Research Methodology

CS 5001

Instructor: Dr. Ramoza Ahsan

Agenda

- Introduction
- Course Logistics
- Class Introduction
- What is Research
- Questions

Contact Details

- **Contact**
  - **Dr. Ramoza Ahsan,**

    Assistant Professor, Artificial Intelligence and Data Science, School of Computing
  - Email: ramoza.ahsan@nu.edu.pk
  - Office: Room (Not assigned yet)
  - Office Hours : Monday and Wednesday 11:30-1pm (In-person)
  - Tuesday and Thursday 11:30-1pm (Online)
  - Friday 4-5pm.
- **Schedule**
  - 1 Class of 3 hours on Friday in C301 from 5:20pm – 8:05 pm
  - Class code: sy4xfcc

Lecture Format and House keeping Rules

- Main Lecture
  - You can ask any question at any time
- Course Material/ slides and reference material will be shared through google classroom
- Grading will be Absolute as per NUCES rules
- No mobile phones in class
- No talking in class
- **Plagiarism will not be tolerated**

Marks Distribution Tentative

Assessment Item	Number	Weight (%)
Quizzes	~5	10
Assignments/HWs	3-4	10
Project	1	15
1st Sessional Exam	1	15
2nd Sessional Exam	1	15
Final Exam	1	30
Class Participation		5
Total		100

Your Favorite Questions

Absolute Grading

Mostly Announced Quizzes

3-4 Assignments

Attendance issues must be addressed within a week

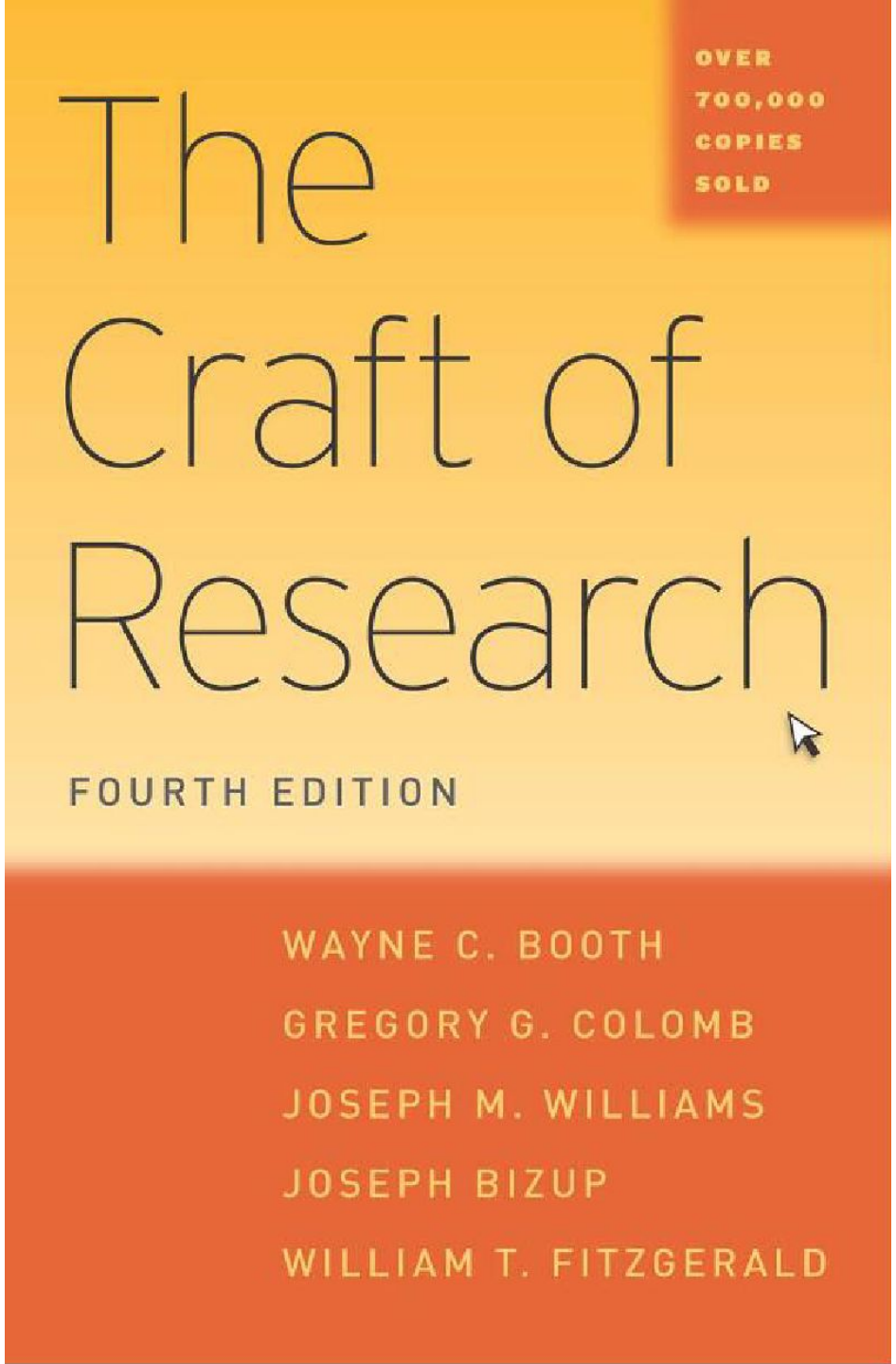
Assignments date and Time will not be extended

Policy about missed assessment items in the course

- Retake of missed assessment items (other than sessional/ final exam) will not be held.
- ••Student who misses an assessment item (other than sessional / final exam) is awarded zero marks in that assessment item i.e., late submission will not be accepted.
- ••For missed sessional/ final exam, exam retake/ pre-take application along with necessary evidence are required to be submitted to the department secretary.
- ••The examination assessment and retake committee decides the exam retake/ pre-take cases.

Course plagiarism policy

- Plagiarism in project will result in F grade in the course.
- Plagiarism in an assignment will result in zero marks in the assignment category.
- AI generated content is prohibited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Course Book

Course Topics

- Research Introduction
- How to read a scientific paper
- Components of a Research paper
- Literature review
- Qualitative research vs Quantitative research
- Sampling methods
- Data Analysis
- Ethics of research
- Presentations from faculty (In-person or recorded)

Course Learning Outcomes (CLOs)

- **CLO 1**: Identify and formulate a research problem that is significant, original, and feasible.
- **CLO 2**: Conduct a systematic and critical review of the relevant literature and sources to support and contextualize the research problem.
- **CLO 3**: Develop and justify a research argument that is clear, coherent, and persuasive, using appropriate evidence, reasons, and warrants.
- **CLO 4**: Communicate the research argument effectively to the intended audience, using suitable language, structure, style, and visual aids.
- **CLO 5**: Demonstrate ethical awareness and responsibility in conducting and reporting research, following the standards and guidelines of academic integrity.

Assignments

- 10% of final grade
- ~3 individual assignments
- Summarizing a paper
- Identify strengths and weaknesses
- Literature review

- AI generated content will result in 0
- Submissions through google classroom
- Assignment will include submitting a report and presentation in class

Project

- 15% of final grade
- Group project
- Form a team of 3-4 students.
- Email your team members names to me by 7th Feb
- Write a survey paper on a topic of your choice
- First deliverable (5% grade) due: 14th March (Abstract, Introduction)
- Second deliverable (10% grade) final paper due:1st May
- Presentations in class on 2nd May
- Final submission will be the paper and presentation

Teacher Introduction

- Assistant Professor, Artificial Intelligence and Data Science, Jan 2023 - Present
- PhD in Computer Science (Worcester Polytechnic Institute, MA, USA, 2013- 2019)
- Worked as a Data Scientist at IRI (market research company providing data insights) May 2019-June 2023.
- BS (2003) and MS (2012) in Computer Science (FAST NU-Islamabad)
- Research Interests: Data science, data mining, machine learning, data visualization and data analysis
- Lecturer at FAST-NU Islamabad Jan 2012-Aug 2013
- Taught various computer and data science courses (Algorithms, Database, Automata, Intro to Computing, Introduction to Data Science, Introduction to Python Programming etc.)

Teacher Introduction

- Academic awards
  - Fulbright scholarship (PhD)
  - World fellowship award
  - Grace hopper scholar
  - Research innovation exchange awards
  - Graduate leadership award
  - Gold medalist (MS)

Overview of my Research

Areas	Data Retrieval and Integration	Frequent Pattern Mining	Similarity Search Mining

2013-2016

1	Ramoza Ahsan, Rodica Neamtu, Jeff Stokes, Armend Hoxha, Jialiang Bao, Stefan Gvozdenovic, Ted Meyer et al.. **Massachusetts Economy and Technology Index System.** DSMM @ SIGMOD 2014.
2	Rodica Neamtu, Ramoza Ahsan, Jeff Stokes, Armend Hoxha, Jialiang Bao, Stefan Gvozdenovic, Ted Meyer et al. **Taming Big Data: Integrating diverse public data sources for economic competitiveness analytics.** Data4u@ VLDB 2014.
3	Ramoza Ahsan, Rodica Neamtu, Elke Rundensteiner. **Towards Spreadsheet Integration using Entity Identification driven by a Spatial-Temporal Model.** ACM SAC 2016.
4	Ramoza Ahsan, Rodica Neamtu, Elke Rundensteiner. **Towards automated big data integration using entity identification and classification.** International Conference on BigData 2016.

Overview of my Research

5

Areas	Data Retrieval and Integration	**Frequent Pattern Mining**	Similarity Search Mining

2013-2016

5	Xiao Qin, Ramoza Ahsan, Xika Lin, Elke A. Rundensteiner, Matthew O. Ward. **iPARAS: Incremental Construction of Parameter Space for Online Association Mining.** BigMine @KDD 2014: 149-165.
6	Xiao Qin, Ramoza Ahsan, Xika Lin, Elke A. Rundensteiner, Matthew O. Ward. **Interactive Temporal Association Analytics.** EDBT 2016: 197-208.

Overview of my Research

Areas	Data Retrieval and Integration	Frequent Pattern Mining	**Similarity Search Mining**

2016-2020

7	Rodica Neamtu*, Ramoza Ahsan*, Elke Rundensteiner, and Gabor Sarkozy. **Interactive time series exploration powered by the marriage of similarity distances.** VLDB 2016, 169-180.
8	Rodica Neamtu, Ramoza Ahsan, Charles Lovering, Cuong Nguyen, Elke Rundensteiner, and Gabor Sarkozy. **Interactive Time Series Analytics Powered by ONEX.** ACM International Conference on Management of Data, 2017
9	Rodica Neamtu, Ramoza Ahsan, Elke Rundensteiner, Gabor Sarkozy, Eamonn Keogh, Hoang Anh Dau, Cuong Nguyen and Charles Lovering. **Generalized Dynamic Time Warping: Unleashing the Warping Power Hidden in Point-Wise Distances.** ICDE 2018.
10	Ramoza Ahsan, Rodica Neamtu, Muzammil Bashir, Elke Rundensteiner, and Gabor Sarkozy. **Correlation-based Time Series Analytics.** 2020 IEEE International Conference on Big Data (Big Data), 4482-4491
11	Rodica Neamtu, Ramoza Ahsan, Cuong Nguyen, Charles Lovering, Elke Rundensteiner and Gabor Sarkozy. **Multi-Warped Distances-Driven Similarity Exploration.** IEEE Transactions on Knowledge and Data Engineering 34 (4), 1516-1529.
12	Ramoza Ahsan, Muzammil Bashir, Rodica Neamtu, Elke Rundensteiner, and Gabor Sarkozy. **Efficient and Exact Nearest Neighbor Search in Time Series Data.** 2019 IEEE International Conference on Big Data (Big Data), 2057-2066.

Class Introduction

1. Background
2. Technical Expertise
3. Why MS Degree ?
4. Favorite place to visit in Pakistan

Research Introduction

- Curiosity and inquisitiveness is a common characteristic of every human being.
- All of us are curious to know about ourselves, our organizations, our institutions, our homes and families etc.
- There are a number of questions we always ask ourselves of which some are not answered well and thus necessitates investigation, thus need for research

Meaning of Research

- Research simply means search for facts or answers to the questions we ask.
- It means seeking solutions to the problems.
- It is a purposive investigation. It is an organized inquiry.
- It seeks to find explanations to unexplained phenomenon, to clarify the doubtful facts and to correct the misconceived facts.

Background “Doing Research”

- What is research ?
  - Your Point of View !!!!

- An Informal Definition
  - Research is defined as a careful consideration of study regarding a particular concern or a problem using scientific methods.
- Organized, systematic, data-based critical inquiry or investigation into a specific problem, undertaken with the objective of finding answers or solutions to it.

What is Research?

- You already know about research because you do it every day.

- Research is simply **gathering the information** you need to **answer** a **question** and thereby help you **solve a problem**.

Ways of searching for Answers

1. **Arbitrary, crude or rudimentary methods**

   involves imaginations, opinions, blind belief or impression. This method of gathering facts has significant weaknesses. It is subjective, the findings will vary from one person to another.

2. **Scientific, logical, systematic methods**

   involves systematic rational approach to seeking facts. This method is objective, precise and conclusions are based on the basis of verifiable facts or empirical evidence.

Is it Research?

- Choosing an idea based solely on personal interest without considering its feasibility, importance, or contribution to knowledge.
- Failing to critically evaluate one's initial idea and consider alternatives that may be more suitable.
- Pursuing a trivial or unimportant topic that lacks conceptual foundation or significance.
- Attempting a project that is too large in scope given available time and resources.
- Duplicating work that has already been adequately reported in the literature.

What research is and what it isn't

- It is based on the works of others – not a copy of their works
- It can be replicated
- It is generalizable to other settings
- It is based on some logical rationale and tied to theory
- It is doable
- It generates new questions or is cyclical in nature
- It is incremental

What Research is Not

- Research is not mere information gathering.
- Research is not mere transportation of facts from one location to another.
- Research is not a catchword used to get attention.

Types of Research

1. **Non-Experimental**

- Descriptive: describe the characteristics of an existing phenomenon
- Historical: relate events that have occurred in the past to current events
- Correlational: examine the relationships between variables
- Example can be study that examines the correlation between hours spent studying and test scores by collecting data on students' study habits and test results without manipulating any variables, essentially just observing the existing relationship between the two factors

Types of Research

2. **Experimental**

- Test for true cause and effect relationships
- Examples include drug trials, psychology experiments, and studies on new teaching methods.

Quasi-Experimental:

- Test for causal relationships without having full control
- is a type of nonrandomized study that's often used when it's not feasible or ethical to conduct a randomized controlled trial.

Examples of Quasi-Experimental Research

- **Educational interventions**
- Comparing student performance in schools that use a new teaching method to schools that don't
- **Public health policies**
- Comparing health outcomes in regions with and without a policy, like a smoking ban

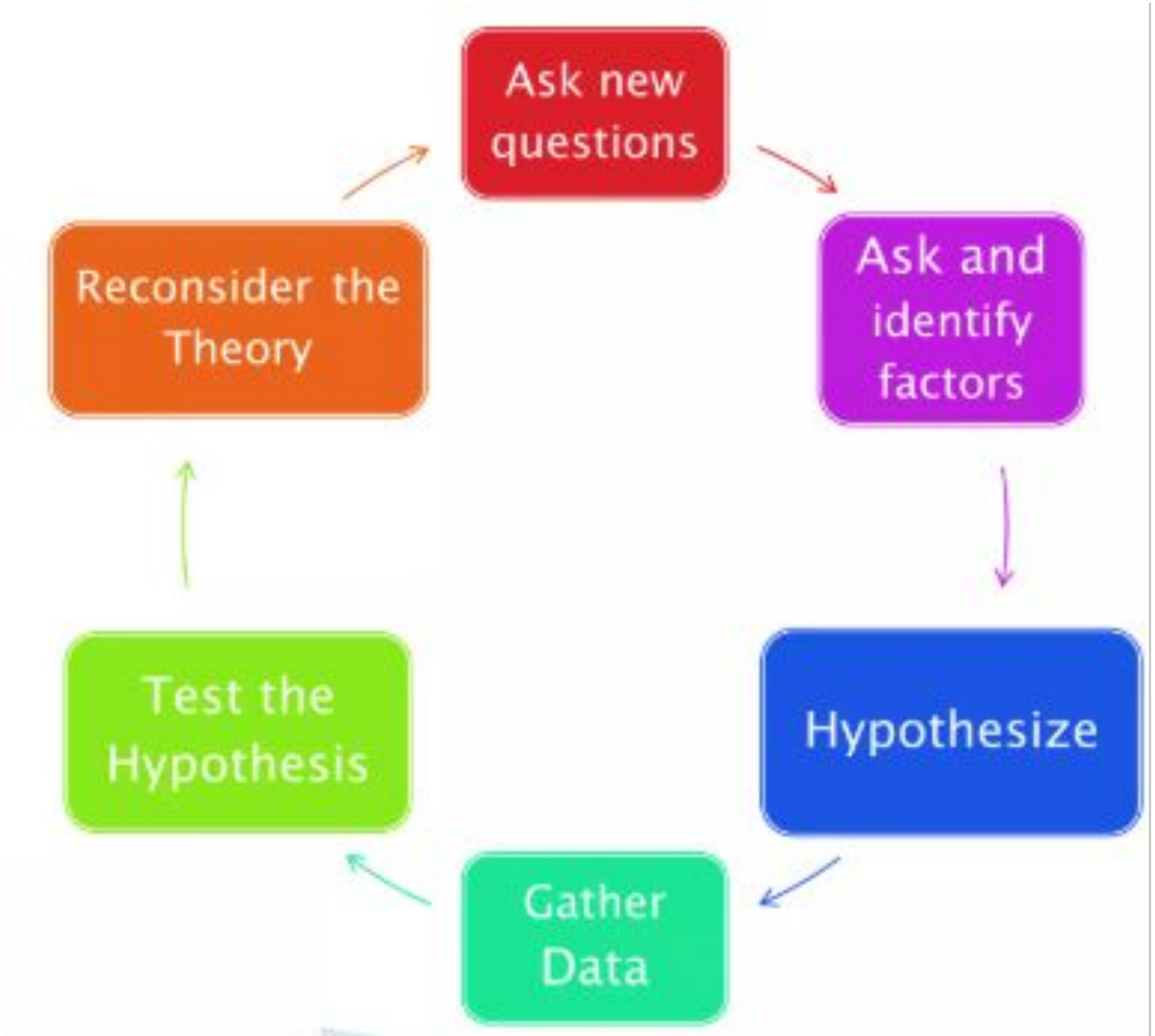
Characteristics of Research

- Research is Systematic; it starts with a question that needs an answer or a problem to be solved
- Research is Logical; it needs a plan and a specific procedure to follow.
- Research is Empirical; its findings must be based on or supported by carefully collected and analyzed data.

Characteristics of Research

- Research is Reproductive; i.e. main research problem is broken down into more specific and manageable sub-problems.
- Research is Replicable; it can be done again or repeated.
- Research is Transmittable; study findings can be applied in new settings.

The Scientific Method



Why to do Research ?

1. A Tool for Building and Prove Knowledge and Efficient Learning
2. Means to Understand Various Issues
3. An Aid to Business Success
4. A Way to Prove Lies and to Support Truths
5. Means to Find, Gauge, and Seize Opportunities
6. A Seed to Love Reading, Writing, Analyzing, and Sharing Valuable Information
7. Nourishment and Exercise for the Mind

How to Present Your Research

- Research Paper
  - A research paper is an expanded essay that presents your own interpretation or evaluation or argument.
  - When you write a research paper you build upon what you know about the subject and make a deliberate attempt to find out what experts know.

Research, researchers and readers

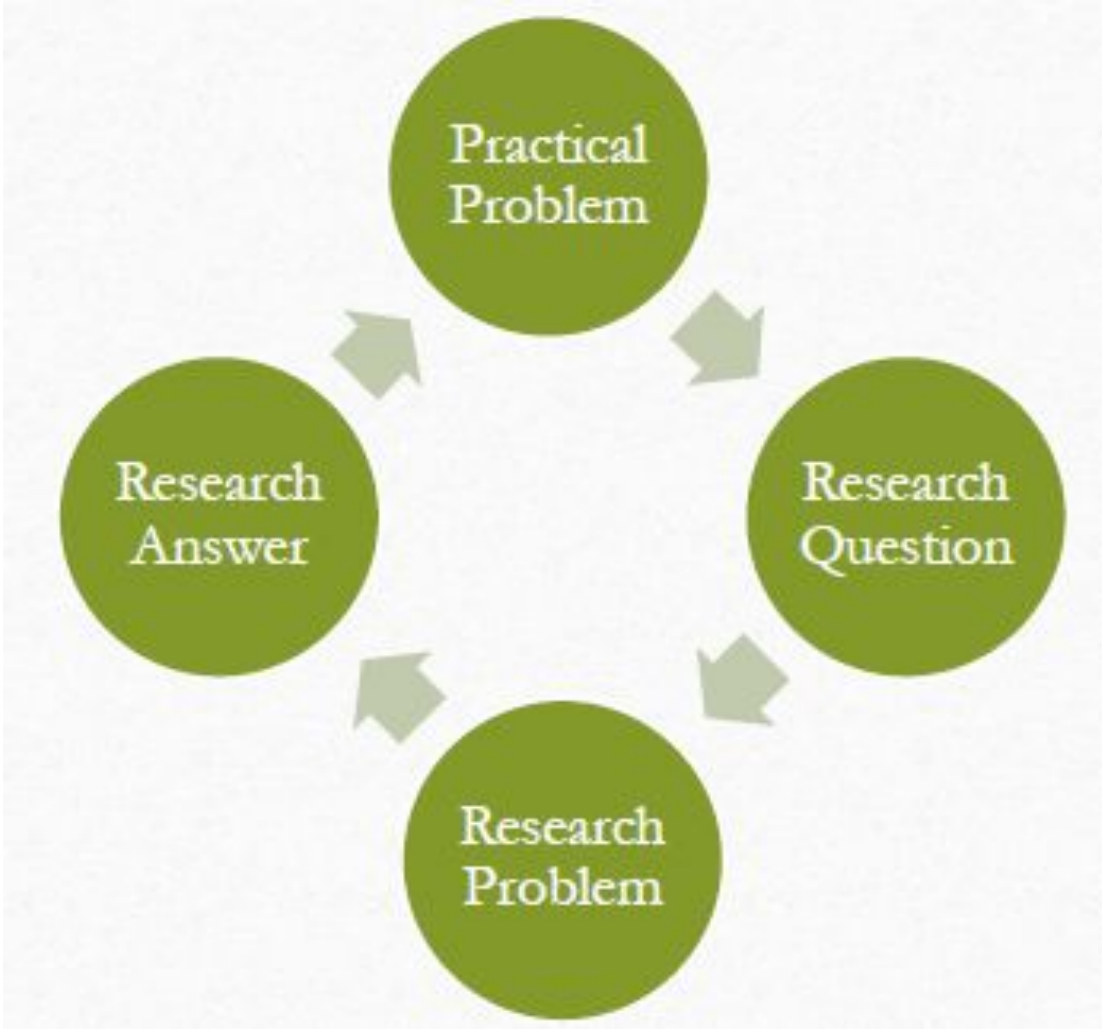
- Starting a research project
- Planning
- The use of research public and private
- Helping to evaluate what you read more thoughtfully. Lets you experience first hand knowledge.
- Without trustworthy and tested published research, we would be locked in the opinions of the moment, will become prisoners of what we hear and experience.

Connecting with your reader

- Who will read my research?
- Professionals?
- General readers who are well informed or know little about the subject?
- Academic scholars?
- Managing the unavoidable problem of inexperience.
  - Be aware of the anxieties and uncertainties
  - Get control over your topic by writing about it along the way.
  - Break the process into steps.
  - Count on your teacher to understand your struggle
  - Set realistic goals.

Planning the project

- From topics to questions
- From questions to problems
- From problems to sources
- Using sources



Research process

1. Select your topic (identification of problem)
2. Refine your topic (review of existing literature)
3. Identify objectives
4. Choose approach (methodology)
5. Explore your topic (gather Data)
6. Perform experiments
7. Analyze the Data
8. Write the report

Identification of Research Area/ Topic

- Some sources of research topics include:
- From the theories
- From literature review
- From area of your interest
- Brainstorming
- Discussion with the teachers
- Discussion from friends/peers
- Consulting the professionals in the area of your interest
- Daily problems confronted
- Problems affecting organizations/communities etc.

Qualities of a good topic

- It should meet the specification of the awarding institution
- It should fit within the available resources
- It should be researchable
- Should enable you access to data/information easily
- It should be in a new area that has not been researched
- It should enable you to get solutions to your research problem etc.

What is a Publication

- Research publication is a written document that presents the findings and results of a research study.
- Typically published in a scholarly journal or other recognized format, allowing the research community to access and evaluate the work done by researchers.
- A way to disseminate new knowledge generated through research to the wider academic field.

Key points about Research Publication

Dissemination of knowledge:

- The primary purpose of a research publication is to share research findings with others in the field, enabling further discussion and development of knowledge.

Peer review process:

- Most reputable research publications undergo a peer review process where other experts in the field evaluate the quality and validity of the research before it is published.

Key points about Research Publication

Different formats:

- Research publications can take various forms depending on the field, including journal articles, book chapters, conference papers, and sometimes even theses.

Author attribution:

- Research publications clearly identify the authors who conducted the research, allowing proper credit to be given.

Why Individuals think Research is difficult

- Individuals are ill-prepared
- Individuals have the wrong perceptions about what research is.
- Individuals have difficulty in formulating a research questions.
- Individuals do not read widely enough
- Individuals do not know how to use the Web for research
- Individuals and their supervisors do not themselves fully understand the research process and how to best explain it.

Publication Process

- Writing
  - First Draft
- Submission
- Editor Review
- Reviewer Assignment
- Review Process
- Revision
  - Major
  - Minor
    - A Paper can go into many rounds of Revision
- Decision
  - Accept
  - Reject

Publication Venues

- Workshop
  - Examples of Workshops from Internet
- Conference
  - Lets Google Now to find Top Conferences in our Field
- Journal
  - Open Access
  - Free

Thank you

Questions?