Assignment 3: Test Plan + Pilot Study

Designing and Testing Your Research Method

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Due: End of Week 5
Weight: 25% of final grade
Length: 3-4 pages + pilot results summary
Format: PDF submission via course portal

Assignment Overview

A3: Test Plan + Pilot Study translates the evidence gaps identified in A2 into a concrete research method. You will design a systematic approach to test your A1 decision claim, conduct

a small-scale pilot to validate your method, and refine your approach based on initial results. This assignment develops **method design skills** and **adaptive planning** essential for reliable evidence collection.

Learning Objectives

By completing this assignment, you will:

1. **Design appropriate research methods** matched to your decision claim and evidence gaps
2. **Plan systematic data collection** with clear protocols and quality controls
3. **Conduct pilot testing** to validate methods and identify implementation challenges
4. **Adapt research plans** based on pilot results and practical constraints
5. **Document methods** clearly enough for reproduction and peer review

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What Is a "Test Plan + Pilot"?

A **test plan** is your systematic strategy for collecting evidence to evaluate your decision claim. It specifies: - Exactly what data you will collect and how - What comparisons you will make to test your claim
- How you will ensure data quality and reliability - What analysis approaches you will use

A **pilot study** is a small-scale trial of your test plan that helps you: - Verify that your methods work in practice - Identify unexpected challenges and solutions - Refine your protocols before full implementation - Estimate time, cost, and resource requirements

Think of this as **engineering your research** — designing a reliable system for generating trustworthy evidence.

Assignment Requirements

Part 1: Research Design (1.5-2 pages)

Research Questions and Hypotheses

Primary Research Question - Restate your A1 decision claim as a specific, testable question - Break complex claims into component sub-questions if needed - Explain how answering this question addresses the evidence gaps identified in A2

Testable Hypotheses - What specific outcomes do you predict for your design object? - What alternative explanations will you test? - How will you distinguish between competing hypotheses?

Success Criteria - What results would support your claim? - What results would refute it? - What results would be inconclusive, and how would you interpret them?

Method Selection and Justification

Approach Overview Choose one of these research approaches (or justify a hybrid):

1. **Comparative Analysis**: Compare performance of different design alternatives
2. **Simulation Study**: Use computational models to test design variations
3. **Measurement Study**: Collect empirical data on existing conditions
4. **User Study**: Evaluate human responses to design alternatives
5. **Case Study Analysis**: Deep investigation of exemplary projects

Method Justification - Why is this approach appropriate for your research question? - What are the strengths and limitations of your chosen method? - How does your approach address the gaps identified in A2? - What alternatives did you consider and why did you reject them?

Data Collection Protocol

Data Sources and Selection Criteria - What buildings, spaces, or conditions will you study? - How will you select your sample (random, purposive, convenience)? - What sample size do you need for reliable results? - How will you handle access and permission issues?

Measurement Procedures - Exactly what will you measure/observe/record? - What tools, instruments, or software will you use? - What protocols will ensure consistent data collection? - How will you handle missing data or measurement errors?

Quality Control - How will you verify data accuracy and reliability? - What calibration or validation procedures will you use? - How will you address potential sources of bias or error? - What documentation will you maintain throughout data collection?

Analysis Plan

Data Analysis Strategy - How will you process and analyze your data? - What statistical or analytical approaches will you use? - How will you visualize and present your findings? - What software tools will support your analysis?

Interpretation Framework - How will you determine if results support your claim? - What threshold or criteria will you use for decision-making? - How will you address uncertainty and limitations? - How will results connect to your stakeholder decision context?

Part 2: Pilot Study Implementation (1-1.5 pages)

Pilot Study Design

Pilot Scope and Objectives - What specific aspects of your method did you pilot test? - What questions were you trying to answer about your approach? - How did you scale down your full method for pilot testing? - What success criteria did you set for the pilot?

Pilot Implementation - Exactly what did you do in your pilot study? - What data did you collect and how? - What challenges or surprises did you encounter? - How long did different tasks take compared to your estimates?

Pilot Results and Learning

What Worked Well - Which aspects of your method performed as expected? - Where did you get good quality, useful data? - What procedures were efficient and reliable? - What tools or approaches exceeded your expectations?

What Didn't Work - Where did you encounter problems or failures? - What data was lower quality or less useful than expected? - Which procedures were inefficient, unreliable, or unclear? - What assumptions proved incorrect?

Unexpected Findings - What did you learn that you didn't anticipate? - Did you discover new data sources or measurement opportunities? - Did you identify alternative approaches worth exploring? - What insights emerged about your design object or context?

Method Refinements

Revised Protocol Based on pilot results: - How will you modify your data collection procedures? - What changes will you make to tools, instruments, or software? - How will you adjust your sample selection or size? - What quality control improvements will you implement?

Updated Timeline and Resources - How has pilot testing changed your time estimates? - What additional resources or support do you need? - What new challenges do you need to plan for? - How will you prioritize if you can't do everything originally planned?

Risk Management - What could go wrong with your revised approach? - What backup plans do you have for likely problems? - How will you maintain data quality if you face constraints? - What would constitute partial success if full implementation isn't possible?

Part 3: Reproducibility Documentation (0.5 pages)

Method Documentation

Step-by-Step Protocol - Document your final method clearly enough for another researcher to replicate - Include specific tools, settings, procedures, and decision criteria - Explain any judgment calls or contextual adaptations - Provide templates, checklists, or forms you developed

Data Management Plan - How will you organize, store, and backup your data? - What file naming and organization system will you use? - How will you ensure data security and privacy? - What metadata will you record to support analysis and interpretation?

Ethical Considerations - Do you need institutional review for human subjects research? - How will you protect privacy of buildings, spaces, or people you study? - What permissions do you need for access or data use? - How will you acknowledge sources and credit collaborators?

Method Options and Guidance

Low-Code Approaches (Recommended for beginners)

Building Performance Comparison

- **Tools**: EnergyPlus GUI, Climate Consultant, Excel
- **Data**: Energy simulation results, climate data, building characteristics
- **Example**: Compare energy use of different window configurations using preset models

Space Usage Analysis

- **Tools**: Manual observation, simple counting apps, Excel
- **Data**: Occupancy patterns, space utilization rates, user behavior
- **Example**: Compare seating usage in different plaza configurations over time

Post-Occupancy Survey

- **Tools**: Google Forms, Qualtrics, Excel/Sheets
- **Data**: User satisfaction, comfort ratings, preference rankings
- **Example**: Compare user satisfaction with different workspace acoustics

Code-Heavy Options (For experienced students)

Parametric Performance Analysis

- **Tools**: Python, Ladybug/Honeybee, Jupyter notebooks
- **Data**: Automated simulation results, optimization studies
- **Example**: Parametric study of shading device performance across climate conditions

Sensor Data Analysis

- **Tools**: Python/R, data loggers, building management systems
- **Data**: Environmental conditions, energy use, occupancy patterns
- **Example**: Statistical analysis of temperature, humidity, and comfort relationships

Spatial Analysis

- **Tools**: QGIS Python, PostGIS, spatial statistics packages
- **Data**: Urban data, building locations, accessibility metrics
- **Example**: GIS analysis of green infrastructure impact on urban heat island

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Differentiated Expectations

Undergraduate Students

- **Method complexity**: Single, straightforward approach with clear protocols
- **Pilot scope**: Simple validation of basic procedures
- **Analysis depth**: Descriptive statistics and basic comparisons
- **Documentation**: Clear step-by-step protocols for replication

MArch Students

- **Method complexity**: Professional-level approach suitable for practice contexts
- **Pilot scope**: Testing feasibility for real project implementation
- **Analysis depth**: Industry-relevant metrics and decision criteria
- **Documentation**: Consultant-quality method documentation

PhD Students

- **Method complexity**: Methodologically innovative or rigorous approach
- **Pilot scope**: Testing validity and reliability of new procedures
- **Analysis depth**: Statistical analysis with uncertainty quantification
- **Documentation**: Publication-quality method description

Common Method Categories and Examples

Simulation-Based Testing

Building Energy Analysis - Compare design alternatives using EnergyPlus or similar tools - Vary parameters systematically (insulation, window area, shading) - Analyze results across multiple climate conditions or use patterns

Daylighting Performance - Use Radiance, VELUX, or similar tools to model natural lighting - Compare spatial layouts, window configurations, or shading strategies - Evaluate metrics like daylight autonomy, glare probability

Urban Microclimate - Model heat island effects, wind patterns, or solar access - Compare building arrangements, materials, or green infrastructure - Use tools like ENVI-met, Climate Consultant, or CFD software

Measurement-Based Testing

Environmental Monitoring - Deploy sensors to measure temperature, humidity, light, noise, air quality - Compare conditions in different spaces or times - Correlate physical conditions with user experience or energy use

Space Utilization Studies - Observe and record how people use different spatial configurations - Count occupancy, track movement patterns, measure dwell times - Compare usage between different design alternatives

Building Performance Assessment - Analyze utility bills, energy monitoring data, or BMS records - Compare actual performance with design predictions - Identify factors that explain performance variations

User Experience Testing

Occupant Satisfaction Surveys - Develop questionnaires to assess comfort, satisfaction, productivity - Compare responses between different design conditions - Correlate subjective responses with objective measurements

Behavioral Observation - Systematically observe user behavior in different environments - Record patterns of space use, social interaction, movement - Compare behavior between design alternatives

Focus Groups or Interviews - Gather qualitative insights into user needs and preferences - Understand reasoning behind quantitative survey responses - Explore unexpected findings from other data collection methods

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Assessment Criteria

Research Design Quality (40%)

- **Methodological appropriateness**: Does your method match your research question?
- **Technical feasibility**: Can you realistically implement your approach?
- **Quality controls**: Have you planned for data reliability and validity?
- **Analysis strategy**: Do you have a clear plan for interpreting results?

Pilot Study Execution (30%)

- **Implementation quality**: Did you conduct a meaningful pilot test?
- **Critical evaluation**: Do you accurately assess what worked and didn't work?
- **Learning integration**: Have you revised your approach based on pilot results?
- **Problem-solving**: Do you have realistic solutions for identified challenges?

Method Documentation (20%)

- **Reproducibility**: Could another researcher follow your protocol?
- **Transparency**: Are your procedures and decision criteria clear?
- **Ethical considerations**: Have you addressed privacy, access, and consent issues?
- **Data management**: Do you have sound plans for data organization and security?

Communication Quality (10%)

- **Professional presentation**: Clear writing, good organization, error-free
- **Appropriate detail**: Right level of technical depth for your audience
- **Logical flow**: Does your narrative connect research design to pilot results to refinements?
- **Visual aids**: Do tables, diagrams, or figures support your text effectively?

Common Challenges and Solutions

Challenge: "My pilot didn't work at all"

This is actually good news! Pilots are supposed to reveal problems. **Solutions:** - Document exactly what went wrong and why - Develop alternative approaches based on what you learned - Simplify your method to something more manageable - Focus on the most important aspects of your original plan - Frame pilot "failure" as valuable methodological learning

Challenge: "I can't get access to data/buildings/people"

Solutions: - Develop backup options with easier access requirements - Scale down to publicly accessible examples - Use existing datasets or published case studies - Partner with classmates for mutual data access - Focus on method development rather than comprehensive data collection

Challenge: "My results are boring/inconclusive"

Solutions: - Inconclusive results are still results — document why - Look for unexpected patterns or interesting secondary findings - Consider what additional data would clarify results - Frame inconclusive results as identifying needs for future research - Focus on validating your method rather than proving your claim

Challenge: "I don't have time/resources to do what I planned"

Solutions: - Prioritize the most important aspects of your research question - Document what you would do with more time/resources - Do a smaller-scale but higher-quality study - Focus on method development and pilot testing rather than full implementation - Plan a phased approach with clear priorities

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Resources and Support

Technical Tools

Low-code simulation: EnergyPlus GUI, VELUX Daylight, Climate Consultant **Data collection**: Google Forms, manual observation templates, basic sensors **Analysis**: Excel/Sheets, QGIS, basic statistical functions **Documentation**: Templates for protocols, data sheets, consent forms

Advanced Tools

Simulation: Python scripting, Ladybug/Honeybee, R statistical packages **Data collection**: IoT sensors, building management system APIs, web scraping **Analysis**: Python/R statistical analysis, machine learning approaches **Documentation**: Jupyter notebooks, GitHub version control, automated reporting

Support Resources

- **Week 3-4 method workshops**: Hands-on help with tool selection and setup
- **Office hours**: Wednesdays 4-6pm at KB722, or by appointment
- **Technical support**: HKU IT services for software installation and troubleshooting
- **Peer collaboration**: Classmate partnerships for data access and method validation
- **External mentors**: Week 5 consultations with practitioners using similar methods

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Timeline and Milestones

Week 3: Research Design

- Finalize research questions and hypotheses
- Select method approach and justify choice
- Develop initial data collection protocol
- Plan pilot study scope and procedures

Week 4: Pilot Preparation

- Set up tools, instruments, and access permissions
- Create data collection materials (forms, templates, protocols)
- Identify pilot test locations, subjects, or data sources
- Conduct any necessary training or calibration

Week 5: Pilot Execution and Refinement

- Conduct pilot study and collect initial data
- Evaluate pilot results and identify needed changes

- Refine method protocol based on pilot learning
- Submit A3 with pilot results and revised method plan

Remember: Your A3 test plan becomes the foundation for your A4 final analysis. Invest time in getting the method right — good evidence comes from good methods, and good methods come from careful planning and pilot testing.

Research is iterative. Your pilot "failures" are actually methodological successes — they help you design better studies and collect more reliable evidence.