AGSC 5110

RESEARCH METHODS

Instructor: Dr. Jason de Koff

Rationale for Course

- Provide you with the skills and knowledge appropriate for:

  - planning

  - designing

  -conducting

  -interpreting

  -reporting

  a research study in agriculture and related areas.

Objectives

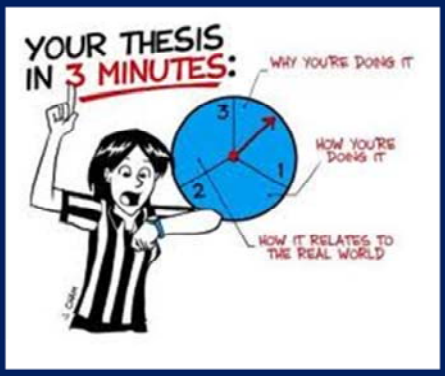
1. To develop an understanding or research philosophy, methods and procedures.
2. To learn how to state problems, formulate hypotheses, and develop specific objectives in a research proposal.
3. To aid in developing and presenting a study proposal.

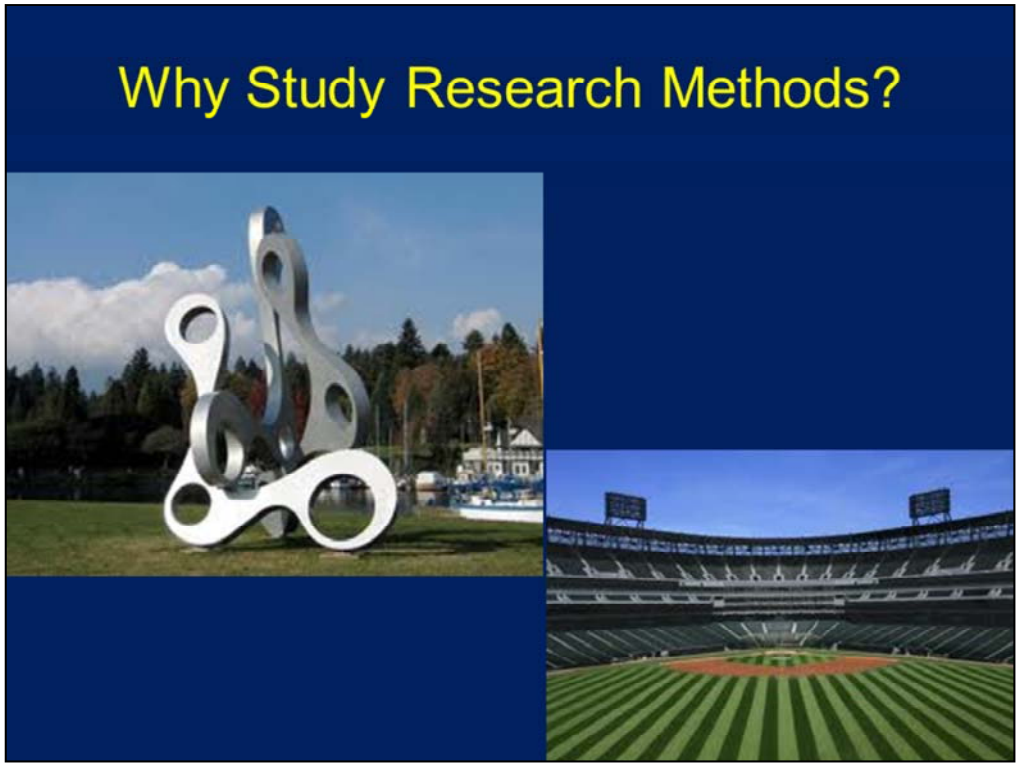
After completing this course you will be able to:

1. Prepare a research proposal for a study or thesis.
2. Use the tools and procedures of research to aid in preparing the proposal.
3. Identify, read and interpret research literature.

Why Study Research Methods?

- You're going to need it





When you go to a museum, paintings, drawings, and sculptures become more meaningful when you know something about the techniques involved in production of the artwork.

When watching a baseball game, it becomes more meaningful if you know the rules.

What is Research?

- Research is essentially systematic inquiry seeking facts through objective verifiable methods.
- Research is systematic thinking about the sorts of problems that require for their solution the collection and interpretation of facts.
- Research may be defined as the systematic and objective recording and analysis of control of events.
- Research applies the scientific method.

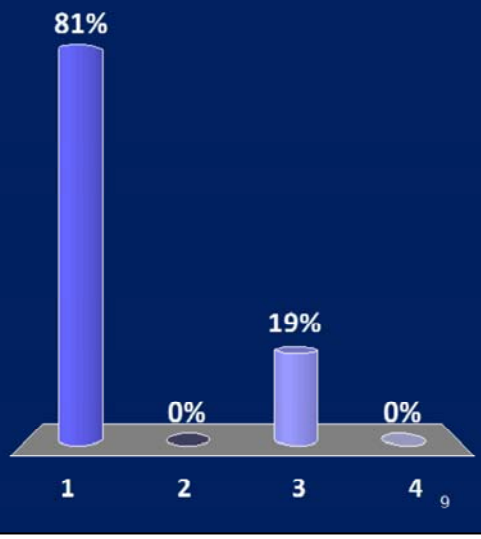
For example, a child is curious about a stove.

- He hypothesizes that it is not something that will hurt him if he touches it. Therefore, he conducts an experiment.
- **He touches it and his fingers hurt!**

All people are to some extent researchers, even children.

The Scientific Method includes:

1. Hypothesis
2. Replication
3. Quantitative data
4. Publication



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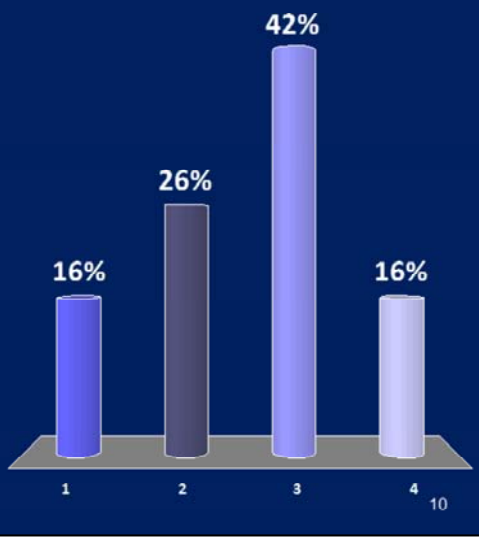
Nominal data is:

1. Ranked data
2. Categorical data
3. Quantitative data
4. Ranked data with arbitrary 0 point



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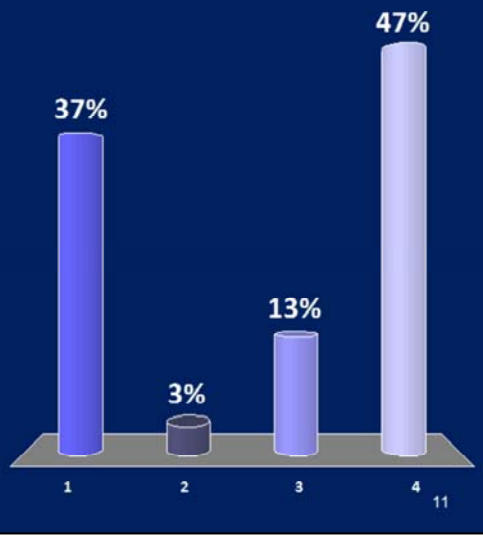
Accuracy is:

1. Precision
2. Reliability
3. Ability of an instrument to measure what it should
4. Consistency with which an instrument gives the same result



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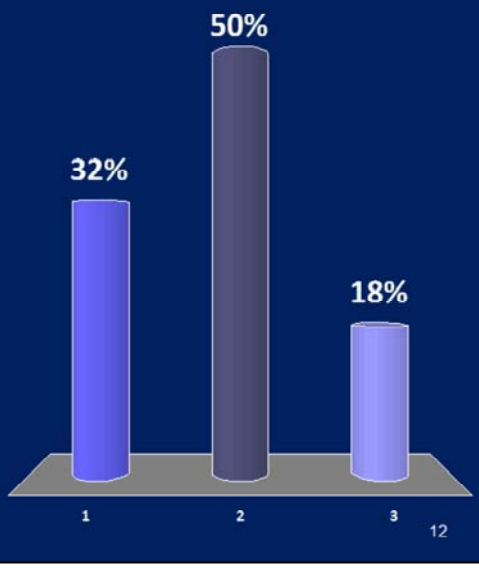
Deductive reasoning:

1. Uses general principles to achieve more specific results
2. Reaches general conclusions from specific facts
3. Makes judgments about a population based on a sample



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The Scientific Research Method

1. Curiosity or Problem
2. Formation of Hypothesis
3. Design of Experiment
4. Data Collection
5. Data Analysis
6. Testing Hypothesis

Use scientific method to organize thoughts into a logical pattern, use thesis or proposal headings for organization of scientific writing (what are these headings?)

Problem can be from personal observation or work done by others

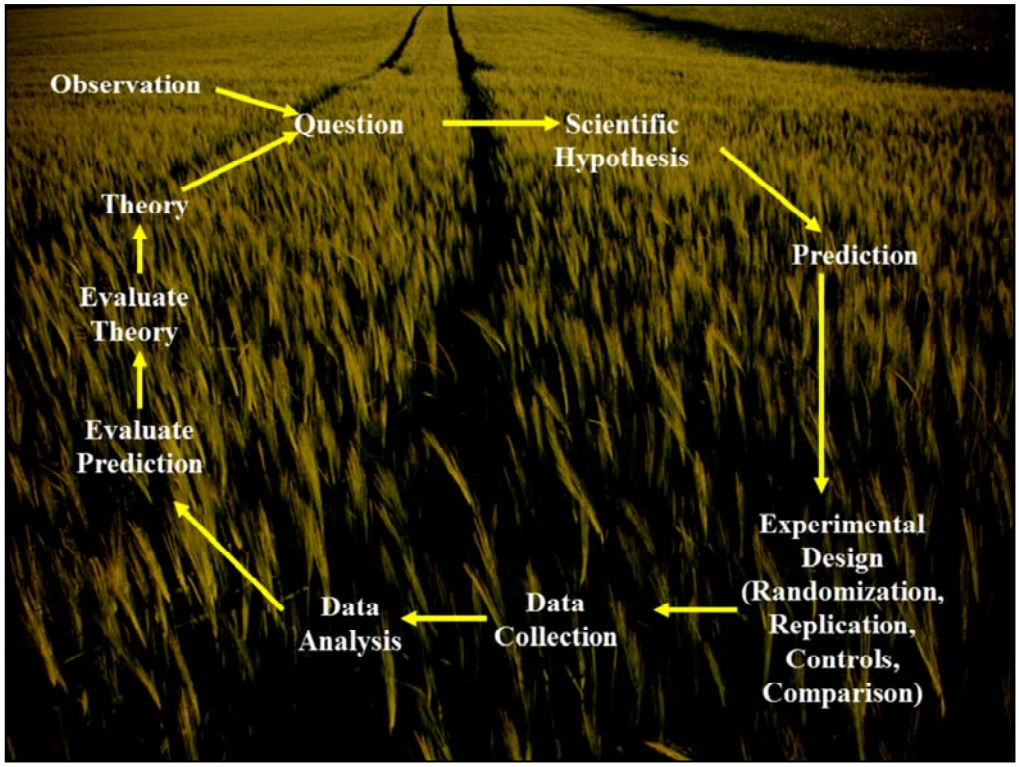
Hypothesis: a tentative answer or solution to the problem…it is derived from previous experience or theory…it directs the thinking of the researcher

Design of Experiment: How many variables? What are you testing for? How many replications of each variable? Identification of survey questions. Experimental and statistical methods used.

Data Collection: measurements

Data Analysis: also called Interpretation of data…organizing data and applying statistical methods, graphing, tables, etc…this is a key component in the research process

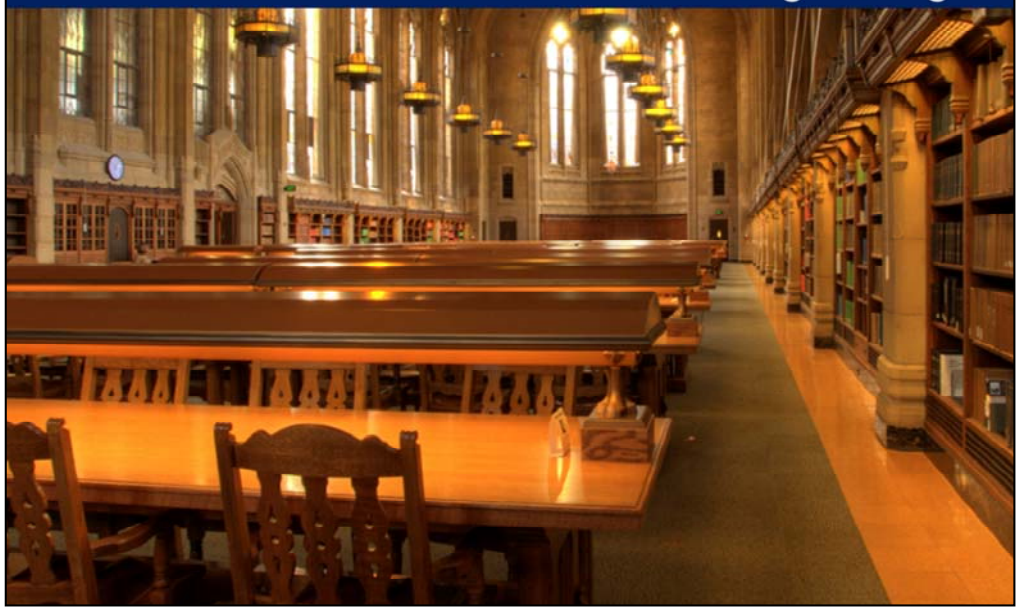
Testing Hypothesis: Statistical inferences from data determine rejection or failure to reject the hypothesis…What does statistics do (identifies the likelihood that outcome is due to chance) $P<0.05$ chance is <5%



The scientific research method

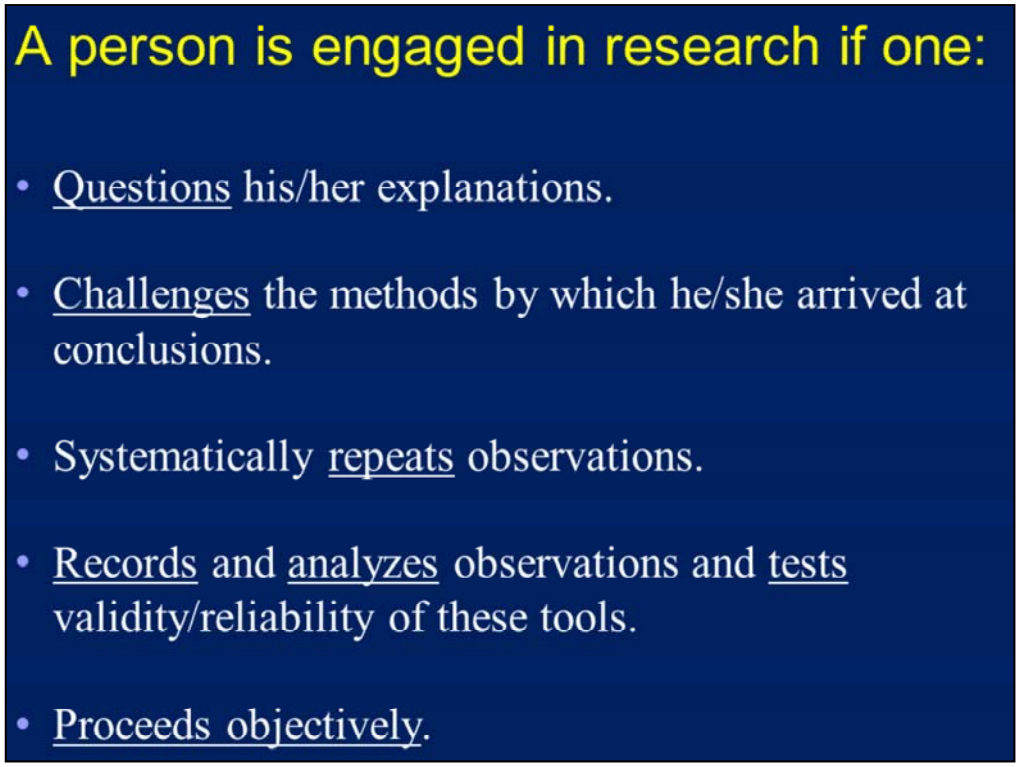
What Research is Not:

Research is not mere information gathering.



Aims of Research

1. **Discover** new facts or **verify** and test old facts
2. **Analyze** potential relationships.
3. **Develop** new scientific tools.



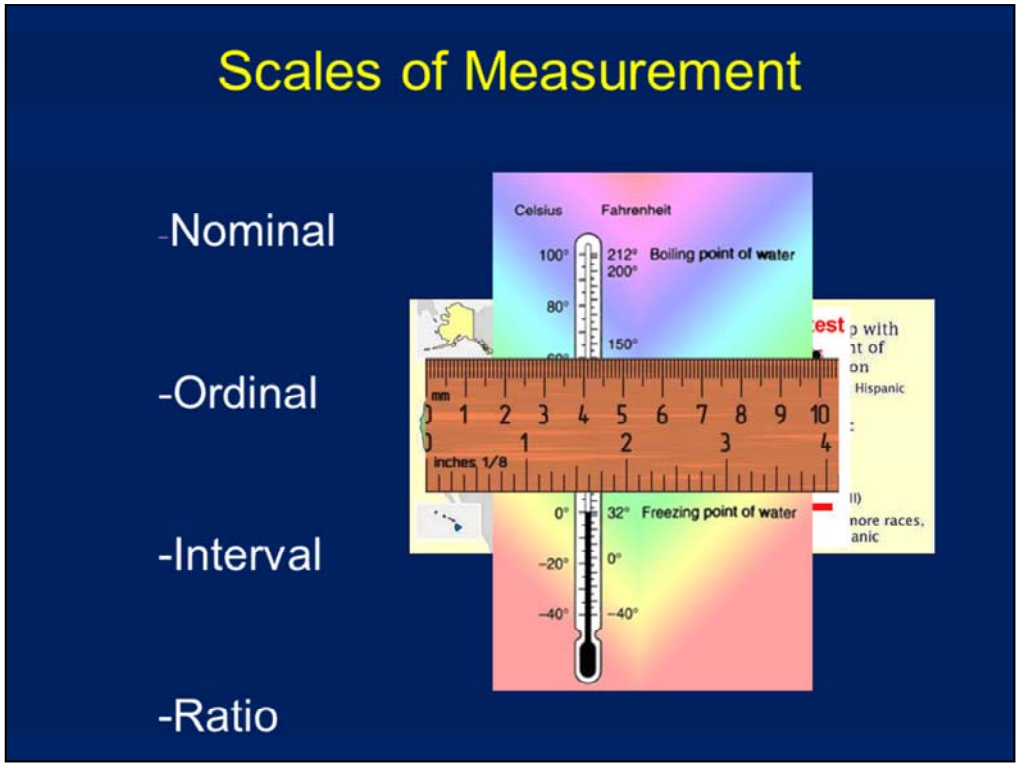
Questions: If you walk into a room and turn on the light switch and the light doesn't come on, should you just assume the power is out? What other causes could there be? (light unplugged, bulb broken)

Challenges: Did I turn it on all the way (i.e. was the method of performed properly?)?

Repeats: Try it a couple of times.

Record and analyze observations and test:

Proceeds objectively: the data should be unbiased and not reflect any preconceived notions. (I know there was a thunderstorm or power outage in the area so this must be the cause).

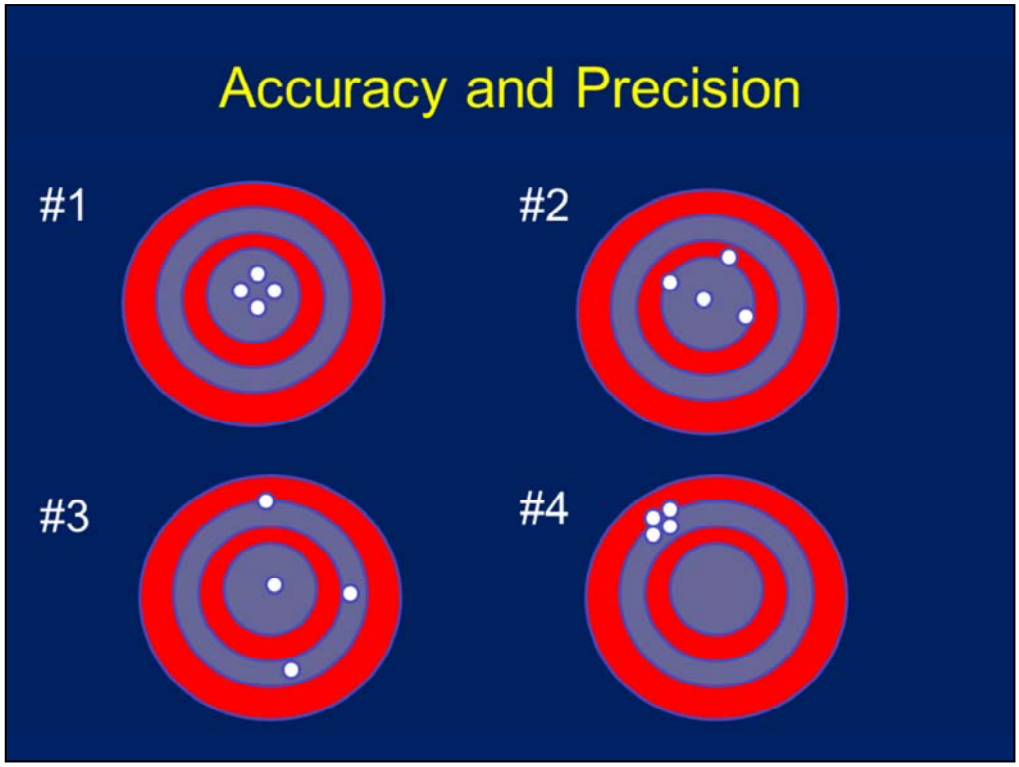


Nominal: categorical data; can be analyzed statistically by mode (frequency of occurrence), percent, chi-square test

Ordinal: ranking data based on order; can be analyzed statistically by mode, percent, median (halfway point in set of data), percentile rank

Interval: has equal units of measurement and its zero point has been established arbitrarily…can be analyzed statistically using measures that employ addition and subtraction (means, standard deviation)

Ratio: has equal measurement units, and an absolute zero point…can express values in terms of fractions or multiples



#1 = Accurate and Precise

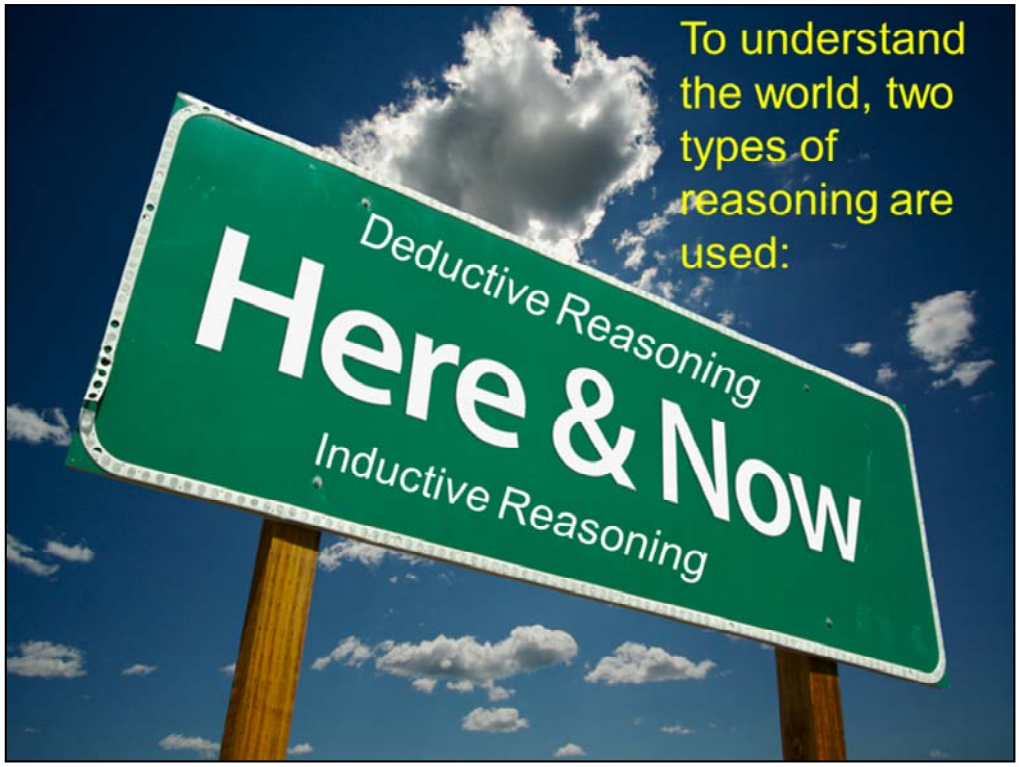
#2 = Accurate and Not Precise

#3 = Not Accurate and Not Precise

#4 = Precise and Not Accurate

Accuracy (Validity): the ability of an instrument to measure what it is supposed to measure

Precision (Reliability): the consistency with which an instrument gives the same result for the same thing being measured


To understand the world, two types of reasoning are used:
Deductive Reasoning
Here & Now
Inductive Reasoning

Deductive Reasoning

- A thinking process from general principles to specific statements using prescribed rules of logic.
- It is a system for organizing what is known to reach conclusions.

Sherlock Holmes always talked about using deduction to solve his crimes but he was actually using induction.

Example

All schools are important

TSU is a school

Therefore, TSU is important

Sequence is from GENERAL to PARTICULAR
or
POPULATION to SAMPLE

Inductive Reasoning

- Empirical process of reaching a conclusion or arriving at a new principle (general rules) from known data and experience by observing realities (facts).
- This type of reasoning is the reverse of the process employed in deductive reasoning.

This is what most scientists do.

Example

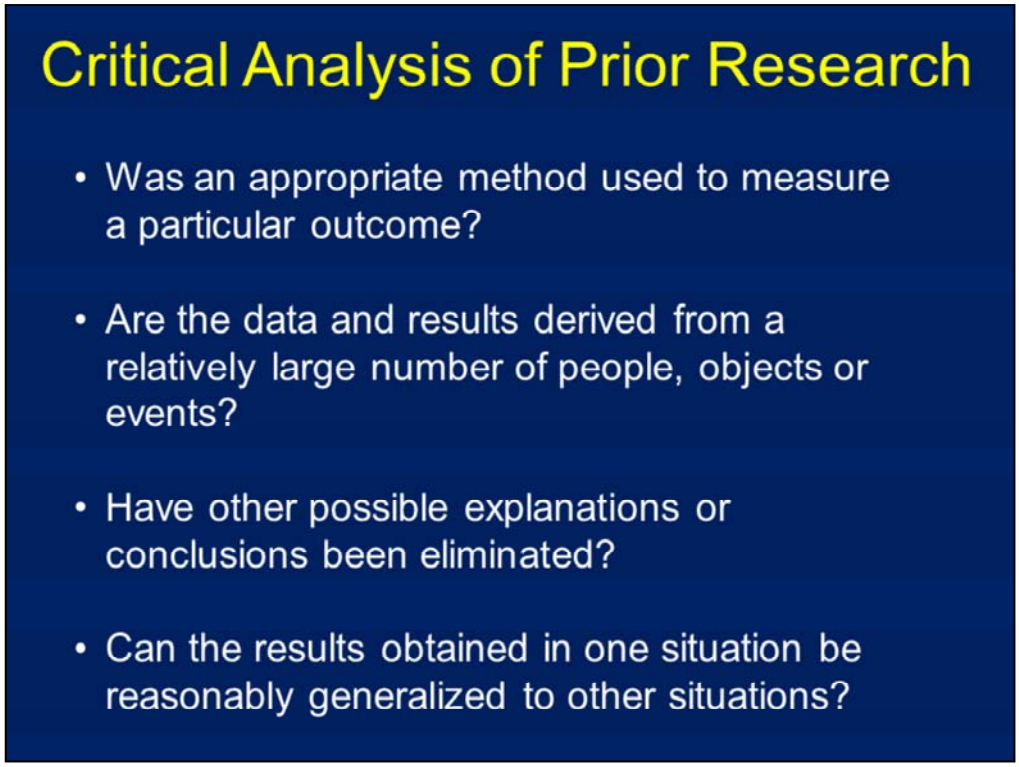
Every TSU student that has been observed likes ballet

Therefore, every TSU student likes ballet.

Sequence is from PARTICULAR to GENERAL
or
SAMPLE to POPULATION

The empirical approach to knowledge is based on observations. These can be misleading and are often misinterpreted. Researchers strive to avoid misleading results and poor interpretations by careful planning.

Everyone uses the empirical approach in everyday living. For instance, if I observe students becoming restless during a certain lesson or sleeping during class, I might say they think the lesson is boring.



Involved evaluating the value of data and research results in terms of the methods used to obtain them and their potential relevance to particular conclusions.

#1 This one will come with time and experience

#2 Replication is always important, most field or laboratory studies use 3 or 4 replicates, human studies use many more

#3 Could there be other variables involved that the researcher does not look into? (i.e. If I am measuring CO2 coming from a field and attributing it to the plant root respiration, could there be other factors contributing to this flux?)

#4 If farmers don't irrigate switchgrass, then don't irrigate switchgrass when you are doing the research.

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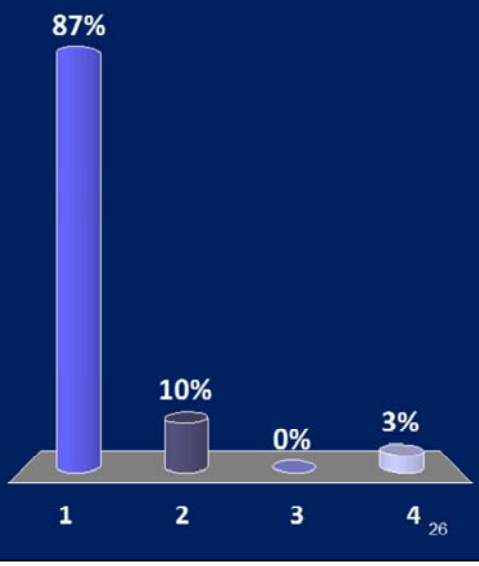

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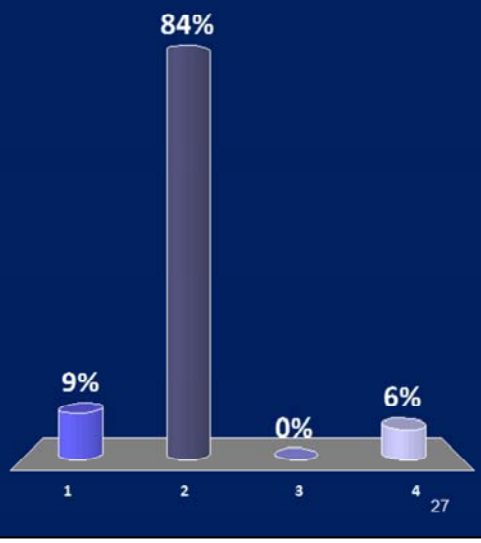

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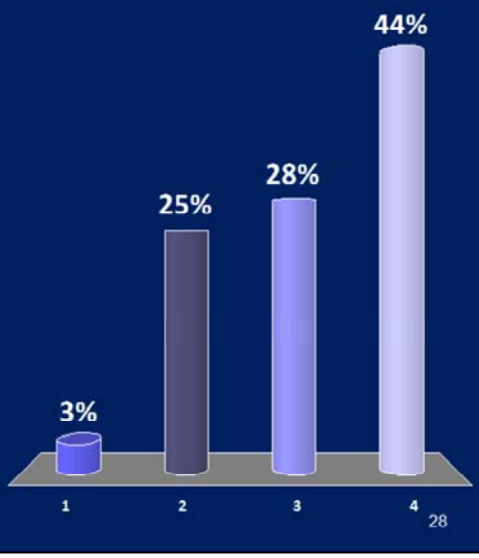

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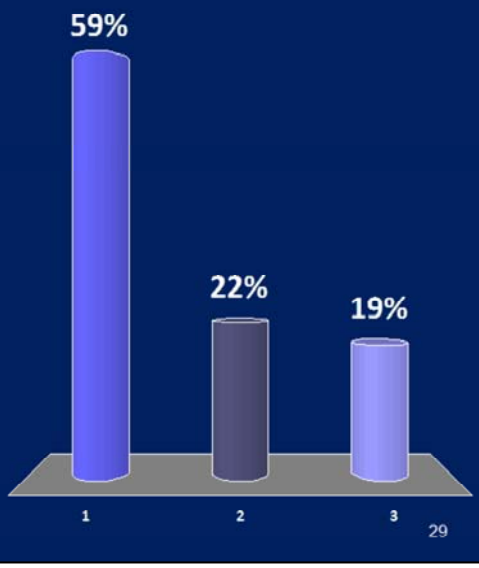

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