Evaluation in Software Engineering

Eduardo Figueiredo

http://www.dcc.ufmg.br/~figueiredo
What is Software Engineering?

Software Engineering means application of a systematic, disciplined, quantifiable approach to development, operation and maintenance of software.

IEEE Standard Glossary

- Evaluation and measurement play a pivotal role in Software Engineering
Software Engineering was born in 1968, but it is still maturing.

Software development is by no means easy
- It runs over a long period of time
- It involves many people and technologies
The complexity of software process means that it is hard to be optimized.

- Companies need to continuously try to improve their software processes.
Software engineers need to know methods, process and techniques

- But, they also should know how to evaluate them

A practitioner wants to evaluate methods and techniques before introducing them into the organization

A researcher wants to evaluate new results against something existing
Evaluation is Control

“You can't control what you can't measure”  
Tom DeMarco

- Control comes from being able to evaluate new methods, techniques, languages and tools
Process Evaluation

- The real evaluation of a process requires people using it
  - Empirical studies are crucial to evaluate process and human-based activities

- Empirical studies are common in social and behavioral sciences
To perform scientific research in software engineering, we have to:
- Understand the methods available
- Understand their limitations
- Understand when they can be applied

There are four main research methods in software engineering:
- Analytical and Scientific
- Engineering and Empirical
Analytical and Scientific

- **Analytical Method**
  - A formal theory is proposed and then compared with empirical observations
  - It is often used in more formal areas of computer science, such as algorithms

- **Scientific Method**
  - The world is observed and a model is build based on observations
  - It is usually used in applied areas, such as network (to evaluate performance)
Engineering and Empirical

- **Engineering Method**
  - The current solutions are studied and changes are proposed
  - It is dominating in industry

- **Empirical Method**
  - A new model is proposed and evaluated through empirical studies
  - Empirical studies have traditionally been used in social sciences and psychology
The need for Scientific Approach

- The engineering and empirical methods are variations of the scientific method
- A more scientific approach to software engineering is needed
  - Engineering method involves higher costs due to actual changes
  - The nature of software engineering is similar to social sciences (it depends on human behavior)
Let’s Use Empirical Methods

- Empirical methods need to be further studied and used in software engineering.
- The need for systematic experimentation has been emphasized since middle 80s.
  - Basili raised this concern followed by Fenton, Kitchenham, Pfleeger and others.
- The number of experiments in software engineering has increased since then.
  - Chapter 1 - Introduction