Power Analysis and Sample Size Determination for Complex Designs Training Course

Professional Development Training Course Outline

Category	Research and Data Analysis	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In today's data-driven world, precision in research design is crucial. Power Analysis and Sample Size Determination for Complex Designs Training Course empowers participants with cutting-edge tools and methodologies to conduct robust statistical analyses. This intensive, hands-on program is designed to help researchers, data analysts, and professionals understand the core principles of power analysis, effect size, and sample size estimation across various complex statistical models, including multilevel, longitudinal, and mixed designs. With growing reliance on data-informed decision-making, mastering these techniques ensures resource-efficient and statistically valid outcomes.

This course is tailored to match current demands in advanced quantitative research by combining theoretical knowledge with practical application. Using real-world case studies and advanced software tools, participants will learn how to optimize study design, increase analytical precision, and minimize errors. Whether you're designing randomized controlled trials or multivariate observational studies, this course provides a comprehensive toolkit to help ensure valid and generalizable results, driving higher impact and credibility in your findings.

Programme Curriculum

Power Analysis and Sample Size Determination for Complex Designs Training Course

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Course Objectives

By the end of the course, participants will be able to:

1. Understand the fundamentals of power analysis and its role in research.
2. Define effect size, Type I and II errors, and their implications for statistical inference.
3. Calculate sample size for t-tests, ANOVA, regression, and chi-square tests.
4. Apply power analysis techniques in multilevel and hierarchical models.
5. Conduct power analysis for repeated measures and longitudinal data.
6. Determine optimal sample sizes for complex and mixed study designs.
7. Use software tools like G*Power, R, and SAS for sample size estimation.
8. Analyze the impact of design parameters on statistical power.
9. Explore Bayesian approaches to power analysis and sample determination.
10. Interpret power curves and sensitivity analysis in real-world scenarios.
11. Integrate ethical and practical considerations in sample planning.
12. Translate statistical results into actionable research decisions.
13. Evaluate case-based scenarios for methodological rigor and accuracy.

Target Audiences

1. Biostatisticians
2. Academic Researchers
3. Clinical Trial Designers
4. Social Science Methodologists
5. Epidemiologists
6. Market Researchers
7. Graduate Students in Quantitative Fields
8. Data Scientists and Analysts

Course Duration: 10 days

Course Modules

Module 1: Introduction to Power Analysis and Sample Size Determination

- Understanding key statistical concepts
- Importance of power analysis in research
- Overview of sample size estimation methods
- Ethical implications of under/over-sampling
- Introduction to G*Power software
- **Case Study:** Underpowered clinical trial outcomes

Module 2: Effect Size and Its Implications

- Types of effect size: Cohen’s d, ?², odds ratio
- Choosing an appropriate effect size
- Impact on power and sample size
- Reporting and interpreting effect size
- Estimating effect sizes from pilot data

- **Case Study:** Effect size inflation in social science

Module 3: Power Analysis for Parametric Tests

- t-tests (independent, paired), ANOVA
- Sample size tables vs software computation
- Setting alpha and beta levels
- Post-hoc vs a priori power analysis
- Effect of variance on sample size
- **Case Study:** Educational intervention effectiveness

Module 4: Regression and Correlation Analysis

- Power in linear and logistic regression
- Detecting small vs large effects
- Predictor selection and sample planning
- Multicollinearity impact
- Using R for regression power analysis
- **Case Study:** Predicting disease risk using lifestyle factors

Module 5: Multilevel and Hierarchical Models

- Introduction to nested designs
- Sample size at each level
- Intraclass correlation and power
- Design effect and design efficiency
- Using MLwiN or R packages for computation
- **Case Study:** School-based intervention study

Module 6: Longitudinal and Repeated Measures Design

- Timepoints vs subjects: planning strategies
- Handling attrition and dropout
- Mixed model vs ANOVA approaches
- Autocorrelation and variance structure
- Software tools for longitudinal design
- **Case Study:** Behavioral tracking study in children

Module 7: Mixed and Complex Designs

- Combining designs: factorial, crossover, split-plot
- Interaction effects and sample size
- Balanced vs unbalanced designs
- Covariates and confounders
- Power analysis for nested factorial designs
- **Case Study:** Agricultural productivity experiment

Module 8: Bayesian Power and Sample Size Approaches

- Contrast with frequentist methods
- Use of priors in determining power
- Posterior predictive checks
- Simulating Bayesian power
- Bayesian software (e.g., JAGS, Stan) overview
- **Case Study:** Ecological modeling and forecasting

Module 9: Software Applications and Tools

- Overview of G*Power, R, PASS, SAS, STATA
- Input/output interpretations
- Common user errors and solutions
- Data visualization of power curves
- Hands-on software tutorials
- **Case Study:** Public health intervention planning

Module 10: Sensitivity Analysis and Power Curves

- Exploring changes in assumptions
- Interpreting and using power curves
- Adaptive designs and sample recalculation
- Threshold analysis for decision making
- Interactive visualization tools
- **Case Study:** Medical device testing redesign

Module 11: Planning and Reporting Guidelines

- CONSORT and SAMPL guidelines
- Transparent reporting of power analysis
- Writing sample size justifications
- Journal expectations and templates
- Integrating results into research protocols
- **Case Study:** Grant proposal for randomized trial

Module 12: Ethical and Practical Considerations

- Risks of under/overestimating sample size
- Budget and time constraints
- Stakeholder communication strategies
- Balancing power with feasibility
- Risk mitigation plans
- **Case Study:** Ethical dilemmas in community trials

Module 13: Real-World Applications Across Fields

- Medical, behavioral, economic, and engineering applications
- Case diversity and design variety
- Cross-sectional vs longitudinal sampling
- Non-normal distributions and small samples
- Lessons learned from published studies
- **Case Study:** Policy research power analysis audit

Module 14: Common Pitfalls and Troubleshooting

- Misinterpretation of statistical parameters
- Overreliance on defaults in software
- Ignoring design complexity
- Sample bias and generalizability
- Corrective strategies and tools
- **Case Study:** Retrospective audit of flawed study

Module 15: Capstone: Project Simulation and Peer Review

- Choose or design a study
- Perform full power analysis and sample planning

- Peer review and critique
- Presentation and reporting session
- Instructor feedback and revision
- **Case Study:** Capstone report based on peer-reviewed journal standards

Training Methodology

- Instructor-led presentations with live demonstrations
- Hands-on software tutorials (G*Power, R, SAS)
- Real-world case study analysis
- Group activities and collaborative simulations
- Peer-reviewed project presentations
- Access to downloadable templates and guides

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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