Research Methods for IT

Week 1,2

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Switch off mobile phones during lectures, or put them into silent mode

Contents

- Announcement
- Class Introduction
- Instructor's Introduction
- Introduction to Course
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- What is Research?
- Surprise!!!

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Announcement!!!

Get your groups Finalized by next Class i.e. 17th Feb 2023

Pre Requisite

NONE

Objective

- To develop a understanding towards field of research
- To examine the research process
- To introduce various aspects of doing scientific research providing practical advice and insight
- To achieve maximum capability to write and read research documents

Outcomes

- To distinguish different types of research
- Be aware of the tools used and their relative roles and reliability
- To review the steps to be taken in the research design, writing & steps in publishing the results.

Outcomes

- Be able to design and conduct a survey and analyze survey results
- Be able to prepare a professional written research report

Contents (1)

Contents (2)

Ethical Issues in research

Measurement scales and indexes

Criteria for good measurement

Research Design

Survey Research

Data Collection

Using Statistical tools to Analyze data

Plagiarism

Course Material

Yogesh Kumar Singh, *Fundamentals of Research Methodology and Statistics,* New Age International Limited Publishers, (ISBN: 978-81-224-2418-8)

Booth, Colomb, and Williams, *The Craft of Research*, The University of Chicago Press, (ISBN- 10: 0- 226- 06566- 9 (paper))

Handouts and Study Material will be provided throughout the course

Grading Policy

Assignments :	10 %
Quizzes :	10 %
Mid Term :	20 %
Final Term :	30 %
Presentation :	5 %
Term Paper:	25%

Attendance:

All students are supposed to attend 100% classes. However 75% attendance is mandatory to make you eligible for the final examination. NO EXCUSES

Guidelines for Students (1)

- Quizzes may be announced/ unannounced
- No quiz will be dropped.
- Quizzes may be of different weights based upon actual marks for each quiz
- Use of Mobile Phones is not allowed in the class, If mobile phone rings (due to: call, sms, alarm, reminder or any other), you will be requested to leave the class and you will be marked ABSENT.

Guidelines for Students (2)

- Students are encouraged to discuss assignments but it is extremely important that everyone works on his/her own assignment
- The cases of plagiarism will be dealt ruthlessly & will be marked Zero, remember this is a Research training course
- Late comers should consult their class fellows for the missing topics, they will not be revised in the class
- No Extensions in deadlines will be given
- Be punctual

Guidelines for Students (3)

- You should keep a track of your attendance yourself, no flexibility in attendance will be given.
- You have to attend 100% classes, Remember minimum attendance required to appear in final exam is 75%
- If you feel that your attendance is not marked and you were present in the class, report this in the same week. No query will be entertained afterwards.

Guidelines for Students (4)

- Student must write and present a research paper to complete this course. Failing to which will result in “F” grade and you will not be allowed to sit in End Term Examination

- Further guidelines will be given time to time

Term Paper

Finalize Group Members and Domain	**17-Feb-2023**
Search Papers and Sort Selected (At least 15)	**24-Feb-2023**
Go Through the Abstract and Introduction of Selected Papers	**24-Feb-2023**
Submit a Summary and Comments on related papers	**TBD**
Submit a complete Survey Report	**TBD**
Presentation of Survey Report	**TBD**
Define Your Problem/ Topic	**TBD**
Submit Initial Draft	**TBD**
Final Paper Submission	**TBD**
Final Presentation	**TBD**

Please note that Every Phase has Marks

Term Paper Starts Today ☺

Finalize your groups (Max 2 persons/ group) by end of this week (2ndWeek of Semester)

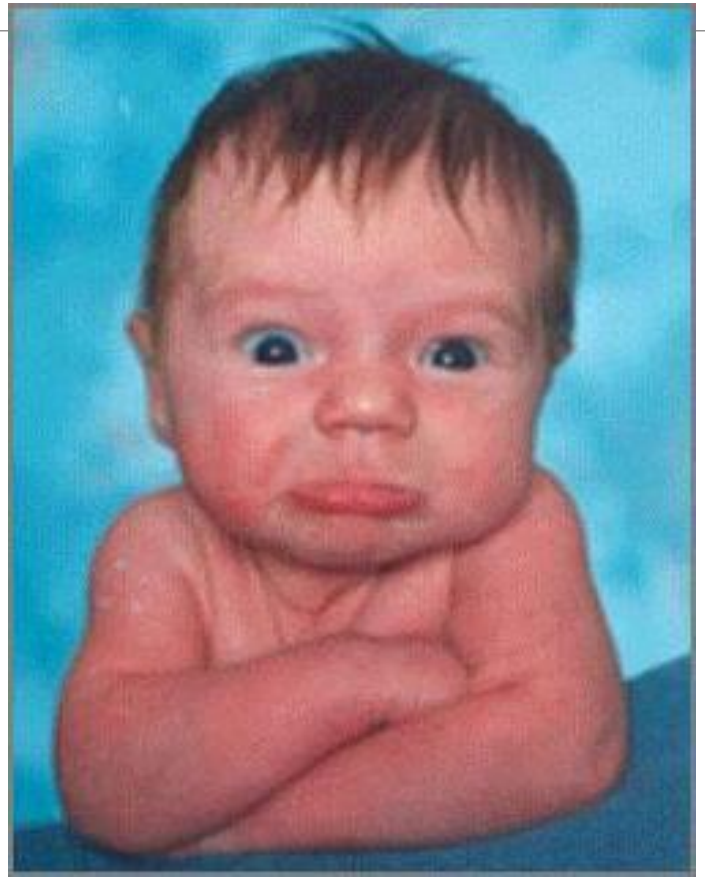
Submission and Presentation :

- Last Week of Semester
- Exact dates will be informed later

We will have weekly meetings/ evaluations

Periodic reporting is important and will carry marks

What About Having a Quiz???



Quiz / Diagnostic test (20 minutes)

(Tuesday 14th February 2023)

- What is Research?
- What is a Research Paper?
- What is your area of Interest?
- Do you have any experience of research? If Yes, Explain?
- How we can get maximum benefit out of this course?
- What do you think should be the teaching methodology?
- Are you interested in writing a research paper?
- What are your expectations from this course?
- What are your expectations from the Instructor?
- Any Suggestions?

Answer all the questions to the best of your ability, I don't want the exact answers, I just want your understanding

Lets Start ☺

Discussion

What is Research?

Why you are here?

Why Research Methods?

Teaches you the skills and practices of research

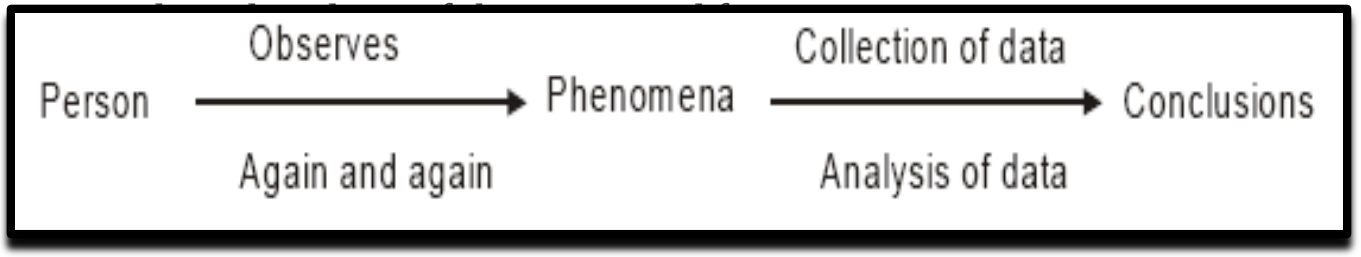
- Reading
- Experimenting
- Analysing
- Writing
- Presenting
- Critical thinking!

Directly relevant to your thesis.

Likely to be relevant to your future activities (research or otherwise…)

What is Research?

- **In general:**
  - Some work of scientist in laboratory in the shape of experiments
- **Term ‘Research’**
  - Re + Search whereas Re = Again and Search = to find something
- **Therefore,**
  - Research is simply the process of findings solutions to a problem after thorough



Definitions of Research (1)

"The systematic and scholarly application of the scientific method interpreted in its broader sense, to the solution of social studies al problems; conversely, any systematic study designed to promote the development of social studies as a science can be considered research"

By George J. Mouly

Definitions of Research (2)

"Research is, literally speaking, a kind of human behavior, an activity in which people engage. By this definition all intelligent human behavior involves some research"

By Francis G. Cornell

Definitions of Research (3)

"Research is a carefully inquiry or examination in seeking facts or principles; a diligent investigation to ascertain something, according to Webster's New International Dictionary"

By Clifford Woody

Definitions of Research (4)

"Research is simply a systematic and refined technique of thinking, employing specialized tools, instruments, and procedures in order to obtain a more adequate solution of a problem than would be possible under ordinary means. It starts with a problem, collects data or facts, analysis these critically and reaches decisions based on the actual evidence. It evolves original work instead of mere exercise of personal. It evolves from a genuine desire to know rather than a desire to prove something. It is quantitative, seeking to know not only what but how much, and measurement is therefore, a central feature of it"

By C. C. Crawford

General Characteristics (1)

The following characteristics may be gathered from the definitions of ‘Research’:

- It gathers new knowledge or data from primary or first-hand sources
- It places emphasis upon the discovery of general principles
- It is an exact systematic and accurate investigation

General Characteristics (2)

- It uses certain valid data gathering devices
- It is logical and objective
- The researcher resists the temptation to seek only the data that support his hypotheses
- The researcher eliminates personal feelings and preferences
- It endeavors to organize data in quantitative terms
- Research is patient and unhurried activity

General Characteristics (3)

The researcher is willing to follow his procedures to the conclusions that may be unpopular and bring social disapproval

Research is carefully recorded and reported

Conclusions and generalizations are arrived at carefully and cautiously

Specific Characteristics (1)

A sound philosophy as the basis of research

Based on insight and imagination

Requires an inter-disciplinary approach

Employs deductive reasoning process

Should come out of a desire to do things better

Is not as exact as research in physical science

Is not the field of the specialist only

Specific Characteristics (2)

Generally requires inexpensive material

Based on the subjectivity and intangibility of social phenomena

Perhaps incapable of being dealt through empirical method

Based on inter dependence of causes and effect

Cannot be a mechanical process

Objectives of Research

- **Theoretical Objective s:** Whose objectives are theoretical formulate the new theories, principles or laws. Such have explanatory nature because it explains the relationships of certain variables. These contribute some basic knowledge to the human knowledge.
- **Factual Objectives:** whose objective is factual find out new facts. This objective is by nature descriptive. These researches describe facts or events which happened previously. Such type of research is done in history.
- **Application Objectives:** Having application objective does not contribute a new knowledge in the fund of human knowledge but suggests new applications.

Classification of Research

Basic Level: It is designed to add an organized body of scientific knowledge and does not necessarily produce results of immediate practical value.

Applied Level: Applied research is undertaken to solve an immediate practical problem and the goal of adding to scientific knowledge is secondary.

Kinds of Research (1)

On the Basis of Objectives of Research

- Fundamental vs. Action oriented

On the Basis of Approach of Research

- Longitudinal Research historical, in nature and case studies are used (e.g., genetic research)
- Cross Sectional Research : Experimental in nature and surveys are the best example

Kinds of Research (2)

On the Basis of Precision in Research Findings

- Experimental vs. Non-Experimental

On the Basis of Nature of Findings

- Explanatory vs. Descriptive

According to National Science Foundation

- Basic Research, Applied Research and Development Research

Nature of Research Outcomes

Descriptive : Description of a behavior or a domain

Explanatory: Systematic explanation of how behaviors arise ascription of causes to occurrences in the domain

Predictive: Statement of: what behavior will arise, and how; what occurrences will arise within the domain; what effect will particular interventions have

Normative: Declarations of interventions to a desired outcome

Designing Research

Fundamental Goals

- ***Of Science:*** To understand, to predict, and to control
- ***Of Scientist:*** To communicate discoveries and findings to a community of peers

Designing Research

- ***Research Purposes:*** Theoretical or applied?
- ***Research Problems:*** What questions are asked?
- ***Research Settings:*** Simulated or Natural?
- ***Research Investigations:*** Background and training
- ***Research Methods:*** A continuum
- Experimental, case study, and survey

Evaluating Research

Validity

- A concern for most social and engineering scientists is the complex nature of the phenomena under study: human or machine behavior
- Multiple perspectives are required in order to adequately reflect the richness of these complexities

Reliability

- Consistency and replicability
- Usefulness or Value of Investigation
- Contribution to knowledge
- Advance Theory and Practice in discipline

Good Research

Advances knowledge/understanding in an important area

Builds on existing scholarship

Is methodologically/technically sound

Addresses important/interesting questions

Leads to some practical insights

Helps us understand world better/differently

Leads to alternative possible action strategies

Publishing Research Outcomes

Why publish?

What to publish?

Where to publish?

How to succeed in publishing

Mistakes to avoid

Purpose of Publishing

Scientific progress based on written contributions

Scientific ideas evaluated based on written contributions

Extrinsic Reasons

- Requirement for graduation/promotion
- Prestige, reputation, visibility
- Reaching a wide (international) audience

Intrinsic Reasons

- Pride, Self-efficacy
- Sense of accomplishment
- Determine standing in the academic community

Sources of Research Questions (1)

Everyday life

Practical issues or needs

Past research

Theory

Sources of Research Questions (2)

Everyday Life

- What are the most effective ways to teach research methods?
- What personal characteristics make a favorable impression in a job interview?
- What other questions come to mind?

Past Research

- Knowledge develops in small steps. Rarely does one study answer all the questions to the research topic.

Sources of Research Questions (3)

Practical Issues or Needs

- Why do some employees have very high absenteeism rates.
- Why do more car accidents happen on specific stretches of the road?
- Why are most heart attacks on a Monday morning?

Theory

- Summarize & integrate existing knowledge
- Suggests new relationships between factors
- Helps one make new predictions about a phenomenon based on the theory.

Developing a Research Question

Idea

Research Question

Research Hypothesis

Literature Review

Research Design

Idea

Research Question

Literature Review

Research Hypothesis

Research Design

Value of Doing Research

As a graduate student

- To be able to read and understand the empirical literature in your field; to become a critical consumer of information.

As a graduate student preparing for a thesis or dissertation

- To be able to both design and implement your thesis or dissertation as well as future studies that interest you.

As a future practitioner:

- To be able to intelligently participate in research projects, evaluations, and studies undertaken by your institution.

As an educated citizen :

- To understand the difference between scientifically acquired knowledge and other kinds of information.

Research Paper (1)

A formal written report that includes research findings and a student's own ideas.

http://www.netnet.org/students/student%20glossary.htm#R

A substantial piece of academic writing, usually done as a requirement for a class, in which the author does independent research into a topic and writes a description of the findings of that research.

http://en.wiktionary.org/wiki/research_paper

Research Paper (2)

Research paper may refer to:

Academic paper (also called scholarly paper), which is published in academic journals and contains original research results or reviews existing results

Term paper, written by high school or college students

Thesis or dissertation, a document submitted in support of a candidature for a degree or professional qualification, presenting the author's research and findings

http://en.wikipedia.org/wiki/Research_paper

Research Paper (3)

This is a major paper, which will be done in a long period of time, usually during one semester. In order to write the paper, a student is expected to select a topic, somewhat narrow in scope and perform library research, quantitative analysis, and software usage. ...

www.bw.edu/stulife/international/information/academic/

For details on “What is a Research Paper” visit

http://www.esc.edu/esconline/across_esc/writerscomplex.nsf/0/ddbc866bc537f67e85256a460066ab2d

Where to Search for a Research Paper

Google Search

Google Scholar

Citeseerx

Sites of

- Universities
- Professors
- Research Institutes

How to Find Good Research Paper

Find papers in high-quality conferences/ Journals

- There are too many conferences/workshops!!
- Security research conferences:
  - Top ranking conferences:
    - IEEE Security & Privacy, ACM CCS, Usenix Security
  - Other good conferences:
    - NDSS, RAID, ACSAC, SecureCom, AsiaCCS, DSN, ESORICS….
  - Conference papers are grouped into sections according to topics
    - The section title will tell you the research topic
    - Help you quickly find papers you are interested

Find Good Research Paper (2)

Good security research journals:

- ACM Transactions on Information and System Security
- IEEE Transactions on Dependable and Secure Computing
- IEEE Transactions on Information Forensics and Security

Problem for journals:

- They are slow in publishing, usually will be two years later than conference papers

Good resource to find security conferences:

- http://faculty.cs.tamu.edu/guofei/sec_conf_stat.htm

How to Read a Research Paper (1)

Glance through abstracts to find interesting ones

Read introduction and one more section to get the big picture

- Understand the novel idea(s) provided by a paper
- Read “related work” and glance over several related papers if not familiar with the topic

Read the whole paper if the paper is worth it

Reference: How to Give a Good Presentation?

By Cliff C. Zou

How to Read a Research Paper (2)

Ask questions actively when reading:

- What is the novel idea(s)?
- Can I do this research, too?
  - Some research are not doable by yourself
    - E.g., require specific hardware, software, data
    - Then they are not much helpful for your own research
- What can I learn from this paper on my own research?
- What are the weaknesses of the paper?
- Which point(s) can I do further research on?
  - Important to conduct your own research

How to Read a Research Paper (3)

Write a brief notes on each paper you just finished reading

- Refresh your memory (important!)
  - Will not forget the paper's idea half year later
- Have a better/clearer understanding of the paper after you write down your thoughts

How to Read a Research Paper (4)

- Keep a record for you to quickly find the paper later
- Better put notes into computer files
  - Each file contains:
    - papers of a conference, of a year
    - Papers of a specific research topic
  - Use clear file name to show the content

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Thanks!