

# **what is research, or introduction to the journey of discovery**

**research.** a) the systematic investigation into and study of materials, sources, etc. in order to establish facts and reach new conclusions. b) an endeavor to discover new or collate old facts etc. by the scientific study of a subject or by a course of critical investigation.

Oxford english dictionary

# What is research?

A process of steps used to collect and analyze information in order to increase your understanding of a topic or issue

it involves three steps:

- pose a question
- collect data to answer the question
- present an answer to the question

# why is research important?

- adds to our **theoretical** knowledge on the foundations of computer science
  - may lead to improved **theories** or **algorithms**
- adds to our knowledge of what is good **practice** in computer science and what is not good practice
  - may lead to improved **tools, processes** or **knowledge**

# The dialectic of research

- **thesis:** presents an original statement of an idea
- **antithesis:** presents an argument to challenge a previous thesis -- this can be drawn upon new sources of evidence and is typically of progress within a field
- **synthesis:** seeks to form a new argument from existing sources -- may resolve the apparent contradictions between a thesis and an antithesis

# how to increase knowledge?

different ways:

- address gaps in knowledge
- replicate knowledge by testing old knowledge with new participants or new research sites
- expand knowledge by extending research to new ideas or practices
- inform practice by developing new ideas

# process of research

- choose a **topic**
- identify a **research problem**
- review the **literature**
- specifying a **purpose for the research**
  - provide a purpose statement
  - then refine it to **research questions or predictions**
- [optional] develop techniques: algorithm, tool or process
- collect **data**
- analyze and interpret the **data**
- report and **evaluate** research

# skills required to conduct research

- asking **useful and relevant research questions** OR identifying an **important research problem**
- use of **academic language**
- knowledge of **background literature**
- knowledge of **research methods**
- research maturity (not just doing what your supervisor tells you to do)
- **communicate, communicate, communicate**
- **having the right cup of coffee!** (learn from others!)



# think critically about research

what is “**significant**” contribution?

- not nobel prize winning stuff!
- think in terms of baby but important steps
- ‘adding to knowledge’

try to answer the ‘**so what?**’ question

- the importance of your question (why is it worth asking?)
- the significance of your findings (why should anyone care?)
- implications for theory
- limitations to generalizability

# types of research questions

TOWARDS UNDERSTANDING THE PROBLEM UNDER STUDY:

- existence questions: **DOES X EXIST?**
- Descriptive and classification questions: **what is X Like?**
- Descriptive-comparative questions: **HOW DOES X DIFFER FROM Y?**

# pattern (empirical) questions

- frequency and distribution questions: HOW OFTEN DOES X OCCUR?
- descriptive questions: HOW DOES X NORMALLY WORK?
- relationship questions: HOW DOES X RELATE TO Y?
- causal questions: DOES X CAUSE Y?

# factors influencing success or failure!

- clear problem definition
- well defined research context
- good documentation
- effective time management
- good presentation skills

# models of argument

- proof by demonstration (e.g. implementation driven research)
- empiricism (e.g. controlled experiments or ground-up theory building)
- mathematical proof (argument of verification and argument of refutation)

# research strategy to obtain research evidence

always involves: somebody or something doing something, in some situation

who, what, where:

- **actors:** human systems - individuals, groups, organizations, communities, but may be computer systems
- **behavior:** all aspects of the states and actions of those human or computer systems
- **context:** temporal, locational and situational features in which the system is embedded

# desirable features of research evidence

- **generalizability** of the evidence over the populations of **actors**
- **precision of measurement** of the **behaviors** being studied
- **realism of the situation** or **context** where the evidence is gathered

although goal is to maximize the above three things, we cannot!

# class collaboration

- let's see what research groups we might have in our class