CSC 333: COMPUTER RESEARCH METHODOLOGY (1 Unit) - R

- The meaning and concept of research. Types of research: Quantitative and qualitative. The Information skills: retrieving and recording bibliographic information from manual and computerized sources. Citation. Intellectual property rights; time management; report writing; oral presentation, plagiarism. Scientific writing.

Research Defined and Described

"Research is the systematic approach to obtaining and confirming new and reliable knowledge"

- Systematic and orderly (following a series of steps)
- Purpose is new knowledge, which must be reliable

This is a general definition which applies to all disciplines

What is Research?/1

- The word re-search is a noun composed of two syllables:
  - re is a prefix, meaning again, anew or over again
  - search is verb, meaning to examine closely and carefully, to test and try, or to probe
- Together they form a noun describing a careful, systematic, patient study and investigation in some field of kenowledge, undertaken to establish facts or principles.

What is Research?/2

- Diligent and systematic inquiry or investigation in an area, with the objective of discovering or revising facts, theories, applications. The goal is to discover and disseminate new knowledge.

  - [Merriam-Webster]

- Systematic investigative process employed to increase or revise current knowledge by discovering new facts. It is divided into two general categories: (1) Basic research is inquiry aimed at increasing scientific knowledge, and (2) Applied research is effort aimed at using basic research for solving problems or developing new processes, products, or techniques.

  [Business Dictionary]

- Careful study of a given subject, field, or problem, undertaken to discover facts or principles.

  - [The Free Dictionary]

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What is Research?/3

- Research comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications. It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories [. . .] The primary purposes of basic research (as opposed to applied research) are documentation, discovery, interpretation, or the research and development (R&D) of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies, which vary considerably both within and between humanities and sciences. There are several forms of research: scientific, humanities, artistic, economic, social, business, marketing, practitioner research, etc.

[Wikipedia]

Research is not

Accidental discovery :

1. Accidental discovery may occur in structured research process
2. Usually takes the form of a phenomenon not previously noticed
3. May lead to a structured research process to verify or understand the observation

Research is not … cont.

Data Collection

- an intermediate step to gain reliable knowledge
- collecting reliable data is part of the research process

Research is not … cont.

<u>Searching out published research results in libraries (or the internet)</u>

- This is an important early step of research
- The research process always includes synthesis and analysis
- But, just reviewing of literature is not research

Research is…

1. Searching for explanation of events, phenomena, relationships and causes
   - What, how and why things occur
   - Are there interactions?
2. A process
   - Planned and managed – to make the information generated credible
   - The process is creative
   - It is **circular** – always leads to more questions

- All well designed and conducted research has potential application.
- Failure to see applications can be due to:
  - Users not trained or experienced in the specialized methods of the research and reasoning
  - Researchers often do not provide adequate interpretations and guidance on applications of the research
- Researchers are responsible to help users understand research implications (How?)

Public good

- Public research is a public good
  - May be more rigorous and objective because it is subject to more scrutiny
- Private research may also be rigorous
  - But research on a company's product may be questioned as biased.

Classification of Research

- Before classification, we must first **define** types of research
- Different criteria are used to classify research types

(All of these are somewhat arbitrary and artificial)

Basic vs Applied Research

- Basic – to determine or establish fundamental facts and relationships within a discipline or field of study. Develop theories … (examples in economics?)
- Applied – undertaken specifically for the purpose of obtaining information to help resolve a particular problem
- The distinction between them is in the application
  - Basic has little application to real world policy and management but could be done to guide applied research

Disciplinary, Subject-matter, and Problem-solving Research (Johnson, 1986)

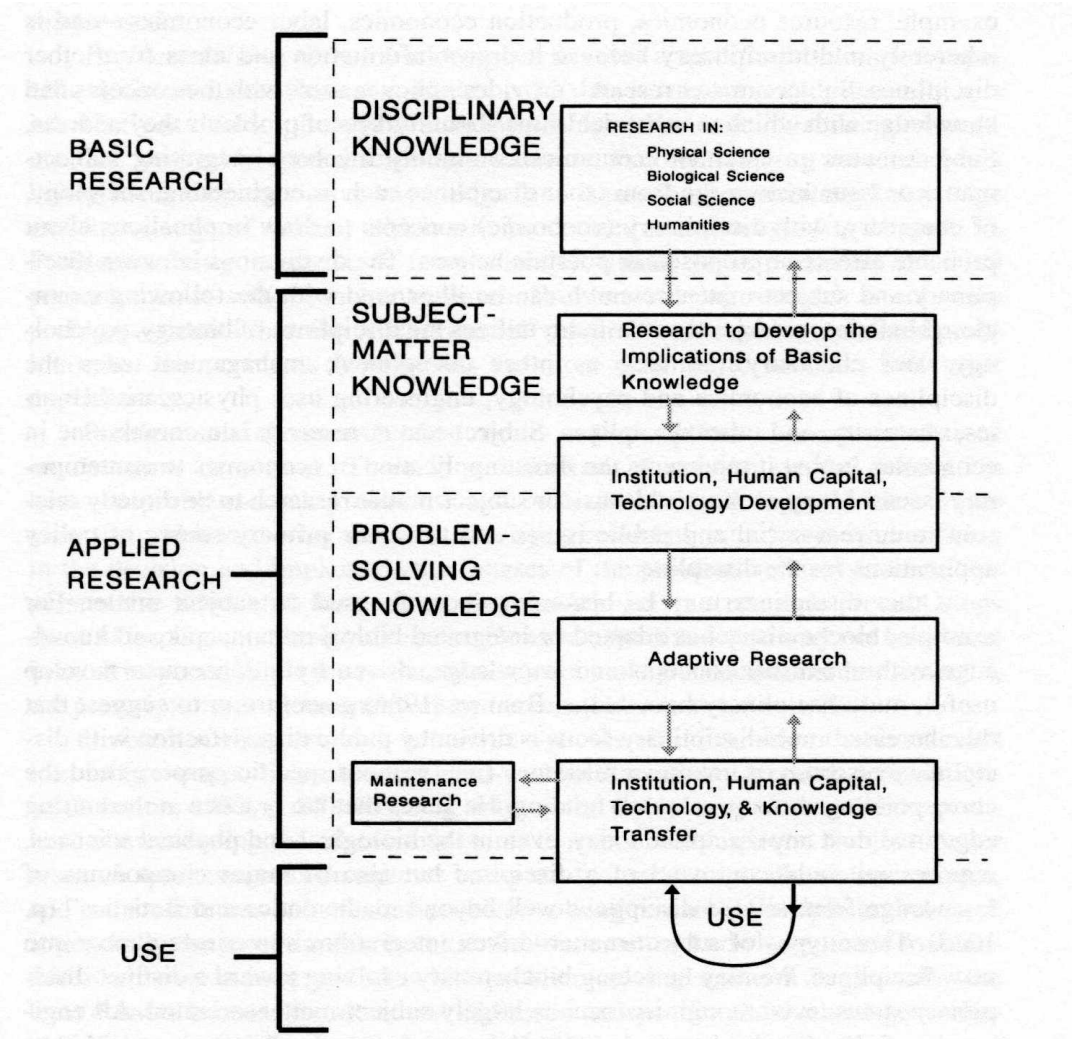


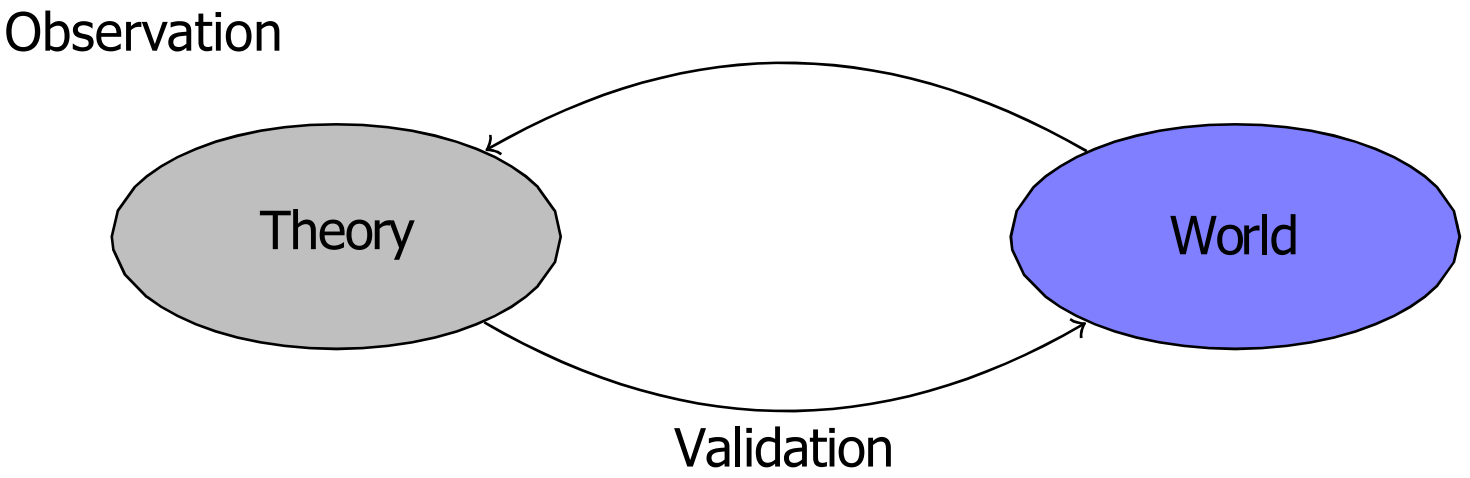
Figure 2.1. Relationship among research, knowledge, and use (Bonnen, 1986).

Research Methods, Techniques and Methodology

- Research Method: refers to the manner in which a particular research project is undertaken.
- Research Technique: refers to a specific means, approach, or tool-and-its-use, whereby data is gathered and analysed, and inferences are drawn.
- Research Methodology: refers to the study of research methods; it does not admit of a plural.

Research Methods

- The purpose of the research determines the method to use
- There is no single research method
- Many methods are available and have to be combined
- But somehow, scientists/researchers are supposed to do this:



Different Research (Methods) Exist

- Exploratory research structures and identifies new problems.
- Constructive research develops solutions to a specific persisting
- problem.

  Empirical research tests the feasibility of a solution using empirical evidence.

Exploratory Research

- This is done to improve the basic knowledge on the concept and walk in to the unknown realms of the subject.
- It is a type of research conducted for a problem that has not been clearly defined.
- It should draw definitive conclusions only with extreme caution.
- Given its fundamental nature, exploratory research often concludes that a perceived problem does not actually exist.

Constructive Research

- This is done by technical professionals to find a new solution to a specific persisting problem.
- It is very commonly used in computer science research.
- The term "construct" is often used in this context to refer to the new contribution being developed, such as a new theory, algorithm, model, software, or a framework.
- This approach demands a form of validation that doesn't need to be quite as empirically based as in other types of research.
- Nevertheless the conclusions have to be objectively argued and
- defined.

  This may involve evaluating the "construct" analytically against some predefined criteria or performing some benchmark tests with the prototype.

Empirical Research

- "Empirical" comes from the Greek word for experience: εμπειρία (empeir´ıa)
- Empirical research is a way of gaining knowledge by means of direct and indirect observation or experience.
- Empirical evidence/observations can be analyzed quantitatively or qualitatively.
- Through quantifying the evidence or making sense of it in qualitative form, a researcher can answer empirical questions, which should be clearly defined and answerable with the evidence collected (usually called data).
- Research design varies by field and by the question being investigated.
- A combination of qualitative and quantitative analysis is often used to better answer questions.

Empirical Research – Example

- Observation is the key: A way of gaining knowledge by direct observation or experience.
- Used to answer empirical questions, e.g., *"Does listening to music during learning have an effect on later memory?"*
- Based on existing theories about the topic, some hypotheses will be proposed, e.g., *"Listening to music has a negative effect on learning."*
- This prediction can then be tested with a suitable experiment.

Depending on the outcomes of the experiment, the theory on which the hypotheses and predictions were based will be supported to a certain degree of confidence or not, e.g., *"People who study while listening to music will remember less on a later test than people who study in silence."*