

Integrated Design and Sample-Size Planning for Longitudinal STEM Education Studies

#2339353: CAREER: Statistical Power Analysis and Optimal Sample Size Planning for Longitudinal Studies in STEM Education

Why this project matters

Longitudinal studies are powerful, but design choices must be made carefully.

Longitudinal designs can answer

- When intervention effects emerge
- Whether effects persist, fade, or grow over time
- How effects vary across students, schools, or cohorts

Key planning decisions

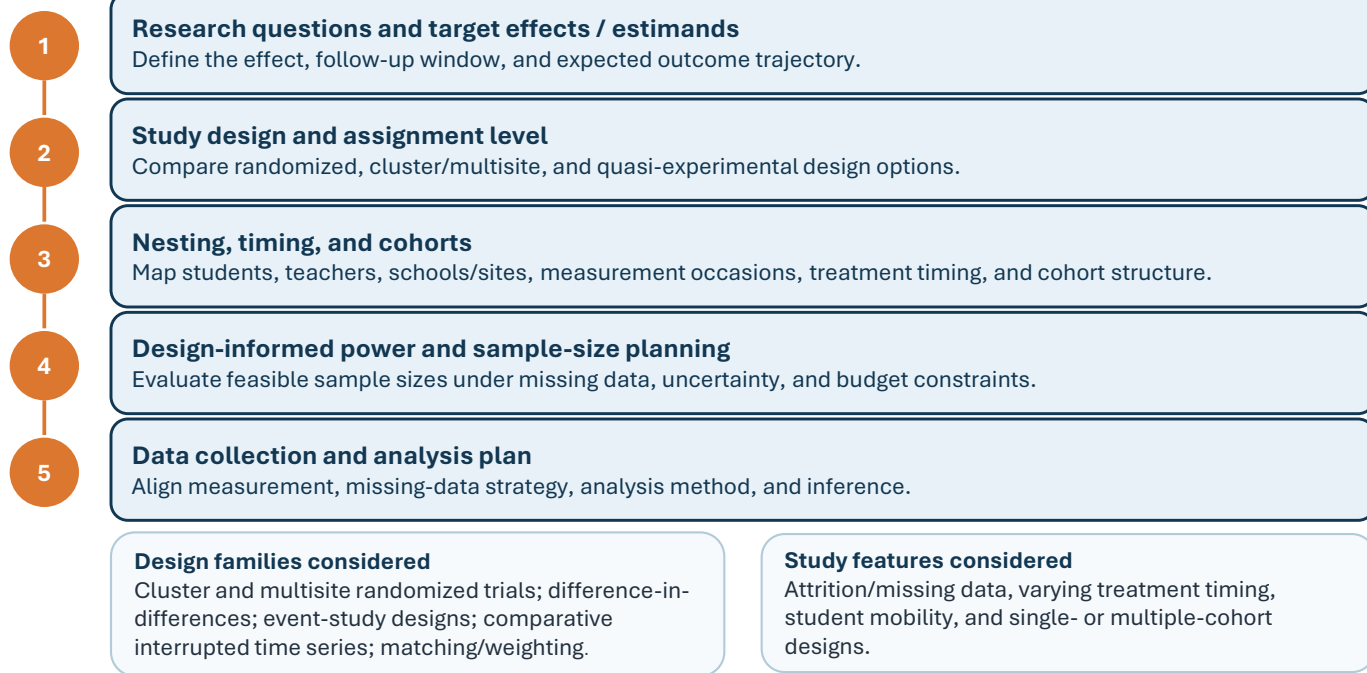
- Target effects and outcomes
- Randomized or quasi-experimental design
- Level of assignment/intervention
- Sample allocation across treatment arms, sites, and cohorts

Current gap

Practical methods and tools are limited for integrated design, analysis, and sample-size planning in complex longitudinal studies with **nested data, multiple cohorts, missingness, varying treatment timing, and budget constraints**.

Planning framework

A five-step framework translates causal questions into coordinated design, analysis, and sample-size decisions.



Project outputs

Methods, tools, and training resources to help researchers plan longitudinal studies before data collection.

New Methods

Power and optimal sample-size computation methods for longitudinal studies.

Design Parameters

Benchmarks for intraclass correlations, reliability, covariate effects, attrition, and other planning inputs.

Software Tools

PowerUpR-Growth R package, Shiny app, documentation, examples, and reusable workflows.

Tutorials & Workshops

Tutorial papers, training materials, workshops, and applied examples.



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