



Faculty of Engineering and Technology Master of Software Engineering (SWEN)

Research Methods in Software Engineering (SWEN6302)

طرق البحث في هندسة البرمجيات

Second Semester 2018/2019

Instructor:	Dr. Abdel Salam Sayyad	asayyad@birzeit.edu
Class Meeting Times:	S 9:00 – 11:40	Room: Masri 407
Office Hours:	S 11:40 – 12:40	Office: Masri 115

Course Description

Research Methods applicable to Software Engineering: definition of scientific research, scientific research approaches: inductive, conductive and deductive; bibliography and citations, ethical principles in research, qualitative and quantitative methods; action research, analytic research, define and collect appropriate software metrics, introduction to empirical research methods and techniques, and statistical analysis. The course will cover general techniques applicable to any research project, including formulating research questions, theory building, data analysis, building evidence, assessing validity, and publishing.

The course aims to provide students with comprehensive understanding and analysis of research methods and apply these methods through relevant case studies and research investigation in software engineering research questions.

Course Objectives

1. Explore the main topics in research and practice used in Software Engineering.
2. Introduce the Qualitative Methods and Analysis
3. Introduce the Quantitative Methods and Analysis
4. Introduce hypothesis testing, how to formulate research questions, and statistical techniques commonly applied in empirical investigations.
5. Choose appropriate research designs and methods for their own projects, and critically evaluate the work of other researchers.

Intended Learning Outcomes (ILOs)

Knowledge and understanding

1. Demonstrate knowledge of the main empirical methods: surveys, case studies, and experiments.

2. Understand the processes involved in carrying out quantitative and qualitative research;

Practical and subject specific skills (Transferable Skills)

1. Demonstrate the ability to plan and conduct empirical studies and to analyze, interpret, and report the results.
2. Apply the hypothesis testing using parametric and non-parametric tests

Cognitive skills (thinking and analysis)

1. Demonstrate the ability to critically analyze and evaluate empirical papers.
2. Evaluate and design appropriate research techniques to assess empirical concerns and problems.

Schedule

Hrs	Topic
3	Introduction & Orientation Should Computer Scientists Experiment More? No Silver Bullet – Essence and Accident in Software Engineering
3	Research Design and Ethics What makes a good research paper? Research Design Research Ethics
3	Personal Opinion Surveys Survey Design Response Rates and Motivation Researcher Bias Survey Validity and Reliability
3	Threats to Validity Construct Validity Internal Validity Conclusion Validity External Validity
3	Systematic Literature Reviews Planning the Review Conducting the Review Reporting the Review
3	Measurement Scale Types Objective and Subjective Measures Direct or Indirect Measures
3	Case studies Single and multi-case Longitudinal Case studies Approaches to Data collection
6	Experiments Controlled Experiments Quasi-experiments Scoping and sampling Hypothesis Formulation

Hrs	Topic
	Threats to Validity Replication
9	Quantitative analysis Descriptive statistics Measures of central tendency Measures of dispersion Measures of Dependency Significant figures Data set Reduction Hypothesis testing Basic concepts Parametric and nonparametric tests Various statistical test (t-test, ANOVA, f-test, Chi-2) Choosing statistical model Model adequacy checking Drawing conclusions
3	Qualitative methods & Qualitative analysis Action research Pilot study Benchmarking Grounded theory
3	Writing an academic paper General Guidelines Where to publish The peer review process
3	Final Exam

Evaluation

- Class Participation, Assignments 25%
- Paper presentation 15%
- Research Project 30%
- Final Exam 30%

References

1. Wohlin, C., Per Runeson, P. et al. (2012) *Experimentation in Software Engineering*, Springer Heidelberg New York Dordrecht London. ISBN 978-3-642-29043-5
2. Balnaves, M. and Caputi P. (2001) *Introduction to Quantitative Research Methods*, SAGE Publications London. ISBN 0-7619-6803-2
3. Hasselbring, W. and Giesecke, S., eds. (2006) *Research Methods in Software Engineering* Gito Verlag, Berlin, Germany. ISBN 9783936771572.
4. Hasselbring, W., B. Kitchenham, S. L. Pfleeger, F. Shull (eds.), *Guide to Advanced Empirical Software Engineering*, Springer 2008. Chapters 4, 5, 6 (6.1-6.4) and 7 from the book *Experimentation in Software Engineering: An Introduction*.