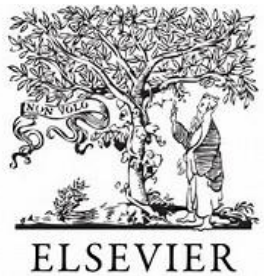
Digital Libraries-A Gateway to Problem Formulation & Research

Saqib Ali (PhD)
Post-doc fellow

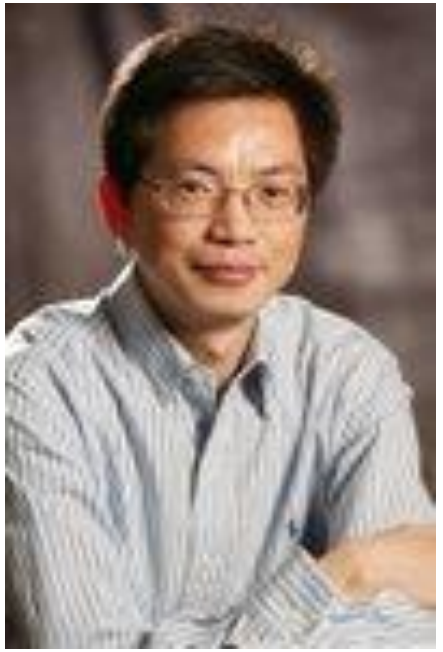
Supervisor:
Dr. Guojun Wang, Pearl River Scholarship Distinguished Professor
Director of Institute of Computer Networks,
Vice Dean of School of Computer Science and Educational Software,
Guangzhou University, Guangzhou.

About Slides?

- Prof. En-Hui Yang Waterloo Canada
- Dr. Imran Siddiqi Bahria University, Pakistan
- Dr. Md Zakirul Alam Bhuiyan Fordham University, USA
- Saqib Ali



Prof. En-Hui Yang
(Professor, Tier 1 Canada Research Chair)



Method of Doubt. (Go beyond doubt)

There is no absolute truth in math and science.

Read his presentation at least every week during your Master or PhD

Research in Academia

Master & PhD

- It is not **game** that you can play around for some years!!
- Is not a **Copy & Paste**
- Is to **explore** unknown, unintended breakthroughs, and overwhelming outcomes
- It is to make **consciousness** of career and life
  - Benefit society and change the world

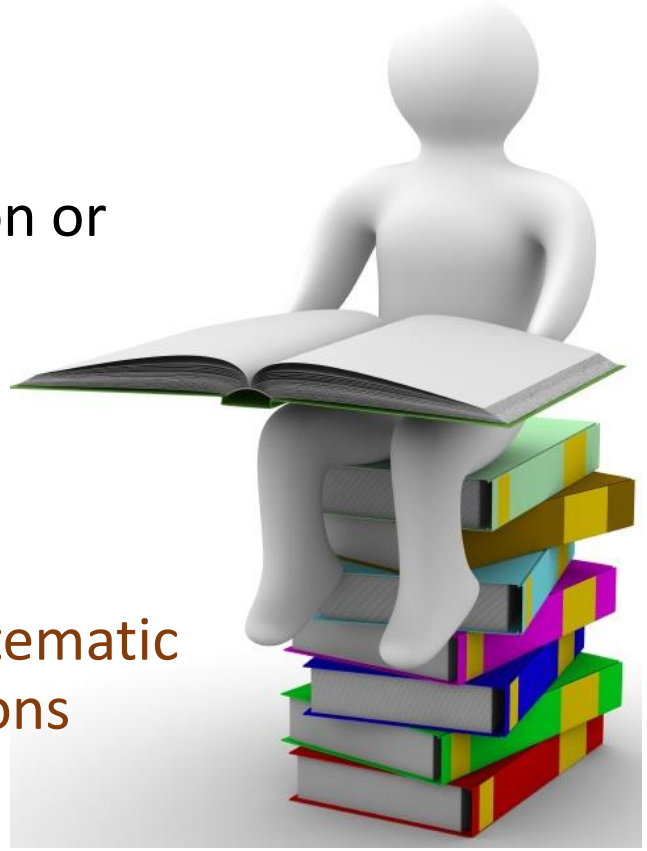
The Impact of Research?

- **Your Research towards a Degree**
  - **Can tell you what and how you are going to after your degree**
    - You will work in a big company or organization
    - You will have good earning
    - You will have good reputation
    - You will have respect from people
    - You will have a good life

What is research?

- Dictionary
  - Scholarly or scientific investigation or inquiry
  - Close, careful study

- Basic Definition
  - Research is an organized and systematic way of finding answers to questions



What is research?

- The word research derives from the French word ***recherche*** meaning *travel through* or *survey*.

*The **systematic** process of collecting and analyzing data in order to discover new knowledge or expand and verify the existing one*

What is research?

Research is an attempt to **increase** the sum of what is known, usually referred to as ‘a **body of knowledge**’, by the discovery of new facts or relationships through a process of systematic inquiry, the research process.

(Macleod Clark and Hockey 1989 cited by Cormack 1991 p4)

What research is NOT

Research isn't information gathering:

- Gathering information from resources such books or magazines isn't research.
- No contribution to new knowledge.

Research isn't the transportation of facts:

- Merely transporting facts from one resource to another doesn't constitute research.
- No contribution to new knowledge although this might make existing knowledge more accessible.

Discovery vs Invention

There are two main ways of practicing science : discovery vs. invention

Biologists, physicists, chemists, researchers in psychology… are discoverers

Computer scientists, researchers in nanotech or researchers in engineering … are inventors

Discovering

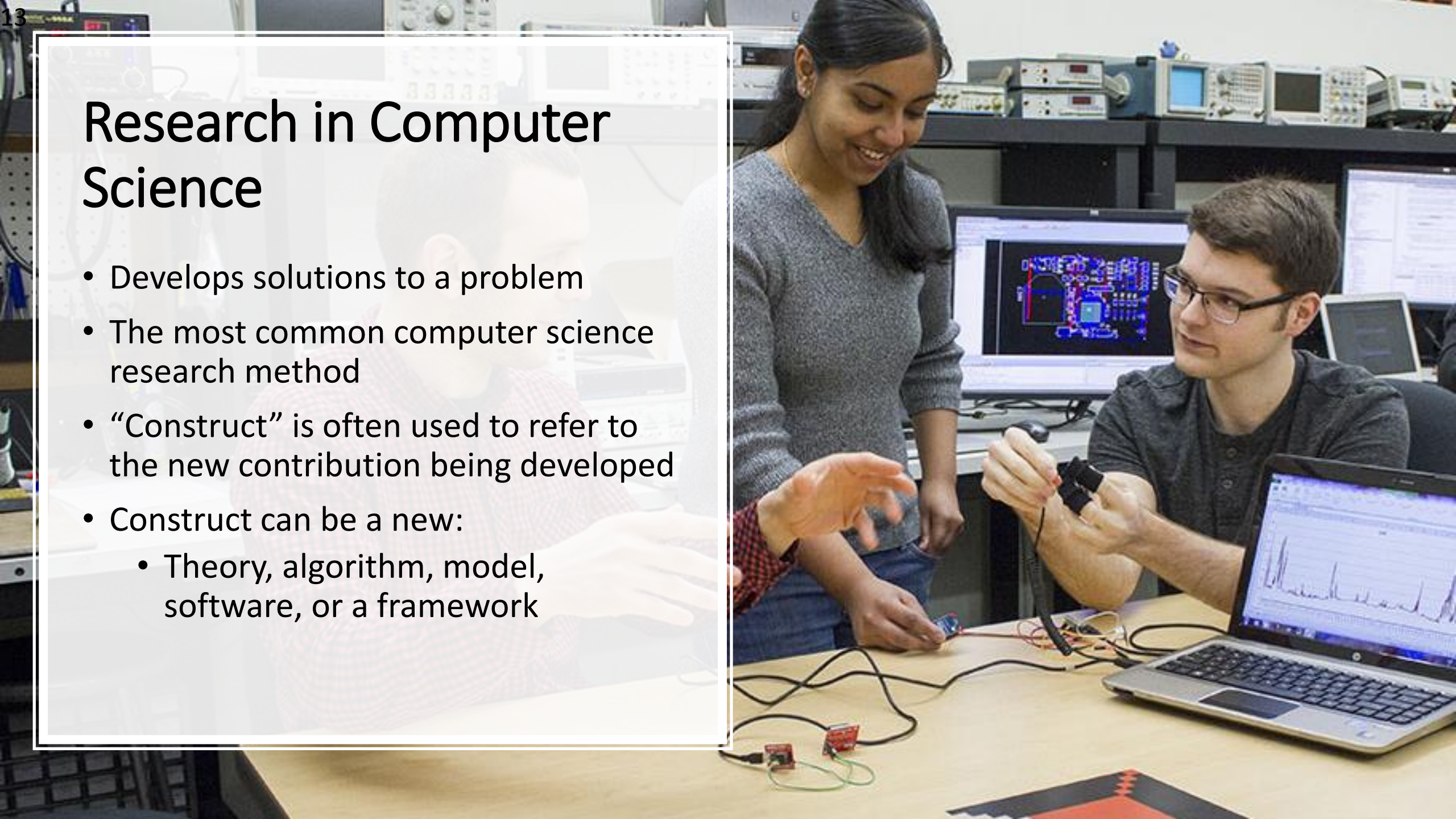
- Understanding the world : what are atoms constituted of, why a disease is inherited, why do people have dreams, etc.

Inventing

- Software computer science produces *inventions*
- Computers do not exist by themselves. They have been created by human beings => there is nothing to *discover* in a computer or in a software
- The objective of research in CS is to make computers and computer networks more efficient more easy to use, more reliable, more powerful… i.e. more useable/useful

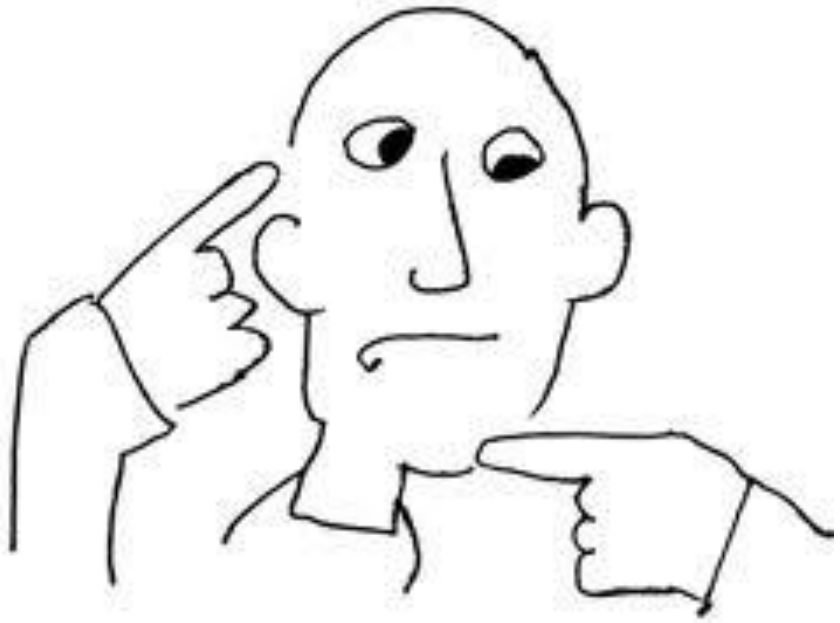
Research in Computer Science

- Develops solutions to a problem
- The most common computer science research method
- “Construct” is often used to refer to the new contribution being developed
- Construct can be a new:
  - Theory, algorithm, model, software, or a framework



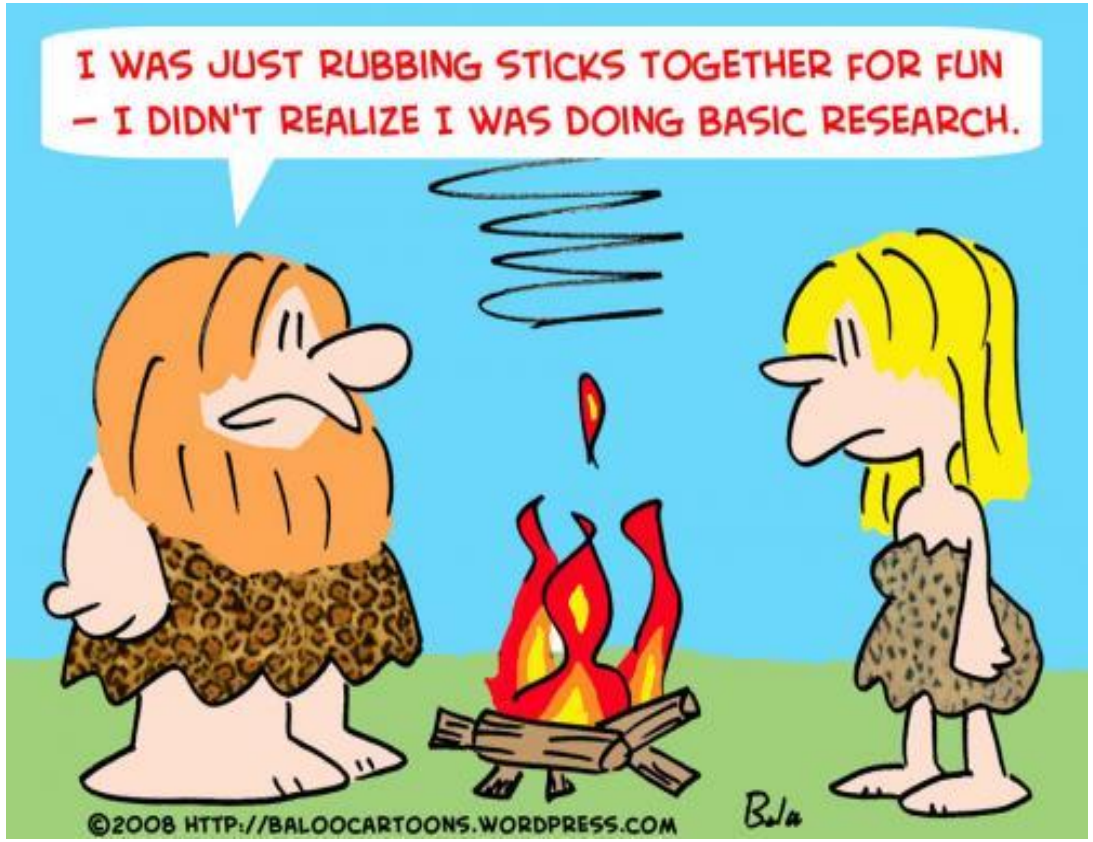
Purpose of research

- Review and synthesize existing knowledge
- Investigate some existing situation or problem
- Provide solutions to a problem
- Explore and analyze general issues
- Construct a new procedure or system
- Explain a phenomenon
- Generate new knowledge or enhance the existing
- Combination of above

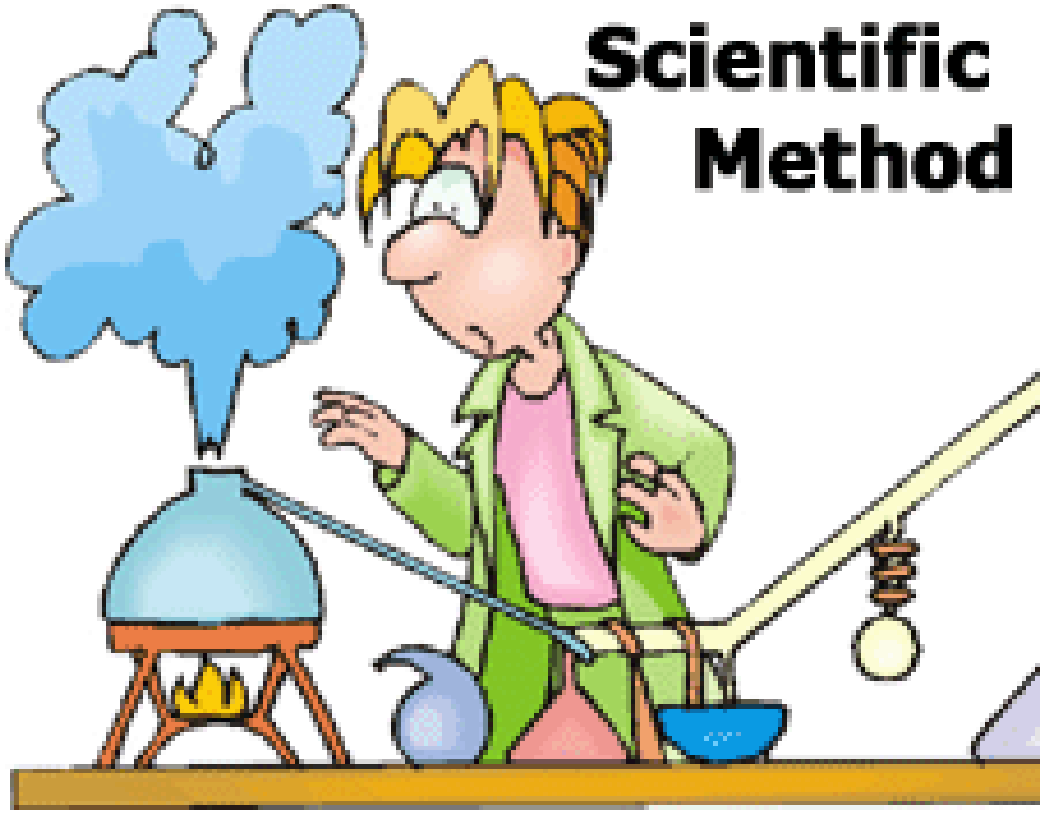


Types of Research Process

- **Non Scientific Way**



- **Scientific Way**



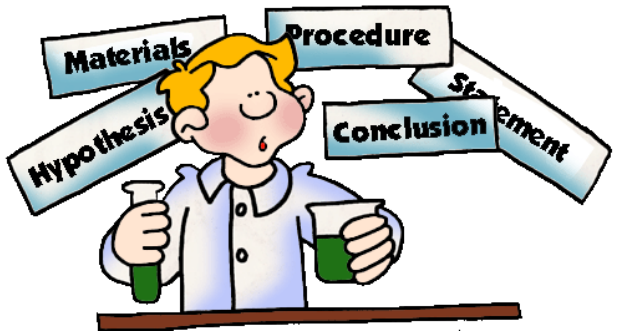
Scientific methods - Steps

- Define the research question
- Research the problem
- State the hypothesis
- Experiment to test Hypothesis
- Collect and Record Data
- Analyze Data
- Draw Conclusions
- Determine Limitations
- Communicate/Report Results

If needed, Do more investigation

Scientific Method

An Overview



First → **Question** — What does the scientist want to learn more about?

Then

Research — Gathering of information

Next

Hypothesis — An "Educated" guess of an answer to the question

Then

Procedure/ Experiment — Written and carefully followed step-by-step experiment designed to test the hypothesis

Next

Data — Information collected during the experiment

And

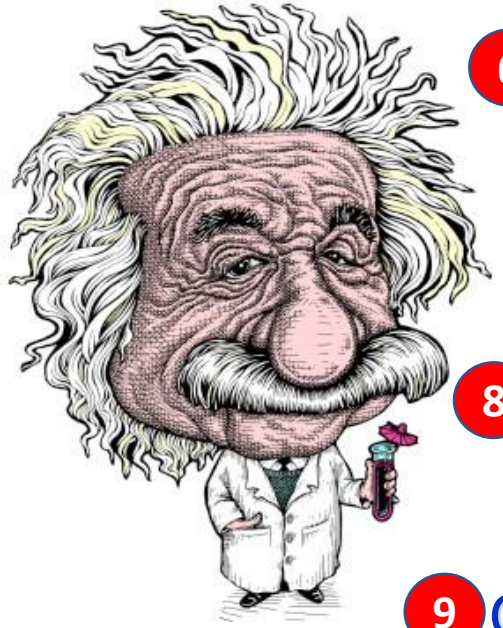
Analysis — Written description of what was noticed during the experiment

And

Finally

Conclusion — Was the hypothesis correct or incorrect?

Think you can name all the steps?

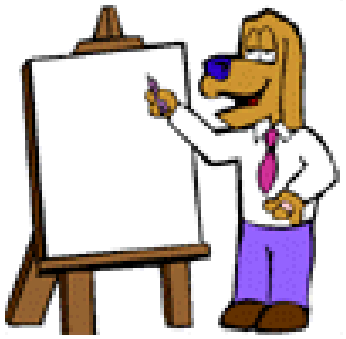


1. Problem/Question
2. Research/ Review
3. Formulate a Hypothesis
4. Experiment
5. Collect Data
6. Analyze Data
7. Conclusion
8. Limitations
9. Communicate the Results

Can you put these steps in order?

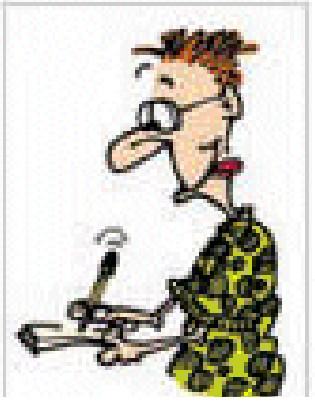
Define the Problem

Analyze Data



Report Results

Make an Observation



State the Hypothesis

Determine Limitations

the Problem

Steps of scientific method in order

1

Make an Observation

2

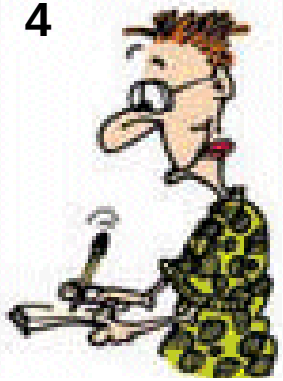
Define the Problem

3

Research

the Problem

4



State the Hypothesis

5

Experiment

6

Collect and Record Data

7

Analyze Data

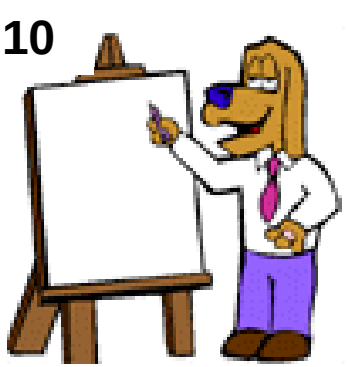
8

Come to a Conclusion

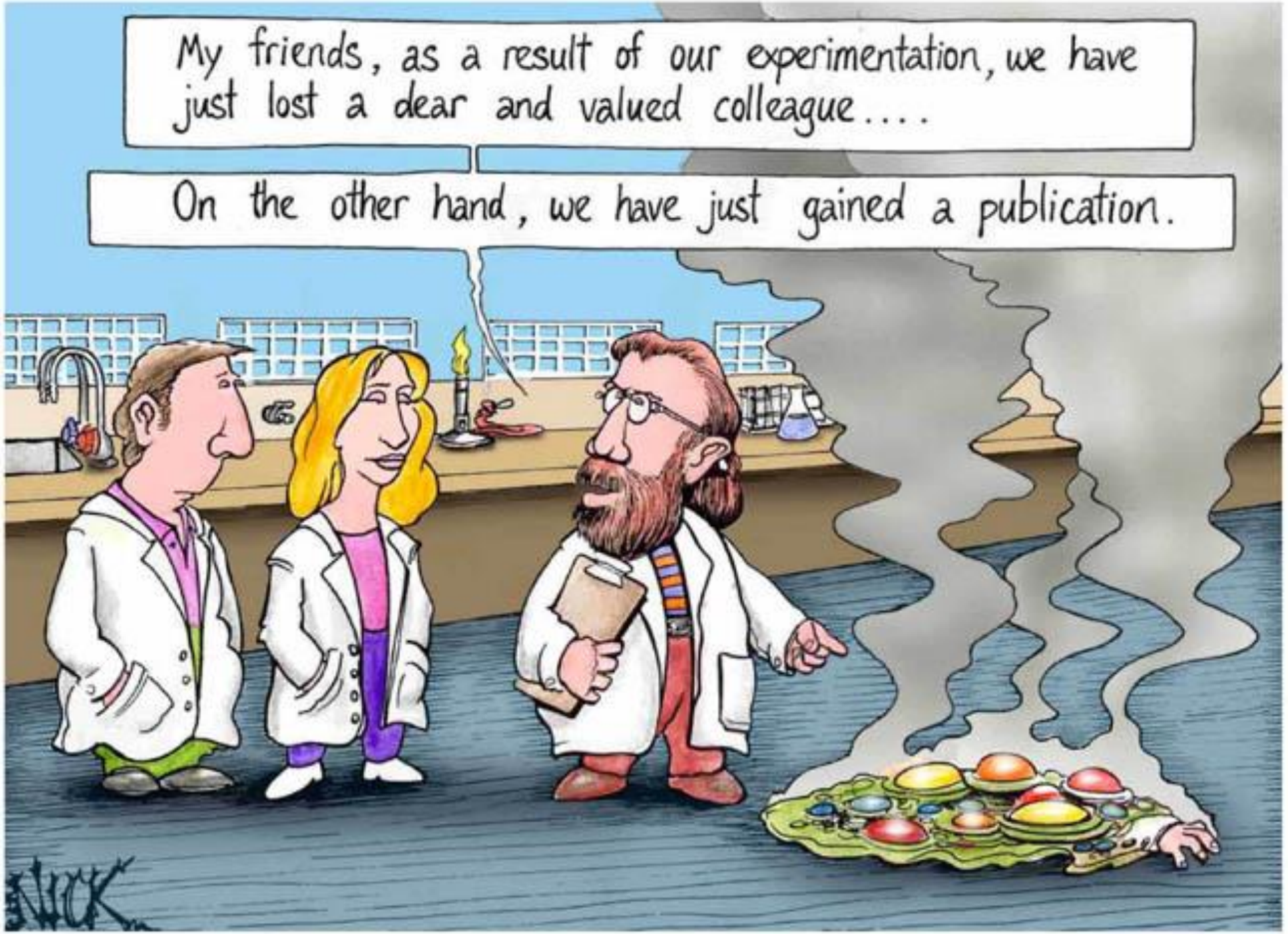
9

Determine Limitations

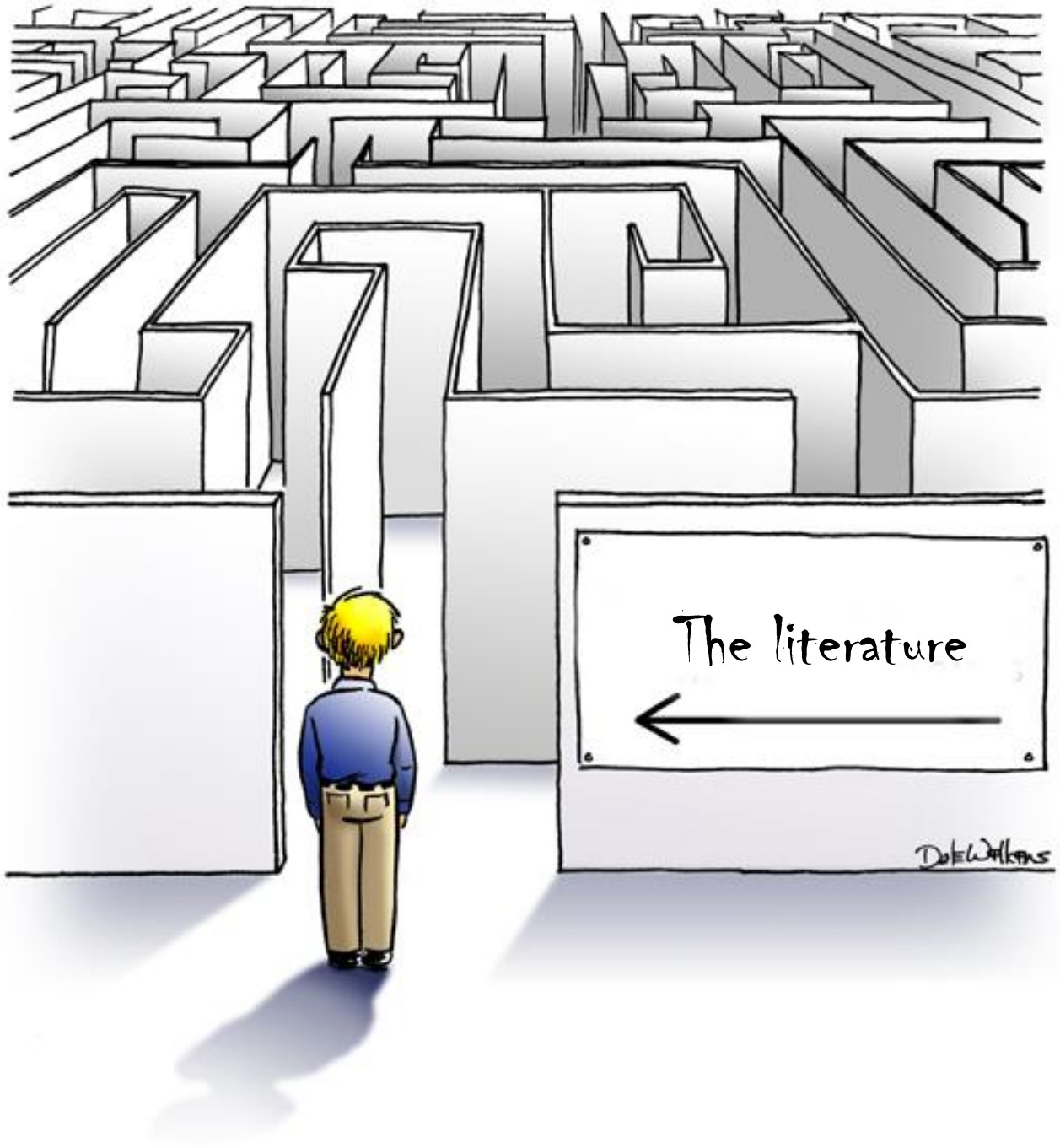
10



Report Results


My friends, as a result of our experimentation, we have just lost a dear and valued colleague....
On the other hand, we have just gained a publication.
NICK

Literature search



Before entering the maze

Be sure of what you are looking for

Literature search

- Literature search is the process of querying the scholarly literature databases in order to gather research manuscripts related to the phenomenon under investigation.

- The major contributions are likely to be in the leading journals – It makes sense, therefore, to start with them

Sources of literature

- Books
- Journals
- Conference Papers
- Theses
- Abstracts
- Electronic Databases
- Government publications
- Interviews and other unpublished research
- …..

Sources of literature

Must be familiar with reputed journals and conferences in your area

For us: CCF List

Publisher & Digital Libraires

Publishers

1. ACM
2. Elsevier
3. Springer
4. IEEE
5. Many more…

Digital Libraries

1. ACM Digital Library
2. Science Direct
3. Springer link
4. IEEE *Xplore* Digital Library
5. Many more…

Journals

1. **IEEE Communications Surveys & Tutorials**
2. IEEE Transactions on Dependable and Secure Computing
3. IEEE Transactions on Information Forensics and Security
4. Journal of Network and Computer Applications
5. Computer Networks
6. Many more…

Conference

1. MOBICOM
2. SIGCOMM
3. INFOCOM
4. Globecom
5. CoNEXT
6. IMC
7. Many more

Index Services

1. Google Scholar
2. Scopus
3. **Web of Science**
4. Many more…

Google scholar

Scopus

THOMSON REUTERS

WEB OF SCIENCE

Citation, Impact Factor & JCR

1. ISI Master List
2. Journal Citation Report

$$\mathrm{IF}_y = \frac{\mathrm{Citations}_{y-1} + \mathrm{Citations}_{y-2}}{\mathrm{Publications}_{y-1} + \mathrm{Publications}_{y-2}}$$

For example, *Nature* had an impact score of 41.456 in 2014:[2]

$$\mathrm{IF}_{2014} = \frac{\mathrm{Citations}_{2013} + \mathrm{Citations}_{2012}}{\mathrm{Publications}_{2013} + \mathrm{Publications}_{2012}} = \frac{29753 + 41924}{860 + 869} = 41.456$$

Key Features of Research Paper

1. Impact Factor
2. Title of the paper
3. Authors list
    a) First author
    b) Corresponding author
4. Keywords
5. Publisher
6. DOI
7. Citations

Exercise

1. Find the highly cited paper in Network Security Domain
2. Paper title:

   On the Security of Cognitive Radio Networks

Q/A