Research Methodology

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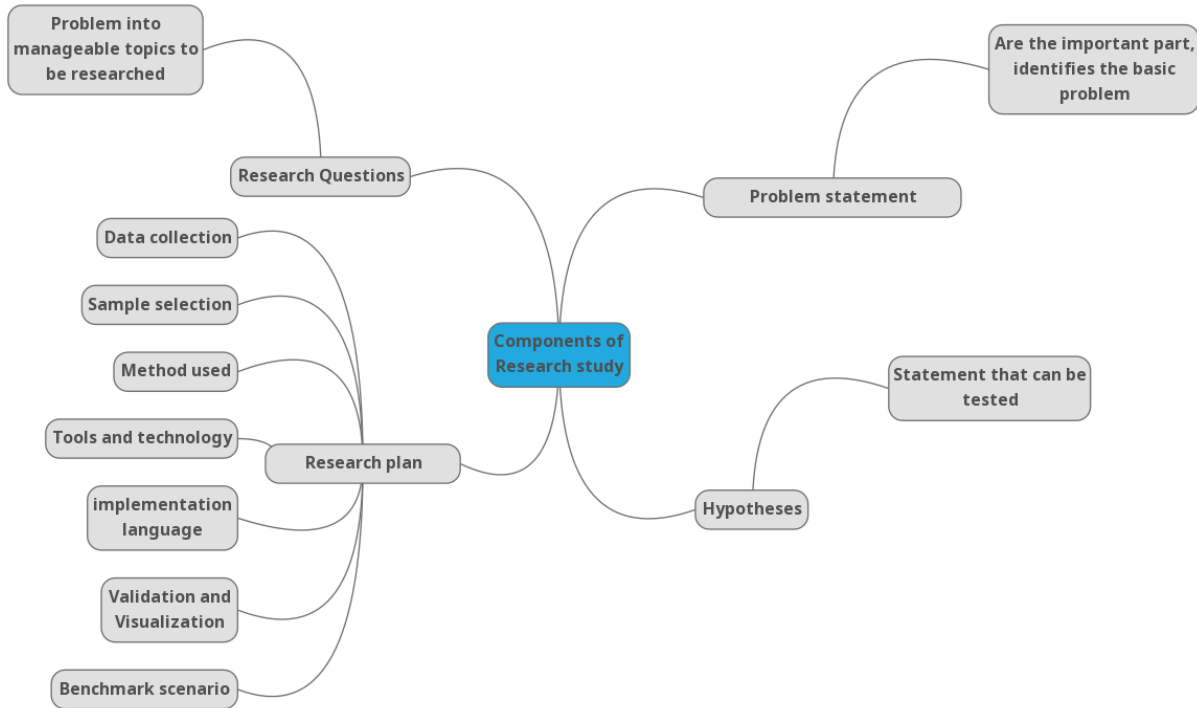Office Location: B-2-15

Group-I

Master by Coursework only

- ✓ **WQC** - Master of Information Technology Management
- ✓ **WQD** - Master of Data Science

Research Questions

W2: Bellavista, P., Corradi, A., Foschini, L., Luciano, S., & Solimando, M. (2019). A Simulation Framework for Virtualized Resources in Cloud Data Center Networks. *IEEE Journal on Selected Areas in Communications*, *37*(8), 1808-1819.

Components of research study!

Problem into manageable topics to be researched

Are the important part, identifies the basic problem

Research Questions

Problem statement

Data collection

Sample selection

Components of Research study

Method used

Statement that can be tested

Tools and technology

Research plan

implementation language

Hypotheses

Validation and Visualization

Benchmark scenario

Research questions!

❖ It has been observed that among the failed students, majority of students are coming from the programming related courses [Observation]

❖ Research Questions

Research questions!

❖ It has been observed that among failed students, majority of students are coming from programming related courses [Observation]

❖ Research questions!
❖ Why did students fail in programming class?
❖ What is the ratio of male and female students.......?

What are research Questions?

✓ Research questions -- that researcher would like to answer in the study.
✓ Questions around which you center your research.

❖ Should be:
✓ **clear**: it provides enough specifics that one's audience can easily understand its purpose without needing additional explanation.
✓ **focused**: it is narrow enough that it can be answered thoroughly
✓ **concise**: it is expressed in the fewest possible words.
✓ **complex**: it is not answerable with a simple "yes" or "no" but rather requires synthesis and analysis of ideas and sources prior to composition of an answer.

https://writingcenter.gmu.edu/guides/how-to-write-a-research-question

What are research Questions?

Unclear question	Unfocused question
Why are social networking sites harmful?	What is the effect on the environment from global warming?
Clear question	**Focused question**
How are online users experiencing or addressing privacy issues on social networking sites like Instagram and Facebook?	How is glacial melting affecting penguins in Antarctica?

Examples: Good and bad research questions!

❖ Why do some students perform better than other in grade 12 examinations?

❖ What strategies improve students understanding of main ideas in English comprehension tests?

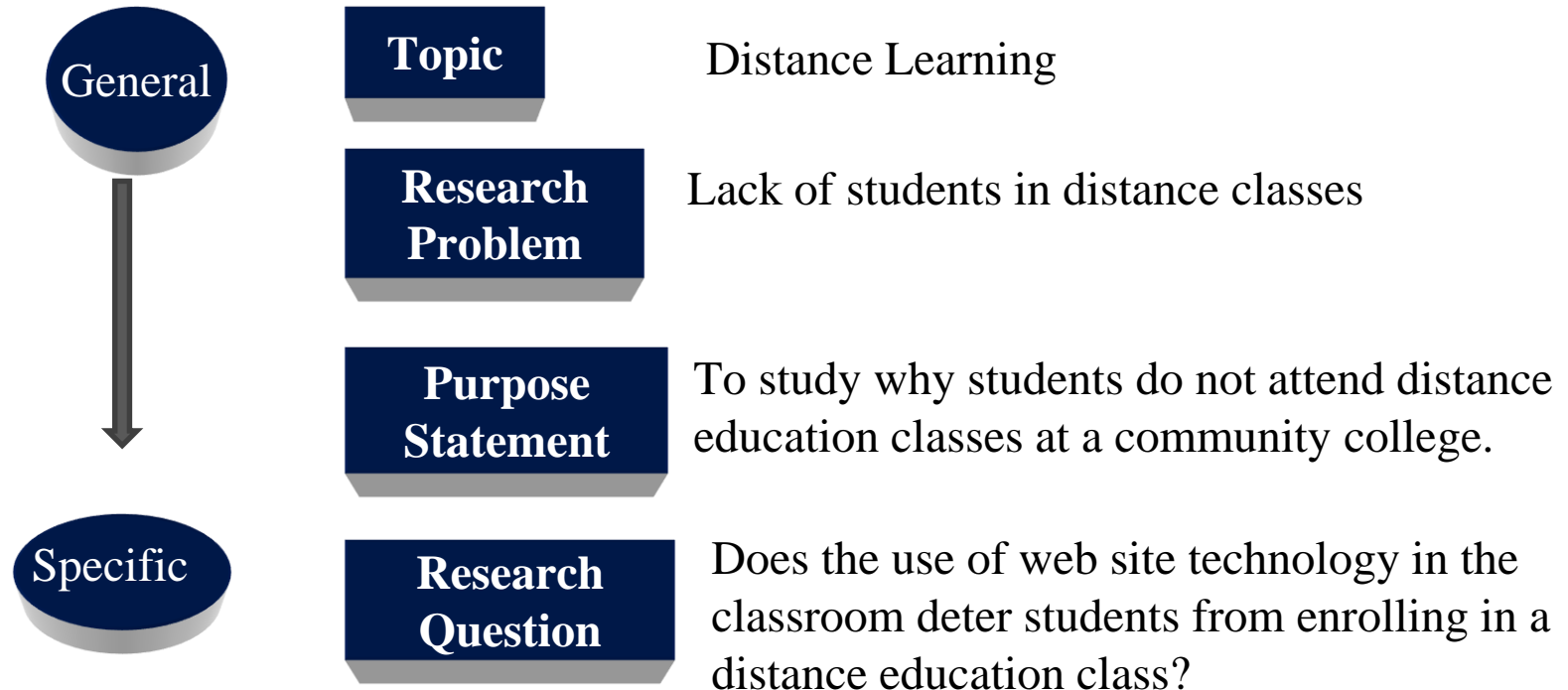# Examples: Good and bad research questions!

- ❖ Why do some students perform better than other in grade 12 examinations?

- ❖ What strategies improve students understanding of main ideas in English comprehension tests?

- ✓ Do students in private schools perform better than in government schools in grade 12 examinations?

- ✓ Do the use of metacognitive strategies improves UM students understanding of main ideas in English comprehension tests?

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Research Question

General	**Topic**	Distance Learning
	Research Problem	Lack of students in distance classes
	Purpose Statement	To study why students do not attend distance education classes at a community college.
Specific	**Research Question**	Does the use of web site technology in the classroom deter students from enrolling in a distance education class?

Student Work!
Problem statement

- Most students believe that programming is a difficult subject to understand and score a good mark. Learning programming is boring and difficult if students are not interested in the subject. Students' learning style is also different for each student, some like discussion with friends while other prefers to study alone *(Masura R. et al, 2012)*. Most of the novice programmer feel shy to ask questions again and again in front of the whole class. As a result they remained stuck or give up solving the problem.

RQ-1 What are the strategies and patterns novice programmers use while solving a problem?
RQ-2 How gamification approach differs from the conventional approach in case of understanding novice programmers behavior ?
RQ-3 What are the difficulties novice programmers face while solving problem?
RQ-4 What strategies can novice programmers adopt to improve their ability to solve problem?

Masura Rahmat , Shahrina Shahrani, Rodziah Latih, Noor Faezah Mohd Yatim, Noor Faridatul Ainun Zainal & Rohizah Ab Rahman. (2012). Major problems in basic programming that influence student performance . Procedia - Social and Behavioral Sciences 59 (2012) 287 – 296

Problem definition

Sample Problem statement & Questions

- Parallel discrete event simulation frameworks have been widely used to analyze the performance of traditional applications under different scenarios. The existing frameworks are designed to work on a cluster and cloud-based computing environments. With the current advances in the internet of things, there is a strong need to revamp such traditional frameworks and make use of the smart connected-devices as an underlying infrastructure to perform simulations (Angelo et al. 2018).

Research questions

✓ What is the architectural difference between cloud and IoT frameworks?
✓ What are the limitations of IoT devices?
✓ Is there any distributed simulation framework that can work on cloud and smart devices?
✓ What are the benefit of using smart devices for distributed simulation?

D'Angelo, G., Ferretti, S., & Ghini, V. (2018). Distributed hybrid simulation of the Internet of things and smart territories. *Concurrency and Computation: Practice and Experience*, *30*(9), e4370.

Research Question to Hypothesis

❖ Research Questions (RQs) is the refined statements of the specific component of the problem.

❖ Hypothesis (H) is the unproven statement or proposition about a factor or phenomenon that is of the interest to the researcher. **Often, a hypothesis is a possible answer to the research question**.

　　❖ Hypotheses are the declarative statements in a **quantitative research** thesis, typically based on **past research**.

Example:

❖ RQ: Do the customers of Sears exhibit store loyalty?

✓ H1: Customers who are store-loyal are less knowledgeable about the shopping environment.

✓ H2: Store loyal customers are more risk-averse than non-loyal customers.

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Research Question to Hypothesis

❖ **RQ**: Is there a correlation between anxiety level and midterm examination scores of UM students?

❖ **Hypothesis (an educated guess)**
✓ There is a negative correlation between anxiety levels and midterm examination scores of UM students.

Assignment-1

- Choose any paper of your area of interest
- Write a problem statement, tentative research questions, hypothesis and critical review.
- Submit a three slide presentation in pdf format for class presentation. (1xslide on problem statement, 1x slide on RQ and H, 1x slide on critical review)
- Submit a critical review in a word file (max two paragraphs).
- Deadline Oct 1, 2019
- We will have a individual class presentation in the next class i.e. Oct 2, 2019
- Presentation will be based on class attendance list.
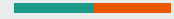
Literature Review

Purpose of Literature Review

❖ **Identify** existing work

❖ Literature **gap**

❖ Identify **Seminal** works

❖ Identify **methodologies** and research tech.

❖ **Provide context to your own work**

❖ Cover **relationship** with previous studies

Literature Review

"re-views" – **looks again** – at what others have said, done, found in a particular area

- ❖ What is Literature review?
    - ❖ Its an evaluation of previous work on your topic
- ❖ What is the purpose?
    - ❖ It gives background information needed to design your solution
- ❖ What do you need to Include?
    - ❖ **Well-established** research in the field
    - ❖ Most **recent** relevant research

Steps in Literature Review

Many Researchers Proceed With <u>Four Stages</u> of Literature Review

- ❖ Search

- ❖ Assess the relevance of the literature

- ❖ Summarize each source

- ❖ Synthesize the body of literature

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Steps in Research Process

- ❖ **I: SEARCH**
  - ❖ An effective literature search
    - ❖ Reduce **time spent** looking for information
    - ❖ Maximize the **quality**
    - ❖ Helps define and **refine research questions**
    - ❖ Helps find data and **research methods**
    - ❖ Helps identify **important work** in the field
  - ✓ **Databases: IEEExplore, Google Scholar, ACM Digital Library and Etc.**

Steps in Research Process

❖ **I: SEARCH**

  ❖ **First time unaware of area** – start with broader perspective, surveys and etc.

  ❖ **Next turn to technical journal articles** – start with most recent work and move backward

  ❖ Follow the same for **conference articles** on your topic

  ❖ If **time permits**, scan **dissertation abstracts**

✓ *I placed referred journal articles high on the list – they provide good source of input*

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Steps in Research Process

❖ **II: Assess the relevance of the literature**

    ❖ Is the literature on the **same** topic as you proposed to study?

    ❖ If Not

        ❖ Re-search if necessary

        ❖ select new keywords

        ❖ change databases etc.

        ❖ Re-assess the relevance of the literature

        ❖ Repeat process if necessary

Identify key concepts & terms

Select relevant databases and resources

Review and refine search results

Search strategy

Combine search terms with Boolean operators

Run searches in selected reources

Steps in Research Process

- ❖ **III: Summarize each source**
    - ❖ **RECAP** the important and **most relevant information** found in each source
        - ❖ **Identify variables**. Identify context/ setting
        - ❖ Identify **theories**
        - ❖ Identify **findings**
    - ❖ Keeping **track of all** of this stuff
        - ❖ When it comes time to **write the literature** review
        - ❖ **do know** what you are **talking about**
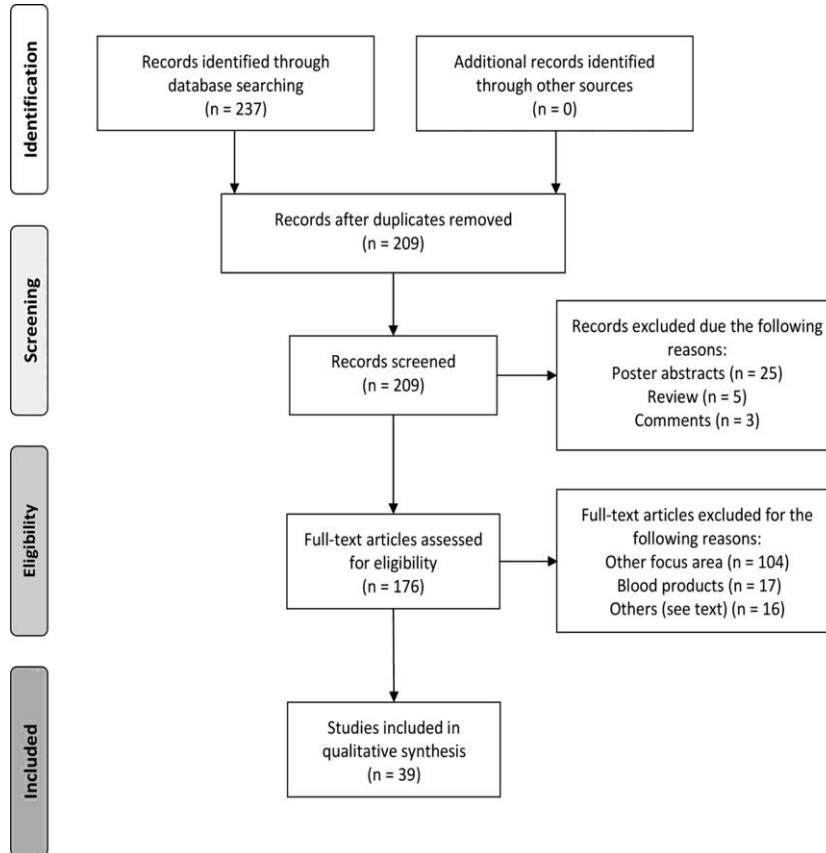   - ❖ **don't** have **to re-read** everything

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Steps in Research Process

IV: Synthesize the body of literature

❖ **Integrate** the literature

❖ **own narrative** of on-going scholarly perspectives, findings, conclusions

❖ with your research questions

❖ **Identify** similarities and **differences**

❖ **Help you to prepare a complete chapter on Literature Review**

Literature review

Identification

Records identified through
database searching
(n = 237)

Additional records identified
through other sources
(n = 0)

Records after duplicates removed
(n = 209)

Screening

Records screened
(n = 209)

Records excluded due the following
reasons:
Poster abstracts (n = 25)
Review (n = 5)
Comments (n = 3)

Eligibility

Full-text articles assessed
for eligibility
(n = 176)

Full-text articles excluded for the
following reasons:
Other focus area (n = 104)
Blood products (n = 17)
Others (see text) (n = 16)

Included

Studies included in
qualitative synthesis
(n = 39)

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Writing **Literature** for **Research** Article/ **Thesis**/ Project **Proposal**

Writing Literature Review – Bad Example

- .....The first group comprises comparative studies. Works under this category investigate different conditions, scenarios, number of tests and types of drivers [5, 74-76] to evaluate whether a given assignment method corresponds to the observed reality. A hybrid routing protocol for VANET based on the application of two most widely accepted mobile technologies and their combination is presented in [77]. Another study incorporates different techniques of localization along with data fusion in V2V communication [78]. Another study explores the possibility of using a single node to emulate a set of nodes to overcome or facilitate the logistic issues during measurement campaigns [79].

Writing Literature Review

❖ **Writing it up – Literature Review in Journal Papers**

  ❖ **Note: You are reviewing the literature, not summarizing it**

  ✓ *Smith (1978) conducted a study which found that squirrels preferred pecans to acorns*

  you want to say something like the following:

  ✓ ***Smith (1978) found that squirrels preferred pecans to acorns.***

  ❖ You do not want to do this:

  ✓ Smith (1978) conducted a 3x3x3 factorial design to study squirrels. He concentrated on brown squirrels, stating "flying squirrels are just too damn unpredictable to study" (page 54). 1000 squirrels were broken into six groups and given the choice of nuts to eat. 1 group was given nothing but pecans, the other nothing but acorns, and then allowed to switch, BLAH, BLAH, BLAH, BLAH …

Writing Literature Review

❖ **Writing it up – Literature Review for technical articles**

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Writing Literature Review

❖ **Writing it up – Literature Review for technical articles**

    ❖ If you are [citing a bunch of people](#) who say the same thing, summarize the basics of their point and cite them. For example:

    ✓ *While Smith (1978) says that squirrels prefer pecans to acorns, his theory was questioned and disproved by a number of people who found that there was no significant difference for nut preference among squirrels* *(Amos, 1979; Barry, 1980; Catzenjammer, 1980, Douglas, 1980; Zimmerman, 1983).*

Writing Literature Review

❖ **Explore Literature Review**

  ✓ **Integrate what other have done**

  ✓ **Criticize previously scholars work**

  ✓ **Build Bridge between related topics**

  ✓ **Identify the central issue in the filed**

Writing Literature Review

❖ **Writing it up – Literature Review in Journal Papers**

End your literature review section by providing the summary on existing work, research gap and how your proposed study will fill that need

Writing Pointers

❖ Define the term when it first appears

"Vehicular ad-hoc networks (VANETs)" have greatly improved transportation systems and helped reducing many unwanted scenarios causing irreversible mishaps on roads" (Shah et al. 2019)

❖ Define abbreviation in abstract only if is repeat again in abstract

Shah, S. S., Malik, A. W., Rahman, A. U., Iqbal, S., & Khan, S. U. (2019). Time Barrier-Based Emergency Message Dissemination in Vehicular Ad-hoc Networks. *IEEE Access*, *7*, 16494-16503.

Writing Literature Review

❖ **Writing it up – Literature Review in Journal Papers**

  ❖ It is always good to have a research comparison table based on under

Simulators	Prog. Language	Platform	Network Configuration	Open Source	Mobile Nodes	Customize Mobility Models	Scheduling Algorithms	Device Handover	Energy Module
EdgeCloudSim [6]	Java	All	No	Yes	Yes	No	Yes	No	No
MobIoTSim [8]	Java	Linux	No	Yes	Yes	No	No	No	No
SimpleIoTSimulator [10]	Java	Unix	No	No	Yes	No	No	No	No
IBM BlueMax [11]	Java/Python	Cloud	No	No	Yes	No	No	No	No
Google IoT Sim [13]	NA	Cloud	No	No	Yes	No	No	No	No
iFogSim/MyiFogSim [14]	Java	All	No	Yes	Yes	No	Yes	No	No
Cooja [17]	C	Linux	No	Yes	Limited	No	No	No	No
FogTorch [18]	Java	All	No	Yes	No	No	No	No	No
RECAP simulator [19]	N/A	–	Limited	N/A	No	No	No	N/A	N/A
EmuFog [20]	Python	All	Yes	Yes	No	No	No	No	No
Edge-Fog cloud [22]	Python	All	No	Yes	Limited	No	No	No	No
Mobile Fog [23]	N/A	–	No	No	Yes	No	No	No	No
FogNetSim++	C++	All	Yes	Yes	Yes	Yes	Yes	Yes	Yes

T. Qayyum et al. FogNetSim++: A Toolkit for Modeling and Simulation of Distributed Fog Environment, *IEEE Access*, vol 6, pp. 63570-63583, 2018

Writing Literature Review

❖ **Writing it up – Literature Review in Journal Papers**

Bilal et al. Services and simulation frameworks for vehicular cloud computing: a contemporary survey, EURASIP Journal on Wireless Communications and Networking 2019.