

# Software Engineering Experimentation

## Types of Experimental Studies

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## A Suggested Categorization of Empirical Research Studies

IT 821, Fall 2001

1. Demonstration of Concept
2. Demonstration of Feasibility
3. Controlled Case Study
4. Practical Field Study
5. Empirical Analysis
6. Limited Lab Experiment
7. Realistic Experiment
8. Survey

## 1. Demonstration of Concept

An idea is tried. An implementation is built, a process is followed, or a technique is used. This should demonstrate that the concept can actually be used.

**Summary: This idea can be applied.**

## 2. Demonstration of Feasibility

An idea is evaluated in some way, either by trying it and analyzing the results or comparing the results with a traditional method. This does not necessarily control variables or attempt to generalize to a broad range of cases.

**Summary: This idea can work and be competitive with other ideas.**

### 3. Controlled Case Study

An idea is used in a limited situation but using realistic assumptions. Variables are not controlled, in fact, a bias might be intentionally included to indicate under what situations the idea can be useful. This does not necessarily generalize to a broad range of cases, but can give hope that the idea is useful.

**Summary: The idea works, at least in some situations.**

### 4. Practical Field Study

An idea is used in a practical, realistic situation to help produce a real product. This has all the characteristics of a case study, but is on a large scale.

**Summary: The idea works in practice.**

## 5. Empirical Analysis

Data is collected and analyzed, with care and attention to potential biases. There does not necessarily have to be an a priori hypothesis, and the data may or may not be based on realistic subjects.

**Summary: To analyze current practice or theory and to generate new directions for empirical research.**

## 6. Limited Lab Experiment

A hypothesis is generated, variables carefully identified and controlled, and data is collected in a scientific manner. The data is analyzed to evaluate the hypothesis. Detailed statistical analysis may or may not be necessary. The experiment may suffer from restrictions such as size of artifacts, number of subjects and artifacts, and technique used. The hypothesis may or may not be of broad applicability.

**Summary: To give strong evidence that the hypothesis is true.**

## 7. Realistic Experiment

Much like a Limited Lab Experiment, but using realistic artifacts. A hypothesis is generated, variables carefully identified and controlled, and data is collected in a scientific manner. The data is analyzed to evaluate the hypothesis, perhaps using detailed statistical analysis. The artifacts and subjects should be typical for the field of study -- e.g., professional programmers and actual software products. The hypothesis may or may not be of broad applicability.

**Summary: To give convincing evidence that the hypothesis is true.**

## 8. Survey

A “meta-empirical” paper. A paper about experimentation, about experimental papers, or that summarizes a group of experimental papers.

**Summary: To educate about experimentation or to coalesce results from a number of related studies.**

## **Summary of Types of Studies**

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6. Limited Lab Experiment
7. Realistic Experiment
8. Survey