Penelitian Ilmiah dan Logical Thinking

Session Objectives

- To understand the meaning of research
- To understand the meaning of research methodology
- To understand the objectives of research
- To understand the basic steps of conducting research

Session Objectives

- To understand logical reasoning using inductive and deductive approaches
- To understand how to build “argument”
- To understand how to analyze and interpret “argument”
- To understand how to draw conclusion using logical reasoning

Pengertian Penelitian (Research) Menurut KBBI

Penelitian adalah….. “Kegiatan pengumpulan, pengolahan, analisis, dan penyajian data yang dilakukan secara sistematis dan objektif untuk memecahkan suatu persoalan atau menguji hipotesis untuk mengembangkan prinsip-prinsip umum.”

What is Research?

- Research is:

"…the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested"

More Understanding on What is Research ?

- Research is a careful and systematic process of inquiry to find answers to **problem** of interest.
- Research include: use of **facts**, use of **theories**, data (fact) **analysis**, sampling, doing an experiment, going to library to read up on a topic
- To do 'research' is to **investigate the problem** systematically and thoroughly
- Goal of research is to solve '**problem**' of interest

Research Characteristics

- Berasal dari pertanyaan atau masalah.
- Membutuhkan tujuan yang jelas.
- Mengikuti rencana atau prosedur tertentu.
- Seringkali membagi masalah utama menjadi submasalah.
- Dipandu oleh masalah, pertanyaan, atau hipotesis tertentu.
- Menerima asumsi kritis tertentu.
- Membutuhkan pengumpulan dan interpretasi data.

The Aims of Research

- To describe about a phenomena
- To predict about "something" in the future
- To explain about solution of problem
- To interpret what is being investigate

Understanding Scientific Methods

- "Methodos" means way
- Methodology is the discipline of scientific procedures
- Hence, methods are used in the procedures of methodology

Pengertian Metodologi (Kamus Ilmu Pengetahuan)

Metodologi adalah…. “Ilmu tentang metode; Uraian tentang metode.”

Ilmu tentang metode-metode, prosedur-prosedur, prinsip-prinsip yang digunakan dalam disiplin keilmuan;

Cabang logika yang merumuskan atau menganalisis prinsip-prinsip yang diperlukan untuk membentuk kesimpulan dan konsep yang logis

Research Methodology Vs. Research Method

Research Methodology:

- Conceptual frameworks and assumptions used to inform research
- Elaboration of research method

Research Method:

- Research technique or procedure used to gather and analyses data

Sometime the distinction is not clear cut

- “Complex research uses research methodology, simple research uses research method”

Why Methodology ?

It will make you better able to understand and utilize scientific information in both your personal life and your work.

It will make you a more literate and cultured person.

It provides you some insight not only into particular scientific findings but also into the general nature of science as a human activity.

Nature of Research in CS/IS/IT

Research in CS often requires experimental design as well as theoretical (basic) research

- Hence, we have to have a methodology in order to conduct research CS
- *Science approach :new knowledge, theory*

Research in IS often requires system development

- Hence, we have to have a methodology in order to develop a system (IS/IT system)
- *Engineering approach: construction of useful products*
- This IS Development Methodology can be used as a Research Methodology in IS/IT field.

Research in IT often requires survey of system components

How to Start A Research?

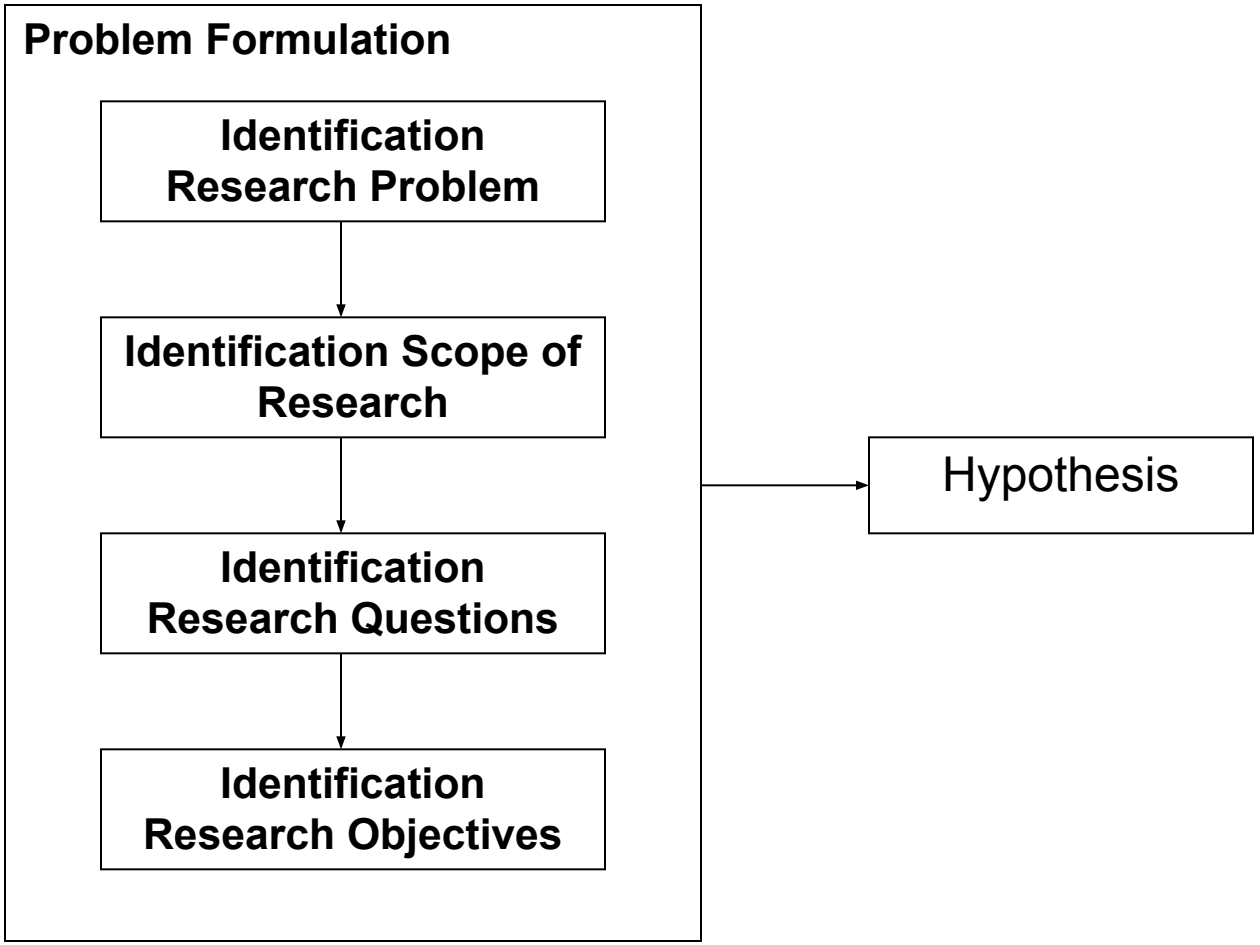
Determine a well define problem

- Understanding about something
  - Science approach: phenomena, theory, hypothesis, experiment..
- Constructing product
  - Engineering approach: build a system that perform a (unique) task, experiment, convergence results (stable)..

Follow the steps in the research methodology

Research results: knowledge, algorithm, methods, product (system), model, etc…

Problem Formulation



Q/A

Why Logical Thinking?

To form and evaluate our “believe” on a statement.

To determined logically an objectively whether a statement is valid or not.

To draw a conclusion from a logical thinking processes.

Logical thinking consists on input, process, and output.

Definition of Logic

Logika (*logic*) merupakan suatu studi tentang metode-metode dan prinsip-prinsip yang digunakan dalam membedakan penalaran (*reasoning*) yang tepat dari penalaran yang tidak tepat**[**Hayon, Y.P., 2000**]**.

Penalaran (*reasoning*, jalan pikiran) adalah suatu proses berpikir yang berusaha menghubung-hubungkan fakta-fakta atau evidansi-evidansi yang diketahui menuju kepada suatu kesimpulan**[**Keraf, Gorys, 1994**]**.

Elements of Logic

Dalam logika terdapat beberapa elemen yang terkait seperti:

- Argumen (*argument*),
- Premis-premis (*premises*),
- Proposisi (*propositions*),
- *Inference*,
- dan *Conclusion.*

Implikasi lainnya adalah kita dapat mulai dari premis yang salah, memprosesnya melalui ***inference*** yang valid dan menuju pada kesimpulan yang benar**.**

Argument

Suatu **argumen** disebut argumen yang sah, atau valid, atau logis, jika kesimpulannya ditarik mengikuti hukum-hukum logika.

Suatu argumen dikatakan valid atau sahih apabila kesimpulan yang terdapat pada argumen tersebut mempunyai kaitan dengan premis-premis sedemikian rupa sehingga kesimpulan itu benar apabila premis-premis yang mendahuluinya benar.

Peranan logika menjadi penting karena pada dasarnya, logika mengevaluasi validitas suatu argumen, sedangkan argumen merupakan salah satu syarat bagi pengembangan ilmu.

Tanpa menggunakan logika dalam mengemukakan penalarannya, para ilmuwan tidak mungkin dapat mengembangkan ilmunya.

Premise

Premis adalah pernyataan yang benar, yang kebenarannya sudah kita ketahui sebelumnya berdasarkan atas argumen sebelumnya, atau terbukti sendiri (*self-evident*), atau yang kita percaya sebagai benar walaupun belum terbukti.

Proposition…(Source: Wikipedia)

In logic and philosophy, the term **proposition** refers to either (a) the *"content"* or *"meaning"* of a meaningful declarative sentence or (b) the pattern of symbols, marks, or sounds that make up a meaningful declarative sentence.

The meaning of a *proposition* includes having the quality or property of being either true or false, and as such propositions are claimed to be truth bearers.

Inference (Source: Wikipedia)

Inference is the act or process of deriving logical conclusions from premises known or assumed to be true.[1] The conclusion drawn is also called an idiomatic. The laws of valid inference are studied in the field of logic.

Human inference (i.e. how humans draw conclusions) is traditionally studied within the field of cognitive psychology; artificial intelligence researchers develop automated inference systems to emulate human inference. Statistical inference allows for inference from quantitative data.

Definition…..

Inductive logical of thinking

- The principle of reasoning to a conclusion about all the members of a class from examination of only a few members of the class
- Reasoning from particular to general

Deductive logical of thinking

- Reasoning from general to particular
- Conclusion follows from the premises
- The premises logically imply the conclusion

Features of Inductive Reasoning

- Evidence
- Premises
- Conclusion
- Argument

Schematic Form of a Simple Inductive Argument

- Inductive argument consists of premises and conclusion
- Premise can be found through observation (data gathering an analysis)
- Structure of argument:

First Premise

Second Premise

n… Premise

Conclusion

Inductive Argument

- It will be possible for a good inductive argument to have a false conclusion even though all its premises are true (what does it mean?)
- Science uses inductive reasoning all the time (explain!)
- Reasoning from sample, Reasoning from examples (the different sample vs. example?)
- Knowledge expanding (how knowledge expanding?)
  - Using inductive argument

Contoh Logika Induktif

1. Apel 1 keras, warnanya hijau, dan rasanya masam
2. Apel 2 keras, warnanya hijau, dan rasanya masam
3. Apel 3 keras, warnanya hijau, dan rasanya masam

Jadi semua apel keras, warnanya hijau, dan rasanya masam

“Bisa jadi kesimpulan ini salah karena sample yang diambil tidak representatif?”

Bahaya Menggunakan Logika Induktif

- Terlalu cepat menarik kesimpulan yang berlaku umum, sementara jumlah kasus yang digunakan dalam premis kurang memadai.
- Premis yang digunakan kurang memenuhi kaedah-kaedah keilmiahan.
  - Dipilih berdasarkan pilih kasih, seharusnya randomize
  - Instrument yang digunakan diragukan validitas dan reliabilitasnya.

Logika Deduktif

- Penalaran deduktif berdasarkan pengetahuan sebelumnya yang bersifat umum, dan menyimpulkan pengetahuan baru yang bersifat khusus.
- Bersifat silogisme: argumen yang terdiri dari premis-premis dan kesimpulan.
- Hubungan antara premis-premis dengan kesimpulan merupakan hubungan yang tidak terpisahkan satu sama lain.
- Intinya terletak pada tepat tidaknya “hubungan” antara premis-2 dengan kesimpulan.
- Bersifat a priori: premis-premis tidak memerlukan pengamatan inderawi atau empiris

Contoh Logika Deduktif

1. Semua manusia berakal budi
2. Cecep adalah manusia

Kesimpulan: Cecep berakal budi

Ciri-ciri Logika Deduktif

- Analitis: kesimpulan ditarik hanya dengan menganalisa proposisi-proposisi atau premis-premis yang sudah ada.
- Tautologis: kesimpulan yang ditarik sesungguhnya secara tersirat sudah terkandung dalam premis-premisnya.
- A priori: kesimpulan ditarik tanpa pengamatan inderawi atau obeservasi empiris.
- Argumen deduktif selalu dapat dinilai valid atau tidak valid.

Contoh Logika Deduktif

Premis:

- Jarak Jakarta-Surabaya kurang dari 750 km, atau antara 750 dan 1500 km, atau lebih besar dari 1500 km.

2. Jarak Jakarta-Surabaya tidak lebih kecil dari 750 km.

3. Jarak Jakarta-Surabaya tidak lebih besar dari 1500 km.

Kesimpulan

Maka jarak Jakarta-Surabaya antara 750 km sampai 1500 km.

Apakah argumen di atas sahih (valid)?

Logical Fallacies

- Logical fallacies, Logical errors in scientific writings.
- Logic is the set of rules by which one can formulate convincing arguments
- It is "the science of argument."
- If an argument contains a fallacy, then the conclusion will not necessarily be proven.

General Categories of Fallacies

- Material fallacies
- Fallacies of relevance
- Verbal fallacies.

Material fallacies

- Material fallacy merupakan kesalahan dalam argumen.
- Misalnya, menggunakan salah satu iPhone yang rusak mengakibatkan bahwa semua iPhone yang diproduksi sebagai barang gagal dan produksi yang tergesa-gesa.

Fallacies of Relevance

- Fallacy tipe ini adalah fallacy yang memiliki pernyataan atau argumentasi yang tidak sesuai dengan konklusinya. Tipe fallacy ini seringkali digunakan oleh para peneliti yang senang “memaksakan” sesuatu pernyataan agar terlihat logis.
- A: Berdasarkan penelitian, coklat itu lebih sehat daripada alkohol.
  B: Alkohol itu kesukaan saya, dan selama ini saya sehat-sehat saja. Jadi alkohol itu lebih sehat daripada coklat.

Verbal Fallacies

- Verbal fallacies deal principally with the misusage of words.
- An argument which contains "improper or ambiguous use of words" is invalid.
- Serang (kota vs tempur), bisa (dapat vs racun), kucing makan tikus mati, Dijual kursi bayi tanpa lengan.

The Importance of Understanding Logical Fallacies

- Identifying logical fallacies is an important skill for everyone to have.
- It is not only helps one to avoid accepting false conclusions, but it also helps one to learn better reasoning and debating skills.
- The process of looking for logical fallacies can help one to better understand the subject one is reading about or discussing.
- Knowing how to identify fallacies and how to avoid using them, can make one better prepared to refute false ideas and present the truth.

Exercise your thought….

Give examples of inductive reasoning

Give examples of deductive reasoning

What are the advantages and disadvantages of using inductive and deductive reasoning?

How do you apply logical reasoning in advancing knowledge?