

Software Engineering Experimentation

Experimental Framework

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Experimental Framework

- Victor Basili, Richard Selby and David Hutchens, “Experimentation in Software Engineering”, IEEE Transactions on Software Engineering, SE-12(7):733–743, July 1986
- A little old but still relevant and helpful
- Three objectives
 1. Framework for performing experiments
 2. Classify and discuss experiments
 3. Problem areas and lessons learned

Framework



- Four categories
 1. Definition – Problem definition and hypothesis
 2. Planning – Design
 3. Operation – Conduct test
 4. Interpretation – Hypothesis test, disseminate

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Framework – 1. Definition



Motivation (why)	Object (what)	Purpose (what)	Perspective (who)	Domain (which)	Scope (which)
Understand	Product	Characterize	Developer	Programmer	Single project
Assess	Process	Evaluate	Modifier	Program /	Multi-project
Manage	Model	Predict	Maintainer	project	Replicated project
Engineer	Metric	Motivate	Project manager		Blocked subject-
Learn	Theory		Corp. manager		project
Improve			Customer		
Validate			User		
Assure			Researcher		

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Framework – 2. Planning



Design (samples, control)	Criteria (what to measure)	Measurement (how to measure)
Experimental designs	Direct reflections of cost / quality	Metric definition
Incomplete block	Cost	Goal-question-metric
Completely random	Errors	Factor-criteria-metric
Randomized block	Changes	Metric validation
Fractional factorial	Reliability	Data collection
Multivariate analysis	Correctness	Automatability
Correlation	Indirect reflections of cost / quality	Form design and test
Factor analysis	Data coupling	Objective vs. subjective
Regression	Information visibility	Level of measurement
Statistical models	Programmer comprehension	Nominal / classificatory
Non-parametric	Execution coverage	Ordinal / ranking
Sampling	Size	Interval
	Complexity	Ratio

Framework – 3. Operation



Preparation	Execution	Analysis
Pilot study	Data collection Data Validation	Quantitative vs. qualitative Preliminary data analysis Plots and histograms Model assumptions Primary data analysis Model application

Framework – 4. Interpretation

Interpretation context	Extrapolation	Impact
Statistical framework Study purpose Field of research	Sample representativeness	Visibility Replication Application

Framework Example

Definition Element	Example
Motivation	To improve unit testing
Object	characterize and evaluate
Purpose	process of functional & structural testing
Perspective	from the perspective of the developer
Domain: programmer	as they are applied by experienced programmers
Domain: program	to unit-size software
Scope	in a blocked subject-project study