Selecting Appropriate Conceptual Frameworks, Research Methodologies Data Gathering, and Analytic Technologies

QEM NETWORK: Proposal Development Workshop on Broadening Participation Research in STEM Education

Kamilah M. Woodson, Ph.D.
Associate Professor of Counseling Psychology
Howard University
QEM Network Consultant
With everything we build, we must begin with a solid foundation!
Theoretical Framework is a theory in the form of a model/paradigm that serves as the basis for the study. It mentions the proponents of the study and their results.

Conceptual Framework is the researcher’s own model illustrating variables that specify the problem and gives direction to the study. It may be an adaptation of a model in an early theory, with modifications to suit the inquiry.
Theoretical Framework

• Intersectionality is a theoretical framework that posits that multiple social categories (e.g., race, ethnicity, gender, sexual orientation, socioeconomic status) intersect at the micro level of individual experience to reflect multiple interlocking systems of privilege and oppression at the macro, social-structural level (e.g., racism, sexism, heterosexism).
(Intersectionality Conceptual Framework)
Conceptual Framework (SCCT) 😊

STEM Transfer Model (Wang, 2015, based on SCCT by Lent et al., 1994, 2000)

- **Person Inputs:**
  - Demographic:
  - Prior academic abilities:
  - Initial attitudes

- **Distal Contextual Factors:**
  - Individual:
  - Programs:
  - Institutions

- **Distal Contextual Factors:**
  - Learning Experiences in STEM Programs & Classes

- **Outcome Expectations Regarding STEM Learning & Transfer**

- **Self-Efficacy in Math and Science & STEM Transfer**

- **Interest in STEM & Transfer**

- **Intent to Transfer in STEM**

- **Upward STEM Transfer**

- **Proximal Contextual Factors:**
  - STEM Transfer Capital (objective and perceived)

- **Transfer Receptivity at 4-Year Institutions**

- **Baccalaureate and Career Attainment in STEM**

- **Alternative Educational and Occupational Attainment in STEM**

- **Upward STEM transfer outcome**

- **Person inputs**

- **Contextual factors**

- **Learning experiences in STEM**

- **Motivational factors**

- **Post-transfer factors and outcomes in STEM**

- **Alternative and post-transfer outcomes to be explored in future research**

*Addressed by the proposed research project*
Research Methodology

A Framework for Research Methodology*

Problem Genesis
- Formal
  - Research
  - Analog
  - Renovation
  - Dialectic
  - Extrapolation
  - Morphology
  - Decomposition
  - Aggregation
- Research Problem
  - Informal
    - Conjecture
    - Phenomenology
    - Consensus
    - Experiential

Mode
- Inductive mode
  - Opinion
    - Individual
    - Group
    - Delphi
    - Survey
    - Interview
    - Brainstorming
  - Empirical
    - Case
    - Field
    - Laboratory
    - Observation
    - Simulation
    - Time & Motion study
    - Observation
    - Observation
    - Observation
  - Archival
    - Primary
    - Content analysis
    - Scanning
    - Observation
    - Sampling
    - Observation
    - Observation
  - Analytic
    - Internal Logic
    - Mathematical modeling
    - Philosophical argument

Deductive mode

* Adapted from Buckley, Buckley & Chiang Exhibit 1, p. 15.
Research Methodology
(Qualitative)

Case study
Attempts to shed light on a phenomena by studying in-depth a single case example of the phenomena. The case can be an individual person, an event, a group, or an institution.

Grounded theory
To understand the social and psychological processes that characterize an event or situation.

Phenomenology
Describes the structures of experience as they present themselves to consciousness, without recourse to theory, deduction, or assumptions from other disciplines.

Ethnography
Focuses on the sociology of meaning through close field observation of sociocultural phenomena. Typically, the ethnographer focuses on a community.

Historical
Systematic collection and objective evaluation of data related to past occurrences in order to test hypotheses concerning causes, effects, or trends of these events that may help to explain present events and anticipate future events. (Gay, 1996)
Research Methodology

- There are four (4) main types of quantitative designs: descriptive, correlational, quasi-experimental, and experimental.
Figure 3-1  Decision tree matching research design to category of research question.

- Is there a treatment?
  - No
    - Is the primary purpose examination of relationships?
      - No: Descriptive Design (Factor-isolating)
      - Yes: Correlational design (Factor-relating)
  - Yes
    - Is the treatment tightly controlled by the researcher?
      - No: Quasi-experimental design (Situation-relating)
      - Yes: Experimental design (Situation-producing)
Data Gathering/Collection

Data Value

Quantitative and qualitative techniques provide a tradeoff between breadth and depth, and between generalizability and targeting to specific (sometimes very limited) populations.
Data Gathering/Collection

Scientific Rigor

Data collected through quantitative methods are often believed to yield more objective and accurate information. They can be replicated, and, unlike qualitative data, can be analyzed using sophisticated statistical techniques.
Data Gathering/Collection

Qualitative methods are most suitable for formative evaluations, whereas summative evaluations require “hard” (quantitative) measures to judge the ultimate Value (impact) of the project. (Know the RFP)
Data Gathering /Collection

- Paper and pencil (mail in)
- Paper pencil (in person)
- Interviews
- Telephone Data collection
- Focus Groups
- Online Surveys (controls) (Google, Survey Monkey, Qualtrics etc.)
- Archival Data
- Action Research
Techniques of Data Analysis

• Data analysis is methodologically contingent. Meaning, it also depends on how the data collection occurred, number of participants and the research questions and hypotheses…
Analytic Techniques
Jigyasa Analytics (2015)
Programs for Analysis

- SPSS
- NVIVO
- Excel
- G*Power
Data Storage

- Should be stored in a secure manner
- Clear delineations of access
- Clear Plan for use and dissemination! (Data Management)
Questions
Thank you

- Kamilah M. Woodson, Ph.D.
- Associate Professor
- Howard University
- (443)744-0845
- kwoodson@howard.edu