

Metodologi Penelitian Kerekayasaan

Kuliah : TUGAS AKHIR I
(IME-184400)

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- 1 Pendahuluan
- 2 Chap 1: What Is Research?
 - How to develop & accessing knowledge?
 - Objectives of Engineering Research
 - Motivation in Engineering Research
- 3 Types of Engineering Research
- 4 Finding and Solving a Worthwhile Problem

Setelah mengikuti kuliah ini, diharapkan mahasiswa akan:

- Mengerti makna dari melakukan sebuah penelitian di bidang rekayasa.
- Mampu memahami langkah-langkah melakukan penelitian rekayasa (*engineering research methodology*).
- Mampu menyusun dokumen Proposal Tugas Akhir sesuai dengan topik yang dipilihnya dengan mengikuti kaidah-kaidah ilmiah yang berlaku. Dokumen Proposal Tugas Akhir yang dimaksud berisi bagian Pendahuluan, Teori Dasar dan Perancangan Sistem.

- Kuliah di kelas, dengan materi: Metodologi Penelitian Kerekayasaan.
- Tugas *paper review*, sesuai topik masing-masing mahasiswa.
- Presentasi proposal Tugas Akhir, terutama bagian Pendahuluan.
- Pembuatan dokumen ilmiah Proposal Tugas Akhir yang terdiri dari:
 - Bab I: Pendahuluan.
 - Bab II: Teori Dasar.
 - Bab III: Perancangan Sistem.
 - Daftar Pustaka (sementara).

Rencana Pembelajaran

Minggu	Deskripsi	Bobot
1-4	Metodologi Penelitian	-
5-7	Pembahasan Bab I (Presentasi & diskusi)	-
8	UTS	10%
9-11	Pembahasan Bab I (Presentasi & diskusi)	5%
12-14	Pembahasan Bab I (Presentasi & diskusi)	5%
15-16	Sidang Proposal Tugas Akhir	80%

- Dipankar Deb, Rajeeb Dey, & Valentina E. Balas. (2019). *Engineering Research Methodology: A Practical Insight for Researchers*. Springer Nature. Singapore.
- Wayne C. Booth, Gregory G. Colomb, & Joseph M. Williams. (2008). *The Craft of Research*. 3rd ed. The University of Chicago Press. Chicago & London.
- Krishnan Nallaperumal. (2015). *Engineering research methodology A computer science and engineering and information and communication technologies perspective*.

What Is Research?

- Research refers to a careful, well-defined (or redefined), objective, and systematic method of search for knowledge, or formulation of a theory that is driven by inquisitiveness for that which is unknown and useful on a particular aspect so as to make an original contribution to expand the existing knowledge base.
- Research involves formulation of hypothesis or proposition of solutions, data analysis, and deductions; and ascertaining whether the conclusions fit the hypothesis.
- Research is a process of creating, or formulating knowledge that does not yet exist.

Ref: [1]

What Is Research?

Research cycle starts with basically a practical problem: one must be clear what the problem being attempted to solve is and why it is important. This problem motivates a research question without which one can tend to get lost in a giant swamp of information. The question helps one zero in onto manageable volume of information, and in turn defines a research project which is an activity or set of activities that ultimately leads to result or answer, which in turn helps to solve practical problem that one started with in the first place as shown in Fig. 1.

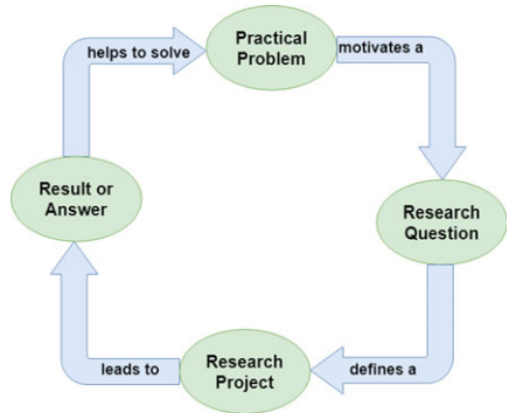


Figure 1: Research flow [2].

How to develop & accessing knowledge?

- 1 **Observation** is the most fundamental way of obtaining information from a source, and it could be significant in itself if the thing that we are trying to observe is really strange or exciting, or is difficult to observe.
- 2 **Models** are approximated, often simplified ways of describing sometimes very complex interactions in the form of a statistical relationship, a figure, or a set of mathematical equations.
- 3 **arranging or doing things through processes**, algorithms, procedures, arrangements, or reference designs, to get a certain desired result.

The categories of knowledge

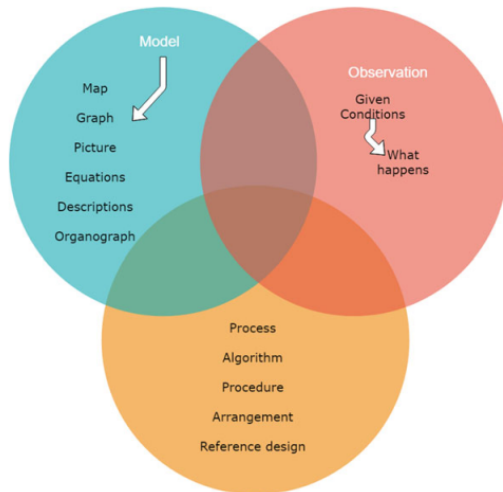


Figure 2: The categories of knowledge in research.

Objectives of Engineering Research

- 1 To solve new and important problems, and since the conclusion at the end of one's research outcome has to be new, but when one starts, the conclusion is unknown.
- 2 Knowing where and how to find different types of information helps one solve engineering problems, in both academic and professional career.
- 3 To apply scientific approaches to seek answers to open questions, and although each research study is particularly suited for a certain approach, in general, the following are different types of research studies: exploratory or formulative, descriptive, diagnostic, and hypothesis-testing.
- 4 Should be to develop new theoretical or applied knowledge and not necessarily limited to obtaining abilities to obtain the desired result.

Motivation in Engineering Research

- 1 **Intrinsic motivations:** interest, challenge, learning, meaning, purpose, are linked to strong creative performance.
- 2 **Extrinsic motivations:** rewards for good work include money, fame, awards, praise, and status.
- 3 **Influences from others:** competition, collaboration, commitment, and encouragement.
- 4 **Personal motivation** in solving unsolved problems, intellectual joy, service to community, and respectability are all driving factors.

Types of Engineering Research

- 1 **Descriptive vs. Analytical.** Descriptive research includes comparative and correlational methods, and fact-finding inquiries, to effectively describe the present state of art. In analytical research, already available facts for analysis and critical evaluation are utilized. Some research studies can be both descriptive and analytical.
- 2 **Applied vs. Fundamental.** Applied research seeks to solve an immediate problem facing the organization, whereas fundamental research is concerned with generalizations and formulation of a theory.
- 3 **Quantitative vs. Qualitative.** Quantitative research uses statistical observations of a sufficiently large number of representative cases to draw any conclusions, while qualitative researchers rely on a few nonrepresentative cases or verbal narrative in behavioral studies.

Finding and Solving a Worthwhile Problem

Four step procedure for mathematical problem-solving (George Pólya, 1887–1985)

- 1 Understand the problem, restate it as if its your own, visualize the problem by drawing figures, & determine if something more is needed.
- 2 One must start somewhere and systematically explore possible strategies to solve the problem or a simpler version of it while looking for patterns.
- 3 Execute the plan to see if it works, and if it does not then start over with another approach. Having delved into the problem and returned to it multiple times, one might have a flash of insight or a new idea to solve the problem.
- 4 Looking back and reflecting helps in understanding and assimilating the strategy, and is a sort of investment into the future.