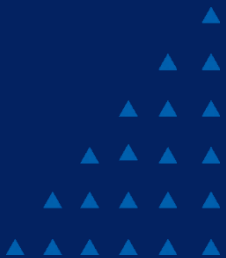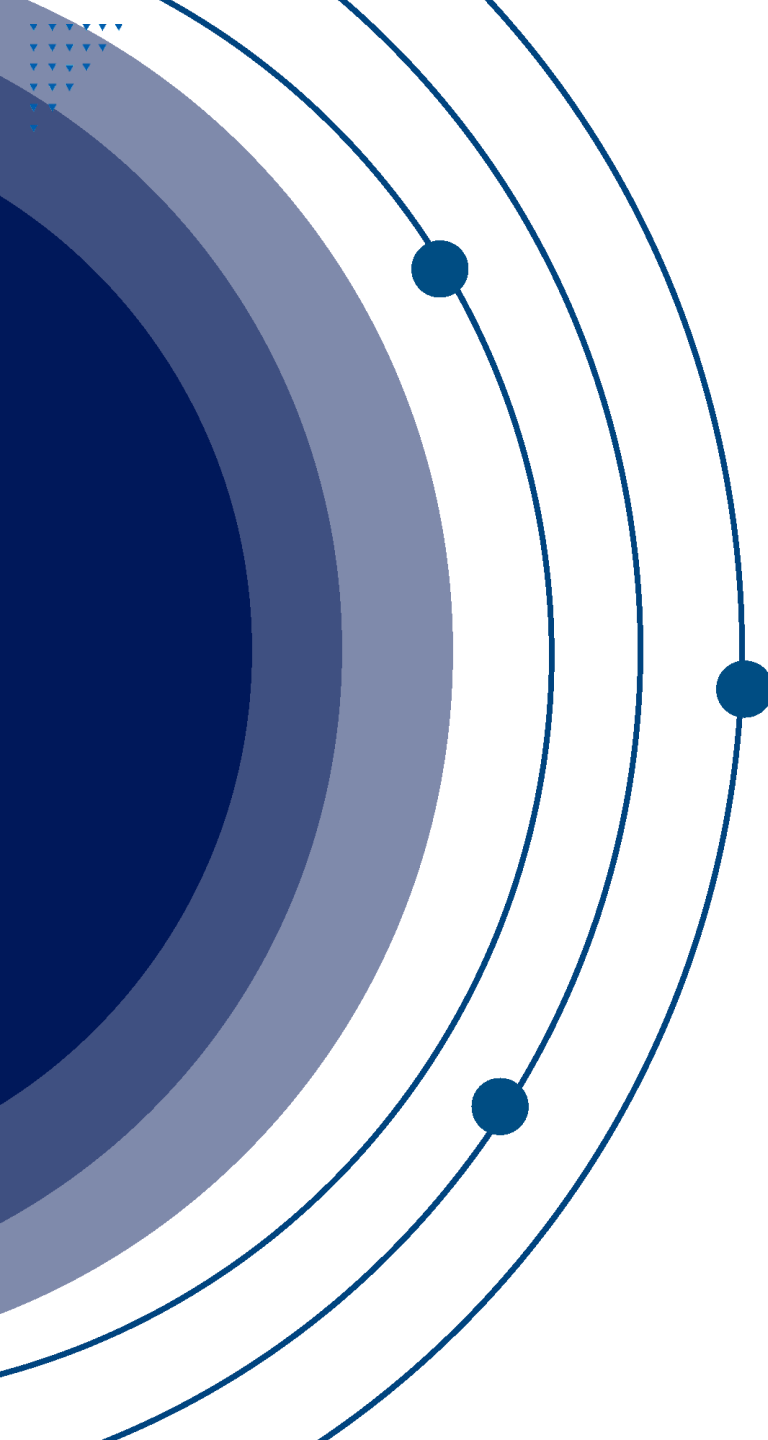# Construction Performance and Productivity Improvement

Changbum R. Ahn, PhD
Email : cbahn@snu.ac.kr
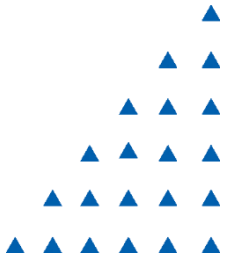
SEOUL NATIONAL UNIVERSITY

Writing a research proposal and abstract

Thesis vs. Dissertation

"A document prepared and defended at the conclusion of a

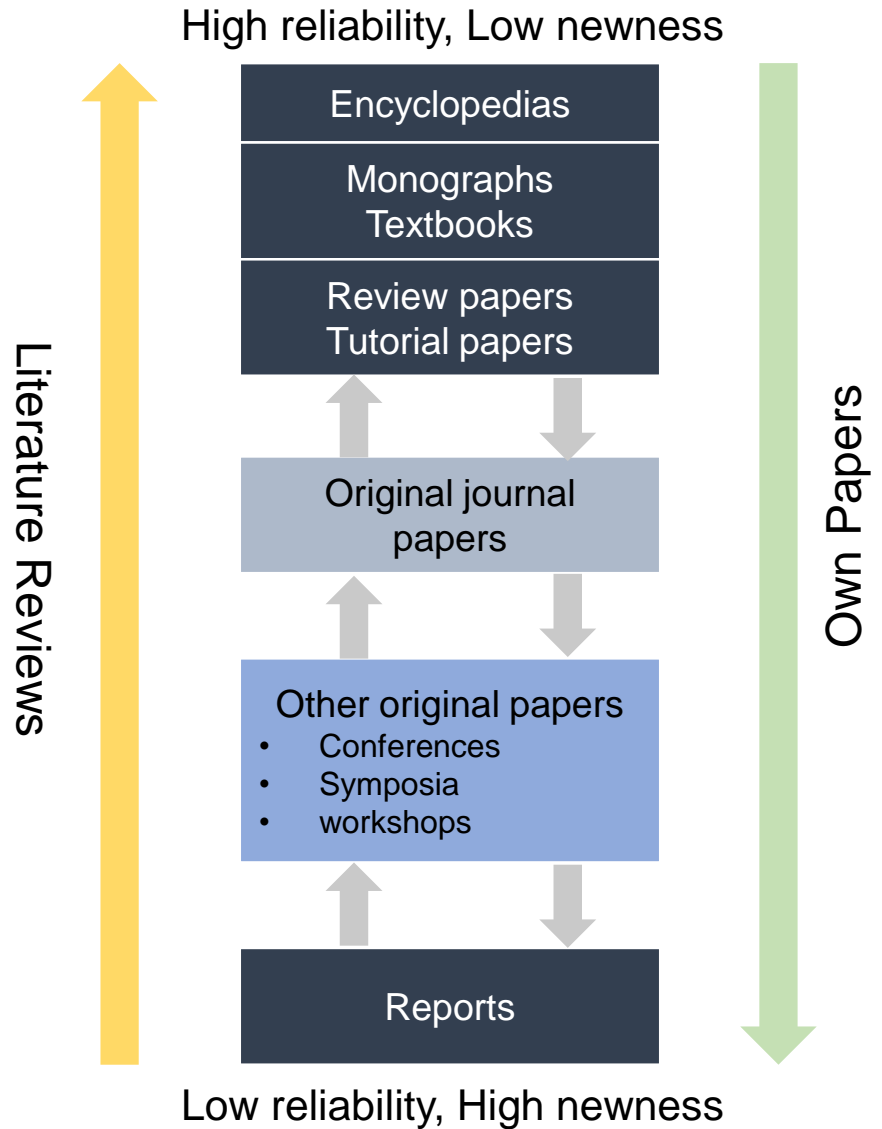doctoral program that details student's own research."

Dissertation

Thesis

"A document prepared and defended at the conclusion of a

master's program that details student's own research."

Characteristics of a Strong Thesis

➢ Original and relevant to the field
- Derived by a need or gap in knowledge.
- New topic, approach, theory, algorithms, …
- Significant modifications and improvement to existing theory or methods.

➢ Clear and concise
- Easy to understand and follow, with no excess verbiage.
- Written in high-quality academic language.

➢ Manageable
- Focuses on a specific, well-defined problem.
- Doable (feasible) within the specified time frame.

➢ Defendable
- Does not present an obvious thought or finding.
- Scientific methodology, valid data, and success metrics (assessment).
- Replicable by other researchers.
- Limitations, assumptions, and directions for future work.

➢ Novel contributions to the body of knowledge

Characteristics of a Strong Thesis

High reliability, Low newness

Literature Reviews →

Encyclopedias

Monographs
Textbooks

Review papers
Tutorial papers

Original journal
papers

Other original papers
- Conferences
- Symposia
- workshops

Reports

Own Papers

Low reliability, High newness

How has the work done previously?

What similar work has been leading up to this point?

What distinguishes your new idea from previous work?

Who/what will be impacted by this research?

…

Research Proposal

❑ A document that presents preliminary planning for a research investigation.

❑ Writing a research proposal requires:

- A research topic or problem to have been chosen and defined

- Determination of an aim and research objectives or a hypothesis

- An identification of key literature and previous research regarding the topic of investigation

- An outline of how you propose to collect data (i.e. data collection method)

- An outline of how you propose to analyze data (i.e., data analysis method)

Key Sections of a research proposal

❑ Title page

❑ Summary (or Abstract)

❑ Contents page

❑ List of figures, tables, equations,…

❑ Acknowledgements (optional)

❑ Main body of texts

    ❑ Chapters, sections

❑ References (sources used)

❑ Bibliography (sources read but not used)

❑ Appendices: Gantt chart proposing work schedule, draft surveys..

Abstract (Summary)

- ❑ Abstract (summary) of the proposal would be different with the abstract of the scholarly paper.

- ❑ It would include:

    - ▪ Problems in practice (motivation): Which problem will be tackled? Why is this important?

    - ▪ Gap in existing knowledge (problem statement): What is the theoretical limitation?

    - ▪ Aim and objectives: What will you do? how?

        - ▪ Proposed data collection method

        - ▪ Proposed data analysis method

    - ▪ Implications

        - ▪ Envisioned contribution to existing knowledge and/or;

        - ▪ Envisioned practical significance

Research Aims and Objectives

The primary focus of your research is expressed in terms of <u>aims</u> and <u>objectives</u>.

Aim (Goal): an intention or aspiration; what you hope to achieve; statements of intent, written in broad terms; set out what you hope to achieve at the end of the project.

Objective: a step on the way to meeting the aim; how you will achieve it;
use specific statements which define measurable outcomes.

SMART

- SPECIFIC — S
- MEASURABLE — M
- ATTAINABLE — A
- RELEVANT — R
- TIME-BOUND — T
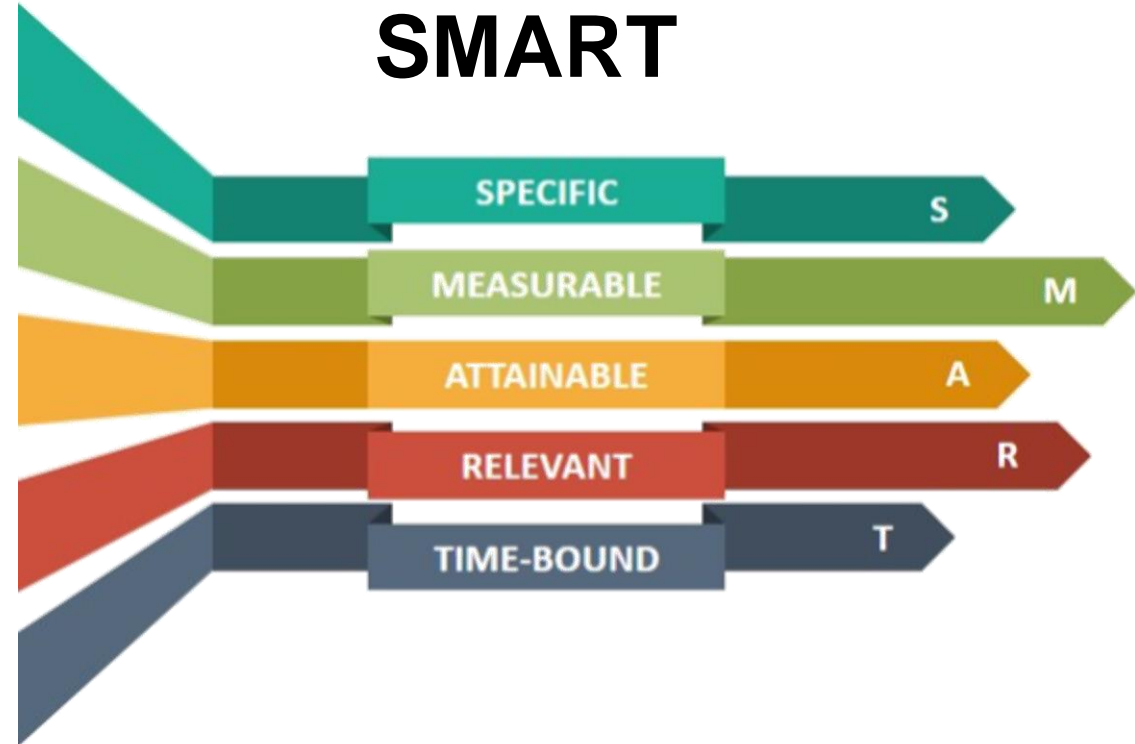
Research Aims

❑ Core focus of your research investigation.

❑ As a statement of intent, the aim sets the scope of the research and can be written in broad terms

❑ Your answer to the question "What is your research about"

❑ Avoid weaker verbs:

appreciate, consider, inquire, learn, know, understand, be aware of, appreciate, listen, perceive, …

❑ Common verbs

Assess, examine, appraise, explain, define, describe, determine, explore, identify, investigate, develop, monitor, establish, test, evaluate

Research Objectives

❑ **Tips for writing "Objectives":**

There is no fixed number of "Objectives", however, 4-8 is a good number.

The objectives when read alone should tell a story through the thesis.

This can be done by ensuring:

✓ 1 or 2 "Objectives" apply to the **literature review**: demonstrating knowledge
(verbs such as Research, Examine, Study, and Investigate are suitable).

✓ 1 or 2 "Objectives" apply to the **research methodology**: how the research is performed
(examples include Collect data, Select interviewees, Analyze results).

✓ 1 or 2 "Objectives" focus on the **critical evaluation** or **discussion**
(verbs such as Analyze, Compare, Discuss, and Evaluate would be appropriate).

✓ In addition, there may be 1 or 2 final objectives to Conclude and/or to Recommend.

When writing "Objectives", keep to just one verb, and avoid the use of "and". If you are using "and" then perhaps this "Objective" should be broken into two separate objectives.

Don't forget that the "Objectives" will need to be repeated and commented on in the conclusion chapter of the thesis.

Research Aims and Objectives

❑ **Example of research "Objectives":**

For the example "Aim" statement earlier, here are some suggested objectives
(note how they start broad, and become more specific):

✓ To examine the current status of the automotive industry.

✓ To study project management as it applies to the automotive industry.

✓ To research project life cycles specifically as used within the automotive industry.

✓ To identify suitable case studies concerning automotive project life cycles for evaluation.

✓ To analyze the case studies.

✓ To compare project life cycles as demonstrated by the case study companies.

✓ To critically evaluate the use of project life cycles at Honda Motor Company.

✓ To recommend improvements to the Honda Motor Company in their use of project life cycles.

Just reading the verbs tells a story through the thesis: to examine, to study, to research, to identify, to analyze, to compare, to evaluate, and finally to recommend.

Research Aims and Objectives
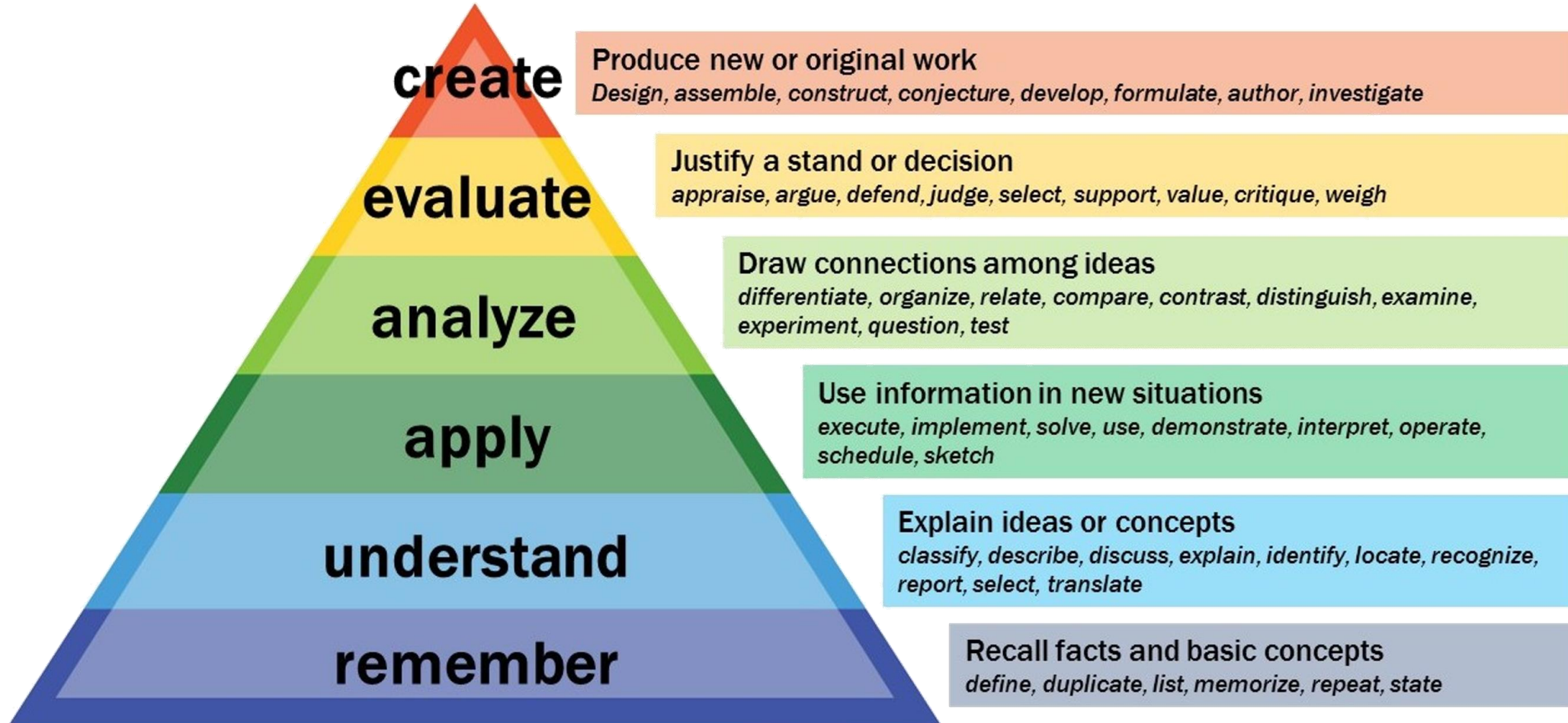
What Is Hypothesis?

- Imagine the following situation:

You are a nutritionist working in a zoo, and one of your responsibilities is to develop a menu plan for the group of monkeys.

In order to get all the vitamins they need, the monkeys have to be given fresh leaves as part of their diet. Choices you consider include leaves of the following species: A, B, C, D, and E.

You know that in the wild the monkeys eat mainly B leaves, but you suspect that this could be because they are safe whilst feeding in B trees, whereas eating any of the other species would make them vulnerable to predation.

You design an experiment to find out which type of leaf the monkeys actually like best: You offer the monkeys all five types of leaves in equal quantities, and observe what they eat.

What Is Hypothesis?

- Which of the following statements is the best hypothesis?

I.   When offered all five types of leaves, the monkeys will preferentially feed on B leaves.

II.   When offered all five types of leaves, the monkeys will preferentially eat the type they like best.

III. When offered all five types of leaves, the monkeys will preferentially eat B leaves because they can eat these safely in their natural habitat.

IV.   In their natural habitat, monkeys that feed in B trees are less vulnerable to predation than monkeys that feed n A, B, D, or E.

V.   When offered all five types of leaves, which type will the monkeys eat preferentially?

What Is Hypothesis?

- "Hypotheses are single **tentative guesses**, good hunches – assumed for use in devising theory or planning experiments intended to be given a direct experimental test when possible". (Eric Rogers, 1966)

- "A hypothesis is a conjectural statement of the **relation between** two or more variables". (Kerlinger, 1956)

- "Hypothesis is a formal statement that presents the **expected relationship** between an independent and dependent variable". (Creswell, 1994)

- "A hypothesis can be defined as a **tentative explanation** of the research problem, a possible outcome of the research, or an educated guess about the research outcome". (Sarantakos, 1993: 1991)

- "A hypothesis is a statement or explanation that is **suggested** by knowledge or observation **but has not, yet, been proved or disproved**". (MacleodClark J and Hockey L 1981)

What Is Hypothesis?

- To summarize, a hypothesis:

    is a **tentative** prediction about the nature of the relationship between two or more variables.

    relates, either generally or specifically, variables to variables.

    is written in a **declarative** sentence form.

    a clear statement of what is intended to be investigated.

    should be specified **before research** is conducted and openly stated in reporting **the results**.

    a powerful tool of **advancement** of knowledge, **consistent** with existing knowledge and conductive

    to **further** enquiry.

Nature of Hypothesis

- Can be tested – verifiable of falsifiable.

- Not a moral or ethical question.

- Neither too specific nor too general.

- A prediction of consequences.

- Considered valuable even if proven false.

Scientists test their *hypotheses* with experiments.

my hypothesis was wrong.

hypothesis (n.) assumption, theory requiring proof

Nature of Hypothesis

- A common practice for writing a good hypothesis is to include two types of variables:
  - **Independent variable(s)**
  - **Dependent variables(s)**

"If skin cancer is related to ultraviolet light, then people with a high exposure to UV light will have a higher frequency of skin cancer."

"If skin cancer is _related_ to ultraviolet light, _then_ people with a high exposure to UV light will have a higher frequency of skin cancer."

"If temperature affects leaf color change, then exposing the plant to low temperatures will result in changes in leaf color."

"If temperature _affects_ leaf color change, _then_ exposing the plant to low temperatures will result in changes in leaf color."

Nature of Hypothesis

- Consider the example of a simple association between two variables, Y and X.

    Y and X are associated (or, there is an association between Y and X).

    Y is related to X (or, Y is dependent on X).

    As X increases, Y decreases (or, increases in values of X appear to effect reduction is values of Y).

- Which one is a better hypothesis? Why?
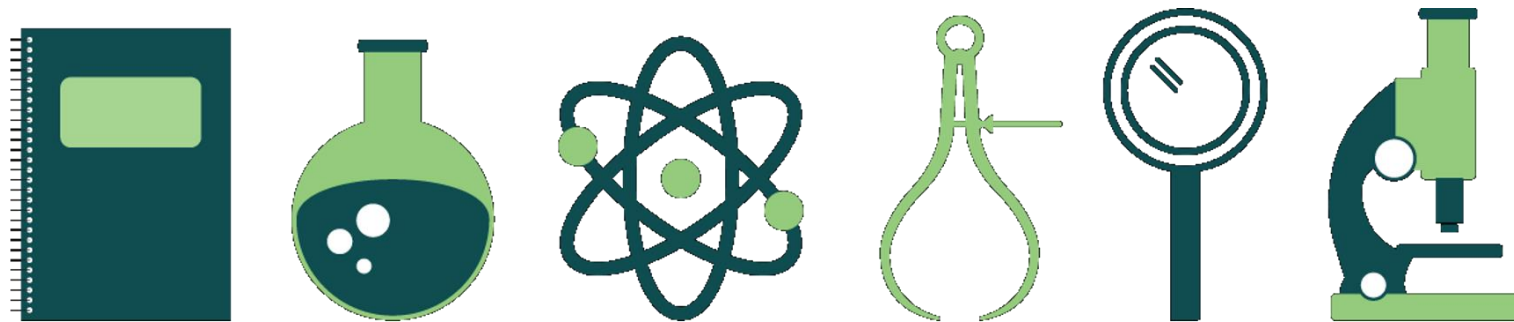
Types of Hypotheses

- **Null Hypothesis**

  Designated by H_0 or H_N

  represents a theory that has been put forward, either because it is believed to be true or because it is to be used as a basis for argument, but has not been proved.

  Has serious outcome if incorrect decision is made!

- **Alternative Hypothesis**

  Designated by H_1 or H_A

  Opposite of Null Hypothesis. Only reached if H_0 is rejected.

  Could be the actual desired conclusion of the researcher!
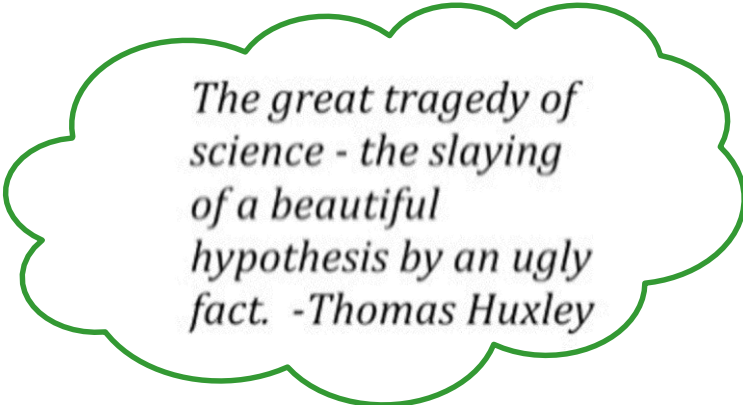
Types of Hypotheses

- **We give special consideration to the null hypothesis…**

    This is because the null hypothesis relates to the statement being tested, whereas the alternative hypothesis relates to the statement to be accepted if/when the null is rejected.

    The final conclusion, once the test has been carried out, is always given in terms of the null hypothesis. We either "reject H_0 in favor of H_1" or "do not reject H_0". We never conclude "reject H_1", or even "accept H_1".

    If we conclude "do not reject H_0", this does not necessarily mean that the null hypothesis is true, it only suggests that there is no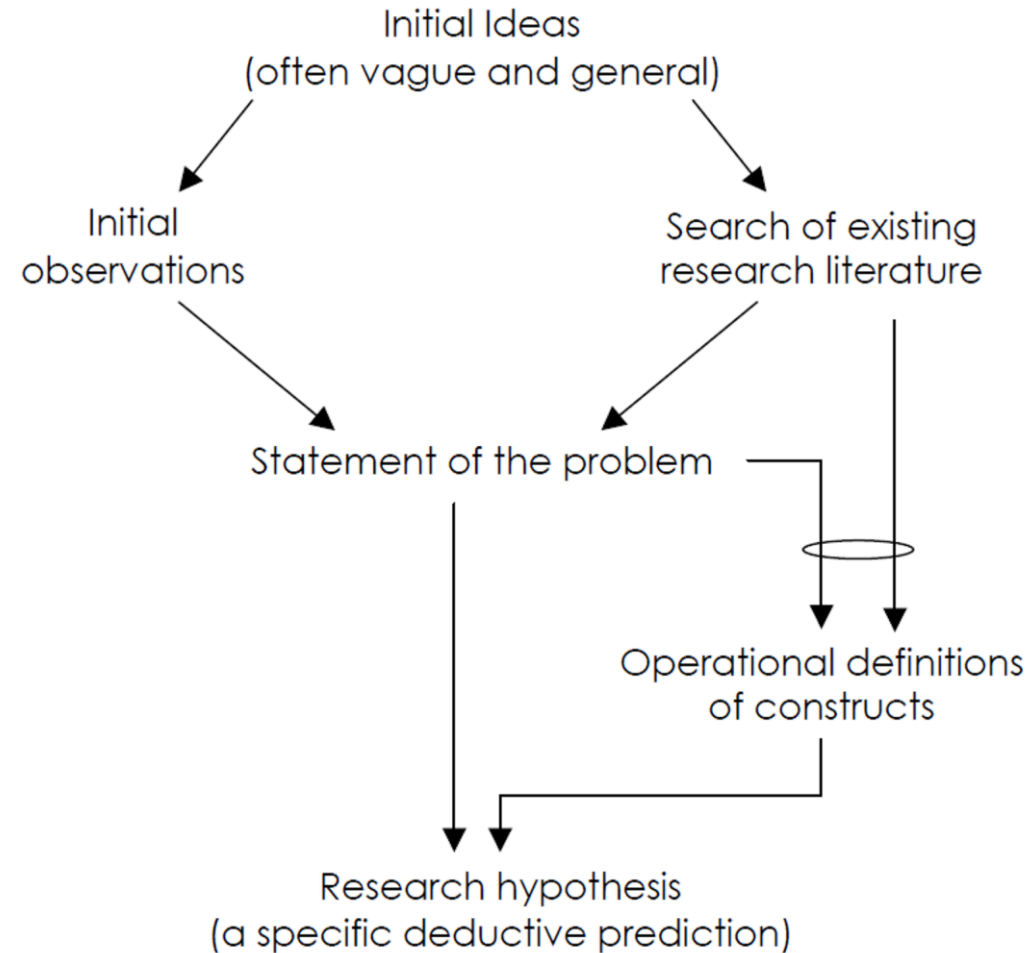t sufficient evidence against H_0 in favor of H_1. Rejecting the null hypothesis thus, suggests that the alternative hypothesis may be true.

The great tragedy of science - the slaying of a beautiful hypothesis by an ugly fact. -Thomas Huxley

Forming a Research Hypotheses

- Problem statements become research hypotheses when constructs are operationalized.

Initial Ideas
(often vague and general)

Initial observations

Search of existing research literature

Statement of the problem

Operational definitions of constructs

Research hypothesis
(a specific deductive prediction)

Testing(Challenging) a Hypotheses

- Hypothesis testing is a 4-step procedure:

  1. Stating the hypothesis (null or alternative)

  2. Setting the criteria for a decision

  3. Collecting data

  4. Evaluate the null hypothesis

- The degree of challenge to the hypothesis will depend on the type of problem and its importance.

- It can range from just seeking "a good enough" solution to a much more rigorous challenge.

- The term "challenging" may include:

Verification	Justification
Refutability	Validity
Rectification	Repeatability
Falsification	

Testing(Challenging) a Hypotheses

Rejecting a properly formulated hypothesis in itself could be worthy of investigator's time and effort.

Testing(Challenging) a Hypotheses

- Which of the following statements is the best hypothesis?

I. When offered all five types of leaves, the monkeys will preferentially feed on B leaves.

II. When offered all five types of leaves, the monkeys will preferentially eat the type they like best.

III. When offered all five types of leaves, the monkeys will preferentially eat B leaves because they can eat these safely in their natural habitat.

IV. In their natural habitat, monkeys that feed in B trees are less vulnerable to predation than monkeys that feed n A, B, D, or E.

V. When offered all five types of leaves, which type will the monkeys eat preferentially?

Assignment

Develop the abstract for your research proposal (pre-proposal)

- One page limit (Font size: 12). By Oct 31. Should be one narrative and include:

    - Motivation

    - Problem Statement

    - Research aim and research objectives.

    - If possible, please write research questions and/or write hypothese.

    - Data collection and analysis methods

    - Envisioned implications

Writing a technical paper asks you to be a historian to document what happened, and writing a research proposal asks you to be a novelist to write a sci-fi novel.