Deductive Reasoning** means a form of logic in which specific inferences are drawn from multiple premises (general statements). It establishes the relationship between the proposition and conclusion. When all the proposed statements are true, then the rules of deduction are applied and the result obtained is inevitably true.

**Example**: - If A = B and B = C, then A = C.

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| --- | --- | --- |
| **Basis for Comparison** | **Inductive Reasoning** | **Deductive Reasoning** |
| Approach | Bottom-up approach | Top-down approach |
| Starting point | Conclusion | Premises |
| Based on | Patterns or trend | Facts, truths and rules |
| Process | Observation > Pattern > Tentative Hypothesis > Theory | Theory > Hypothesis > Observation > Confirmation |
| Argument | May or may not be strong. | May or may not be valid. |
| Structure | Goes from specific to general | Goes from general to specific |
| Draws inferences with | Certainty | Probability |

1. **Positivist versus Interpretivist view of reality**

**Positivist** the positivist ontology believes that the world is external (Carson et al., 1988) and that there is a single objective reality to any research phenomenon or situation regardless of the researcher’s perspective or belief (Hudson and Ozanne, 1988).

**Interpretivists** avoid rigid structural frameworks such as in positivist research and adopt a more personal and flexible research structures (Carson et al., 2001) which are receptive to capturing meanings in human interaction (Black, 2006) and make sense of what is perceived as reality (Carson et al., 2001).

1. **Objectivism versus subjectivism in research**

**Objectivism** emphasizes only objective criteria of evaluation and eliminates any subjective evaluation. “Objectivity means a more factual approach”;

**Example**: - A person who works hard on a farm his entire life to be completely self-sustaining.

**Subjectivism** works on the presumption of individualism. It stresses the role of knowing subject which means that different interpreters can interpret the conduct of the other party in different ways. The subjective theory of interpretation is based on the actual intentions of the parties.

1. **Research objective versus Research question versus research hypothesis**

**Research objective** Research questions and hypothesis are tools used in similar ways for different research methods. Both hypothesis and research questions are written before research begins and are used to help guide the research.

## Example: - Exploratory research objectives

**Research question** is a highly focused question that addresses one concept or component of the hypothesis whereas the hypothesis itself is used to state the relationship between two variables.

Brainstorming with teachers, advisors, or colleagues may provide valuable feedback that helps the researcher focus on a specific research question area.

**Example** supposes a researcher told a colleague that her area of interest was pain as a prevalent problem for older adults.

**Hypothesis** is used in deductive research, where researchers use logic and scientific findings to either prove or disprove assumptions. Heuristic research is based on experience, where researchers use observations to learn about the research subject.

**Example**: - If I replace the battery in my car, then my car will get better gas mileage.

1. **Theoretical framework versus conceptual framework**

**Theoretical framework** provides a general representation of relationships between things in a given phenomenon. The conceptual framework, on the other hand, embodies the specific direction by which the research will have to be undertaken. Statistically speaking, the conceptual framework describes the relationship between specific variables identified in the study.

**Conceptual framework** is the researcher’s idea on how the research problem will have to be explored. This is founded on the theoretical framework, which lies on a much broader scale of resolution. The theoretical framework dwells on time tested theories that embody the findings of numerous investigations on how phenomena occur.

**Examples of the Theoretical and the Conceptual Framework**

The difference between theoretical framework and conceptual framework can be further clarified by the following examples on both concepts:

* Theoretical Framework: Stimulus elicits response.
* Conceptual Framework: New teaching method improves students’ academic performance.
1. **Quantitative versus qualitative versus mixed method research**

**Qualitative research** is a planned, empirical investigation that aims to gain a deep understanding of a specific organization or event, rather than to compile a surface description of a large sample of a population via measurement.

**Quantitative research** is the systematic, empirical investigation of social phenomena using statistical, mathematical or computational techniques.

**Mixed methods research** is a planned investigation for collecting, analyzing, and “mixing” both quantitative and qualitative research and methods in a single study in order to understand a research problem from multiple perspectives.

1. **Variable versus construct versus theory/concept**

**Variables** are created by developing the construct into a measurable form. Variables, by definition, correspond to any characteristic that varies (meaning they have at least two possible values).

**Examples** of variables include height in inches, scores on a depression inventory, and ages of employees

**Constructs** are broad concepts or topics for a study. Constructs can be conceptually defined in that they have meaning in theoretical terms. They can be abstract and do not necessarily need to be directly observable.

**Examples** of constructs include intelligence or life satisfaction.

**Concept** is a term that is often used in metaphysics, especially in ontology that can be defined as a fundamental category of existence. It is a group of abstract ideas put together in order to describe a phenomenon. However, in philosophy, there exists three ways of defining a concept.

**Theory** can be defined as a collection of ideas, facts, phenomena or events that can be used to explain a certain topic. When developing a theory, it is necessary to use the rational and contemplative forms of generalized and abstract thinking while a theory is based upon general factors that are independent of the phenomenon being explained.

**What is the difference between Concept and Theory?**

A concept is an abstract notion. A theory is a collection of explanations about a particular subject.

1. **Research method versus research design**

**Research methods** are generalized and established ways of approaching research questions (e.g., qualitative vs. quantitative methods). Not all methods can be applied to all research questions, so the choice of method is limited by the area of research that you wish to explore.

**Research design** involves determining how your chosen method will be applied to answer your research question. The design of your study can be thought of as a blueprint detailing what will be done and how this will be accomplished.

1. **Data versus information versus knowledge versus wisdom**

**Data** means raw facts gathered about someone or something, which is bare and random. Data is an unsystematic fact or detail about something

**Information** is a systematic and filtered form of data, which is useful. In this article, you can find all the important differences between data and information.

|  |  |  |
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| **Basis for Comparison** | **Data** | **Information** |
| What is it? | It is just text and numbers. | It is refined data. |
| Based on | Records and Observations | Analysis |
| Form | Unorganized | Organized |

**Knowing** or understanding something, especially about a particular subject , Having awareness of facts and/or truths , Something that can be known, information

**Wisdom** The state of being wise , The ability to use knowledge and/or experience intelligently , Capable of determining what is wise vs. what is unwise , A saying, philosophy, or other advice that is considered wise

|  |
| --- |
| Knowledge versus Wisdom comparison chart |
|  | **Knowledge** | **Wisdom** |
| **Time** | Allows for change in response to new information or analyses. Seeks to always improve. | Timeless. Wisdom is "Who we are" vs. "What we do" Wisdom governs choice, pursuit of knowledge, communication and relationships. |
| **Source** | Learning, education, science, reflection, reasoned and logical thought. | Self. Intuition. Our personal experience. Wisdom defines and refines our character. "Character is simply who we are and is the persona and identity of everything we do." |

1. **Nominal versus ordinal versus interval versus ratio type of data**

**Nominal data** simply names something without assigning it to an order in relation to other numbered objects or pieces of data. An example of nominal data might be a "pass" or "fail" classification for each student's test result. Nominal data provides some information about a group or set of events, even if that information is limited to mere counts.

**Ordinal data** it involves some order; ordinal numbers stand in relation to each other in a ranked fashion. For example, suppose you receive a survey from your favorite restaurant that asks you to provide feedback on the service you received. You can rank the quality of service as "1" for poor, "2" for below average, "3" for average, "4" for very good and "5" for excellent.

I**nterval data**, also called an integer, is defined as a data type which is measured along a scale, in which each point is placed at equal distance from one another. Interval data always appears in the form of numbers or numerical values where the distance between the two points is standardized and equal.

**Ratio** scale is a type of variable measurement scale which is quantitative in nature. Ratio scale allows any researcher to compare the intervals or differences. Ratio scale is the 4th level of measurement and possesses a zero point or character of origin. This is a unique feature of ratio scale.

E**xample**, the temperature outside is 0-degree Celsius. 0 degree doesn’t mean it’s not hot or cold, it is a value.

1. **Primary versus secondary data sources**

**Primary data** is data originated for the first time **by** the researcher through direct efforts and experience, specifically for the purpose of addressing his research problem.

**Example** The data can be collected through various methods like surveys, observations, physical testing, mailed questionnaires, questionnaire filled and sent by enumerators, personal interviews, telephonic interviews, focus groups, case studies, etc.

**Secondary data** implies second-hand information which is already collected and recorded by any person other than the user for a purpose, not relating to the current research problem. Secondary data offer several advantages as it is easily available, saves time and cost of the researcher. But there are some disadvantages associated with this, as the data is gathered for the purposes other than the problem in mind, so the usefulness of the data may be limited in a number of ways like relevance and accuracy.

**Example**: - websites, books, journal articles, internal records

 **Key Differences between Primary and Secondary Data**

Primary data collection is a very involved process. On the other hand, secondary data collection process is rapid and easy. Primary data collection sources include surveys, observations, experiments, questionnaire, personal interview, etc. On the contrary, secondary data collection sources are government publications, websites, books, journal articles, internal records etc.

1. **Validity versus reliability in quantitative study**

**Validity** implies utility. It is the most important yardstick that signals the degree to which research instrument gauges, what it is supposed to measure. Simply, it measures the point to which differences discovered with the scale reflect true differences, among objects on the characteristics under study, instead of a systematic and random error. To be considered as perfectly valid, it should not possess any measurement error.

**Example**: - Concurrent Validity, Content Validity.

**Reliability** is used to mean the extent to which the measurement tool provides consistent outcomes if the measurement is repeatedly performed. There are two key aspects, which requires being indicated separately are:

Stability: Degree of stability can be checked by making a comparison of the results of repeated measurement.

Equivalence: Equivalence can be gauged when two researchers compare the observations of the same events.

1. **Credibility versus dependability in qualitative study**

**Credibility** is involved in establishing that the results of the research are believable. This is a classic example of ‘quality not quantity’. It depends more on the richness of the information gathered, rather than the amount of data gathered.

**Dependability** ensures that the research findings are consistent and could be repeated. This is measured by the standard of which the research is conducted, analyzed and presented. Each process in the study should be reported in detail to enable an external researcher to repeat the inquiry and achieve similar results. This also enables researchers to understand the methods and their effectiveness.

1. **Probable /random versus non probable sampling**

**Probability sampling** refers to the sampling method in which all the members of the population has a pre-specified and an equal chance to be a part of the sample. This technique is based on the randomization principle, wherein the procedure is so designed, which guarantees that each and every individual of the population has an equal selection opportunity. This helps to reduce the possibility of bias.

**Non-probability sampling** when in a sampling method, all the individuals of the universe are not given an equal opportunity of becoming a part of the sample, the method is said to be Non-probability sampling. Under this technique as such, there is no probability attached to the unit of the population and the selection relies on the subjective judgment of the researcher. Therefore, the conclusions drawn by the sampler cannot be inferred from the sample to the whole population. The methods of non-probability sampling are listed below:

|  |  |  |
| --- | --- | --- |
| **Basis for Comparison** | **Probability Sampling** | **Non-Probability Sampling** |
| Alternately known as | Random sampling | Non-random sampling |
| Basis of selection | Randomly | Arbitrarily |

1. **Population versus Sample**

**Population** means the aggregate of all elements under study having one or more common characteristic.

**Examples** The population of all workers working in the sugar factory.

**Sample**, we mean a part of population chosen at random for participation in the study. The sample so selected should be such that it represents the population in all its characteristics. While conducting statistical testing, samples are mainly used when the sample size is too large to include all the members of the population under study.

1. **sample frame versus sampling**

**Sampling frame** units with a proper identification (which represents the population to be covered is called sampling frame). The frame may consist of either a list of units or a map of area (in case sample of area is being taken), such that every element in the population belongs to one and only one unit.

**Sampling** The sample will be representative of the population if the researcher uses a random selection procedure to choose participants. The group of units or individuals who have a legitimate chance of being selected are sometimes referred to as the sampling frame.

**Examples: Sampling Frame and Sampling**

1. List of household (and persons) enumerated in population census.
2. A map of areas of a country showing the boundaries of area units.
3. In sampling an agricultural crop, the unit might be a field, a farm or an area of land whose shape and dimensions are at out disposal.
4. **Small versus large sample size**

**Sample size** is the number of pieces of information tested in a survey or an experiment.

**Example** For instance, if you test 100 samples of seawater for oil residue, your sample size is 100. If you survey 20,000 people for signs of anxiety, your sample size is 20,000. Larger samples sizes have the obvious advantage of providing more data for researchers to work with; but large sample-size experiments require larger financial and time commitments.

1. **error versus bias in research**

**Random error** is also known as variability, random variation, or ‘noise in the system’. The heterogeneity in the human population leads to relatively large random variation in clinical trials. Random error has no preferred direction,.

**Example: -** Measuring the mass of a sample on an analytical balance may produce different values as air currents affect the balance or as water enters and leaves the specimen.

**Bias error** refers to deviations that are not due to chance alone. The simplest example occurs with a measuring device that is improperly calibrated so that it consistently overestimates (or underestimates) the measurements by X units.

1. **Central limit theorem versus Normal curve**

**Central Limit Theorem** is that the average of your sample means will be the population mean. In other words, add up the means from all of your samples, find the average and that average will be your actual population mean. Similarly, if you find the average of all of the standard deviations in your sample, you’ll find the actual standard deviation for your population.

**Examples** A population (i.e. 29-year-old males, seniors between 72 and 76, all registered vehicles, all cat owners)

**normal curve** is a bell-shaped curve which shows the probability distribution of a continuous random variable. Moreover, the normal curve represents a normal distribution. The total area under the normal curve logically represents the sum of all probabilities for a random variable. Hence, the area under the normal curve is one.

1. **Descriptive versus inferential statistics**

**Descriptive statistics** involves all of the data from a given set, which is also known as a population. With this form of statistics, you don’t make any conclusions beyond what you’re given in the set of data.

**Example**, if you have a data set that involves 20 students in class, you can find the average of that data set for those 20 students, but you can’t find what the possible average is for all the students in the school using just that data.

**Inferential statistics** makes inferences about populations using data drawn from the population. Instead of using the entire population to gather the data, the statistician will collect a sample or samples from the millions of residents and make inferences about the entire population using the sample.

**Example**, suppose you want to know the average height of all the men in a city with a population of so many million residents. It isn't very practical to try and get the height of each man.

1. **Descriptive versus statistical analysis**

**Descriptive Analysis** The transformation of raw data into a form that will make them easy to understand and interpret; rearranging, ordering, and manipulating data to generate descriptive information.

**Example**: - A company that wants to evaluate the morale of its staff.

**statistical analysis** is used extensively in science, from physics to the social sciences. As well as testing hypotheses, statistics can provide an approximation for an unknown that is difficult or impossible to measure.

Example Find key measures of location. For example, the mean tells you what the average (or “middling”) number is in a set of data.

1. **Confidence interval versus margin of error**

**A confidence interval (CI)** refers to the amount of uncertainty associated with a sample population estimate (the mean or proportion) of a true population.

**Example**: - Record the ages of the victims, add them all up all, and divide by 100 to get the mean. Let's say the mean age in this case is 34.25 years.

**Margin of error (MOE)** is a statistical concept that is most often associated with polls and pollsters. It serves to quantify the uncertainty associated with sampling in a poll or other survey. In survey research, it is almost never practical to measure the entire population.

1. **Parametric versus non parametric test**

**Parametric test** is the hypothesis test which provides generalizations for making statements about the mean of the parent population. A t-test based on Student’s t-statistic, which is often used in this regard. The t-statistic rests on the underlying assumption that there is the normal distribution of variable and the mean in known or assumed to be known. The population variance is calculated for the sample. It is assumed that the variables of interest, in the population are measured on an interval scale.

**Nonparametric test** is defined as the hypothesis test which is not based on underlying assumptions, i.e. it does not require population’s distribution to be denoted by specific parameters. The test is mainly based on differences in medians. Hence, it is alternately known as the distribution-free test. The test assumes that the variables are measured on a nominal or ordinal level. It is used when the independent variables are non-metric.

|  |  |  |
| --- | --- | --- |
| **Basis for Comparison** | **Parametric Test** | **Nonparametric Test** |
| Basis of test statistic | Distribution | Arbitrary |
| Measurement level | Interval or ratio | Nominal or ordinal |
| Measure of central tendency | Mean | Median |
| Information about population | Completely known | Unavailable |
| Applicability | Variables | Variables and Attributes |
| Correlation test | Pearson | Spearman |

1. **Research ethics versus misconduct**

**Research Ethics** is Ethical decision making in academic research focuses on providing maximum benefits to the participants. the strengths and culture of the community, including community researchers and staff as well as material resources, must be respected and utilized whenever possible.

**Example**: - To help to address any issues that are raised as a result of research.

**Misconduct** is the violation of the standard codes of scholarly conduct and ethical behavior in the publication of professional scientific research.

**Example** Plagiarism – utilizing someone else words, published work, research processes, or results without giving appropriate credit via full citation.

1. **Data analysis versus interpretation versus finding**

**Data interpretation** refers to the implementation of processes through which data is reviewed for the purpose of arriving at an informed conclusion. The interpretation of data assigns a meaning to the information analyzed and determines its signification and implications.

**Data analysis is** the use of a variety of qualitative and quantitative techniques to better understand data. Correlation is a common quantitative technique discussed in this module, but many others exist. Qualitative techniques involve thematic analysis of the text to discover and understand categories, patterns, and themes.

**Data Finding**s is observations about your data. They are the statements that summarize the important points. Findings will help you to come up with conclusions, because they help you form a more thorough and accurate interpretation.

**Example**: - Site number 3 violated water quality standards for dissolved oxygen on all days

1. **Conclusion versus recommendation**

**Conclusion**s section sums up the key points of your discussion, the essential features of your design, or the significant outcomes of your investigation

**Example** The aim of this project is to design a mobile phone tower for a suburban location. Conclusions. The mobile phone tower presented here can be erected safely in a suburban street. It requires a total area of no more than 2m2 l, and has the following safety features

**Recommendation** Always address limitations and suggest how they might be overcome in future work. The excerpt below is from the Conclusions of a report on a project investigating the effect of pulsation on heat transfer in horizontal pipe flow.

**Example**: - Organize an educational workshop for waterfront landowners about the benefits of best management practices to control erosion.

1. **Citation style versus Reference versus Bibliography**

**Citations** or in-text citations are similar to references, but occur in the body of the text with direct quotes and paraphrases to identify the author/publication for the material you have used. Citations are used:

**Example** For direct quotes – when you repeat a passage from a text (or speech, video, etc.) in your assignment without changing any words.

**Reference** is a list of the resources that you used when writing your assignment or doing your research. These resources may include:

**Example** books, including electronic books, journals

 **Bibliography** is listing all the materials that have been consulted while writing an essay or a book. References, on the other hand, are those that have been referenced in your article or book.

A bibliography will contain all research materials, including books, magazines, periodicals, websites and scientific papers, which you have referred. References contain source of material like quotes or texts, which has been actually used when writing an essay or book.

1. **Research dissemination versus research Utilization**

**Research dissemination** researchers who are applying for funding or have research in progress. It is designed to help you to plan your dissemination and give your research every chance of being utilized.

Research involves many steps, and sharing the results of your efforts is the next task that lies before you after the working phase of your project has been completed. This crucial step of disseminating the new knowledge you have uncovered is absolutely essential to the research process.

**research Utilization** Pragmatically developed indicator systems usually address specific aims, and often reflect preferred policy while following up its execution. These are fairly simple systems of indicators that have main effects on the variability of educational outcomes. Thus they are easy to be interpreted and translated into policy decisions.

[**https://www.quora.com**](https://www.quora.com/)