

## Science and Research:

*Science is best defined as a careful, disciplined, logical search for knowledge about any and all aspects of the universe, obtained by examination of the best available evidence and always subject to correction and improvement upon discovery of better evidence.*

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## Science

- It took a long while to determine how is the world better investigated.
  - One way is to just talk about it
    - Example: Aristotle, the Greek philosopher, stated that males and females have different number of teeth, without bothering to check; he then provided long arguments as to why this is the way things ought to be).
  - This method is unreliable:
    - arguments cannot determine whether a statement is correct, this requires *proofs*.
- A better approach is to do experiments and perform careful observations.
  - The results of this approach are universal in the sense that they can be reproduced by any skeptic.
  - It is from these ideas that the *scientific method* was developed.
  - Most of science is based on this procedure for studying Nature.
- Science defined
  - The state of knowing : knowledge as distinguished from ignorance or misunderstanding
  - 2 **a** : a department of systematized knowledge as an object of study <the *science* of education> **b** : something (as a sport or technique) that may be studied or learned like systematized knowledge <have it down to a *science*>
  - 3 **a** : knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through *scientific* method **b** : such knowledge or such a system of knowledge concerned with the physical world and its phenomena : **NATURAL SCIENCE**
  - 4 : a system or method reconciling practical ends with *scientific* laws

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## Scientific philosophy

- Evolved in the 14th century
  - a new way of understanding the universe and acquiring knowledge
    - previously:
      - knowledge was derived from religious teachings and based on faith and/or
      - philosophical reasoning and logical deduction
  - at the time, a radical new system that emphasized objectivity in seeking answers to questions about the way of things

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## Scientific method

- Principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses
  - these principles and procedures are the basis of *all* research
- Research is the methodological process through which scientifically based knowledge and understanding is attained
  - Research methods represent the various "tools" that we use to work through the problems we seek to solve

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## Science versus research

- Not all researchers are scientists, but...
  - all valid research is based upon the scientific method
- Five big words...
  - Theoretical: relating to or having the character of *theory*
  - Empirical: capable of being verified or disproved by observation or experiment
  - Nomothetic: relating to, involving, or dealing with abstract, general, or universal statements or laws
  - Probabilistic: of, relating to, or based on *probability*
  - Causal: involving *causation* or a cause
  - Parsimony: a criterion for deciding among scientific theories or explanations. One should always choose the simplest explanation of a phenomenon, the one that requires the fewest leaps of logic.
    - Occam's Razor: Given a choice between two explanations, choose the simplest – the explanation which requires the fewest assumptions

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## Two major paradigms in research

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| <ul style="list-style-type: none"><li>■ Quantitative Research<ul style="list-style-type: none"><li>□ based on a belief of an objective reality</li><li>□ reality can be organized in measurable ways (variables)</li><li>□ problems are measured in a defined population</li><li>□ a methodical, structured, and distant approach is used to measure for comparison</li><li>□ findings confirm (or don't) hypotheses are generalizable to the defined population only</li><li>□ data is gathered under controlled conditions and analyzed statistically</li></ul></li></ul> | <ul style="list-style-type: none"><li>■ Qualitative Research<ul style="list-style-type: none"><li>□ based on the belief in a reality constructed by its participants</li><li>□ reality does not exist separately from its participants<ul style="list-style-type: none"><li>■ it has different meanings for each of its participants</li></ul></li><li>□ researcher is an active participant rather than a distant observer.</li><li>□ findings emerge and are not generalizable, but lead to theories which may be tested later</li><li>□ data is gathered in the field and interpreted intuitively</li></ul></li></ul> |
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## Counseling research

- The systematic collection and analysis of data (information) in order to develop valid, generalizable descriptions, predictions, interventions, and explanations relating to various aspects of human behavior, relationships, change processes, etc.
  - Development
  - Treatment outcomes
  - Attitudes
  - Needs

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## Some important terms

- Theory/Construct
- hypothesis
- data
- variables
  - dependent
  - independent
- sample
  - subjects/participants

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