EDIT 6900 Research in Instructional Technology

Part I. The Fundamentals
Chap 2. Tools of Research

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Objectives

- Identify the types of tools that researchers can use for their research.
- Identify basic concepts associated with each tool.

General Tools of Research

- Tools of research ≠ Methodology of research
- Research tool: a specific mechanism, strategy, or resource the researcher uses to collect, manipulate, or interpret data.
- Research methodology: the general approach the researcher takes in carrying out the research project; to some extent, this approach dictates the particular tools the researcher will select.
- Six General Tools of research: 1) the library and its resources, 2) the computer and its software, 3) techniques of measurement, 4) statistics, 5) the human mind, and 6) language.

The Library and Its Resources as a Tool of Research

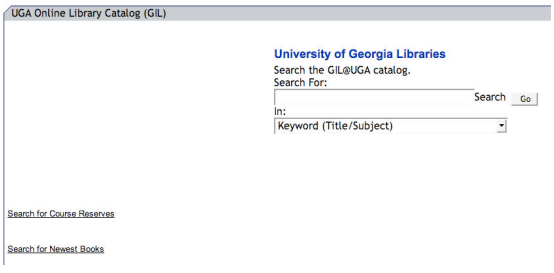
- How to access information quickly and efficiently
  - Library catalog online
  - Indexes and abstracts
    - ✓ Electronic indexes & abstracts
    - ✓ A wide variety of online databases allows access to sources in other libraries and institutions around the world.

The Library and Its Resources as a Tool of Research

- Two quick tips for online searching at UGA
  - GIL searching (UGA libraries catalog, mostly for books or names of journals)
  - GALILEO database searching (multiple databases, mostly for journal articles)

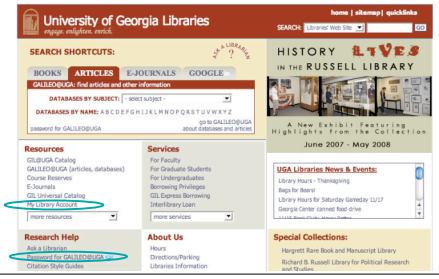
The Library and Its Resources as a Tool of Research

- GIL searching



The Library and Its Resources as a Tool of Research

- GALILEO database searching
  - Notes for accessing from off campus



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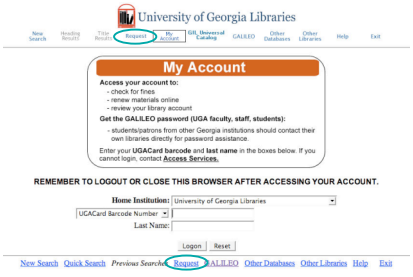

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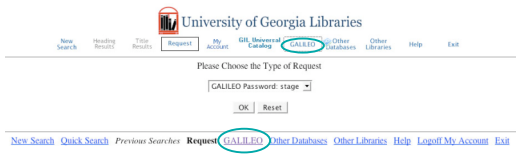

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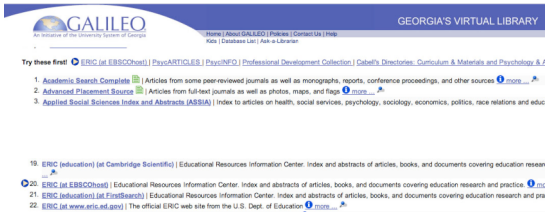
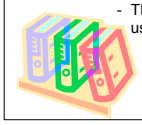


- How to access information quickly and efficiently in the library
  - The reference librarian
    - Do not be afraid to ask librarians for assistance
  - Browsing GIL or GALILEO from computer stations in the library
  - Browsing the library shelves
    - Books are coded and arranged on the library shelves in accordance with two principal systems for the classification of all knowledge:
      - The Dewey decimal system - used by most public libraries & many public schools
      - The Library of Congress (LC) system - used by most colleges & universities



The Computer and Its Software as a Tool of Research

- Planning the study: Brainstorming, outlining, project management, budget assistance
- Literature review: Background literature identification, telecommunication, electronic storage and retrieval, writing assistance
- Study implementation and data gathering: Materials production, experimental control, survey distribution, data collection assistance
- Analysis and interpretation: Organizational, conceptual, statistical, graphic production assistance
- Reporting: Communication, writing and editing, publishing, and distribution assistance

Take Advantage of the Internet

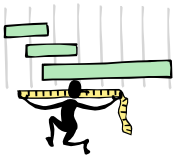
- World Wide Web:
  - Online journals
  - Online databases
  - Search engines such as Google or Yahoo
    - Academic search services such as Google Scholar, Microsoft Live Search Academic (search.live.com)
  - Other WWW Tools - Wikis, RSS readers, bookmarking sites
- Electronic Mail: facilitate collaboration among people having similar interests
- Listservs (email mailing lists managed by special email server programs): formed on a wide variety of special interests and provided a mechanism for electronic discussion groups.

Beware of the Internet

- The WWW is an open forum - virtually anyone can publish virtually anything
- As a researcher, you simply can't use unverified sources
- Even Wikipedia is not an acceptable source to cite for a research paper!
  - Wikipedia can sometimes be used as a pointer to reliable sources, such as peer-reviewed research reports
  - Other online articles from university sites can often be used in the same way
  - Track down those published sources and use them; otherwise, you have no credibility as a researcher

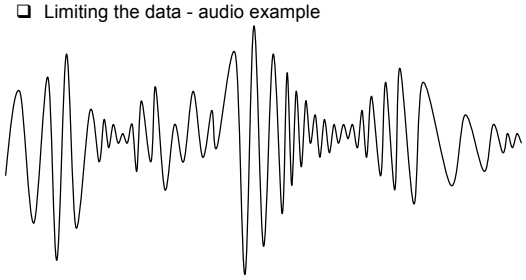
Measurement as a Tool of Research

- "Measurement is limiting the data … so that those data may be interpreted and, ultimately, compared to an acceptable qualitative or quantitative standard."
  - Substantial - having an obvious basis in the physical world (e.g., an engineer measures the span of a bridge)
  - Insubstantial - existing only as concepts, ideas, opinions, feelings, or other intangible entities (e.g., the degree to which students have learned)
- Data is limited by:
  - Measurement construct
  - Instrument capability
  - Amount of raw information we are prepared to deal with



Measurement as a Tool of Research

- Limiting the data - audio example



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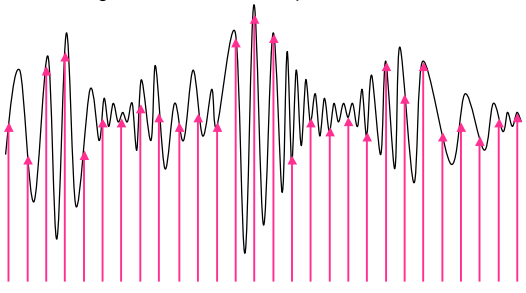

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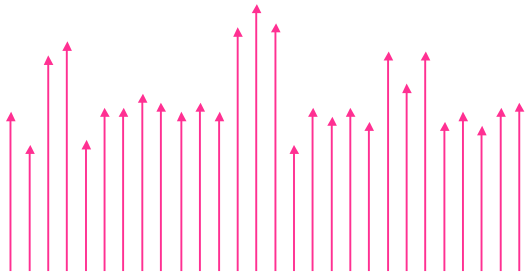

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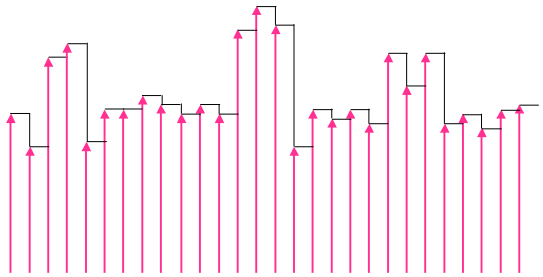

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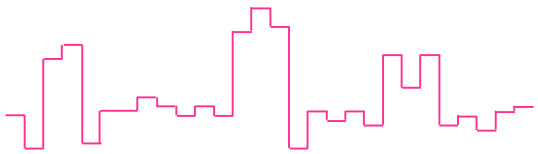

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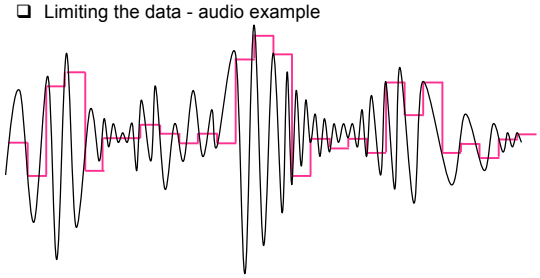

Measuring Insubstantial Phenomena: An Example

- Measure the interpersonal dynamics of a group of people
  - Give each person in the group a slip of paper on which to confidentially record three choices
    - ✓ One or more individuals in the group whom the person likes most
    - ✓ One or more individuals whom the person likes least
    - ✓ One or more individuals for whom the person has no strong feeling one way or another
  - Draw a chart or sociogram
  - Assign "weights" that place the data into three numerical categories: +1 for a positive choice, 0 for indifference, and -1 for a negative reaction
  - Construct a sociometric matrix
  - Certain relationships begin to emerge

Interpretation of the Data

- Interpretation: The data have been transformed into small discoveries, revelations, enlightenments, and insights that the researcher has never seen before.
- Measurement is ultimately a comparison with an acceptable qualitative or qualitative standard: norms, averages, conformity to expected statistical distributions, goodness of fit, accuracy of description.

Four Scales of Measurement: Nominal, Ordinal, Interval, Ratio (1)

- Nominal Scale
  - "Measures" data to some degree by assigning names to them.
  - Divides data into discrete categories that can then be compared with one another
  - Only a few statistics are appropriate for analyzing nominal data (e.g., mode, percentage, Chi-square test).
- Ordinal Scale
  - Compares various pieces of data in terms of one being greater or higher than another (Rank-order data)
  - Expands the range of statistical techniques that can be applied to data (e.g., median, percentile rank, and Spearman's rank order correlation).

Four Scales of Measurement: Nominal, Ordinal, Interval, Ratio (2)

- Interval Scale
  - Has equal units of measurement.
  - The zero point has been established arbitrarily
  - Enables one to determine the mean, standard deviation, and product moment correlation.
  - Allows one to conduct most inferential statistic analyses.
- Ratio Scale
  - Has equal measurement units (similar to an interval scale).
  - Has an absolute zero point.
  - Expresses values in terms of multiples and fractional parts and the ratios are true ratios (e.g., yardstick)
  - Enables one also to determine the geometric mean and the percentage variation
  - Allows one to conduct virtually any inferential statistical analysis.

Validity and Reliability of Measurement(1)

- The validity and reliability of your measurement instruments influence
  - the extent to which you can learn something about the phenomenon you are studying
  - the probability that you will obtain statistical significance in your data analysis
  - the extent to which you can draw meaningful conclusions from your data
- Validity: the extent to which the instrument measures what it is supposed to measure
- Reliability: the consistency with which a measuring instrument yields a certain result when the entity being measured hasn't changed.

Validity and Reliability of Measurement(2)

- Reliability is a necessary but insufficient condition for validity
- Both validity and reliability reflect the degree to which we may have error in our measurements.
- Validity and reliability take different forms, depending on the nature of the research problem, the general methodology the researcher uses to address the problem, and the nature of the data that are collected.

Statistics as a Tool of Research

- Typically more useful in some academic disciplines than in others (e.g., psychology, sociology, & education)
- "What do the data indicate?"
- Statistics give researchers information about the data.
- Discovering the meaning of the data and its relevance to the research problem is a task of researchers.

Primary Functions of Statistics

- Statistics have two principal functions: to help the researcher 1) describe the data and 2) draw inferences from the data
- Descriptive statistics: summarize the general nature of the data obtained
- Inferential statistics: help the researcher make decisions about whether or to what extent the data for the research participants can be generalized to others outside of the study

The Human Mind as a Tool of Research

- Only the mind of a researcher can interpret collected data and arrive at a logical conclusion as to their meaning.
- Strategies to help researchers make use of the human mind to better understand the unknown: deductive logic, inductive reasoning, the scientific method, critical thinking and collaboration with others.

Deductive Logic

- Begins with one or more premises which are statements or assumptions that are self-evident and widely accepted truths.
- Reasoning proceeds logically from these premises toward conclusions that must also be true.
- It is extremely valuable for generating research hypotheses and testing theories.

Inductive Reasoning

- Begins with observation and leads to general conclusions

The Scientific Method

- A method of searching after knowledge.
- It is a means whereby insight into the unknown is sought by
  - identifying a problem that defines the goal of one's quest,
  - positing a hypothesis that if confirmed, resolves the problem,
  - gathering data relevant to the hypothesis, and
  - analyzing and interpreting the data to see whether they support the hypothesis and resolve the question that initiated the research.
- Application of the scientific method often involves both deductive and inductive reasoning.

Critical Thinking

- Good researchers engage in critical thinking.
- Involves evaluating information or arguments in terms of their accuracy and worth.
- A variety of forms of critical thinking
  - Verbal reasoning
  - Argument analysis
  - Decision making
  - Critical analysis of prior research

Collaboration with Others

- Any single researcher is apt to have certain perspectives, assumptions, and theoretical biases that will limit how he or she approaches a research project.

Language as a Tool of Research

- Language: the greatest achievement of humankind, allowing communication and enabling effective thinking
- Value of knowing two or more languages
- Importance of writing

Closing

- "Tools of research" are different from "methodologies of research"
- Research tools are specific mechanisms or strategies that the researcher uses to collect, manipulate, or interpret data.
- Six general tools of research: 1) the library and its resources, 2) the computer and its software, 3) techniques of measurement, 4) statistics, 5) the human mind, and 6) language.