Theory, Models, Variables

Y520
Strategies for Educational Inquiry

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Three Meanings of Theory

- A set of interrelated concepts or ideas that gives an account of intrinsic (aka, philosophical) values.
- A set of principles for practice.
- A set of interrelated concepts or ideas that give an account of empirical phenomena. (This is the meaning of theory used in research)
Face vs Theory

- Fact (ad. L. *fact-um* thing done, neut. pa. pple. of *facere* to do) is something that has occurred and so can be experienced directly.
- Facts can be observed.
- Theory, in contrast, is a conception or idea of a fact or an idea of something to be done.
- Facts can be experienced directly.
- Ideas refer to universals.

Face vs Theory (continued)

- Ideas and conceptions refer to universals.
- Universals are expressed linguistically through statements of lawlike generalizations.
- Because theoretical statements are interrelated, they must be systematically related.
- Because theoretical statements describe phenomena, they must be related to observational statements (facts) through correspondence rules.
Theories as Models

- Theories are called models if:
  - Stated in terms of mathematical concepts
  - Are simplifications of facts or intrinsic values
  - Bear a substantive analogy to the facts or intrinsic values.
  - Not fully established as a theory, or represents a radical departure from previous theory.

Models

- Visual representation of how something works.
- Helps understanding of research question, but may over-simplify.
- Shows elements linked by relationships.
- Elements of models are either explicit or latent variables.
Simple Model

A. Victimization Hypothesis

B. Stress–Strain Hypothesis

C. Vulnerability Hypothesis

D. Additive Burden Hypothesis

E. Chronic Burden Hypothesis

F. Event Proneness Hypothesis


Complex Model

FIG. 8.4. Final model of burnout for calibration sample of elementary school teachers (Byrne, 1986).
### Variables

- Theoretical constructs in the formal structure are not directly observable and must be linked to corresponding empirical constructs, which in turn are linked to things (physical constructs).
- Intelligence is a construct that cannot be observed directly or measured directly. Its existence is inferred from behavior and variables such as size of vocabulary and ability to recall strings of numbers.
Construct Validity

Concept

Which, when refined so that it acquires more specificity, becomes a Construct

Resulting in the development of an instrument to become an Operational Definition

From Black, Thomas (1999). Doing Quantitative Research in the Social Sciences

Operational Definitions

- Conceptual definitions – Explain the concept (construct) the variable attempts to capture.
- Operational definitions – State how the variable will be measured in practice.
Variables

- Measurable characteristics of people or objects that can take on values.
- Hypothesis states presumed relationship between two or more variables in an empirically testable manner.
- Independent variable – manipulated by the experimenter. If non-exp. design, “exogenous” variable.
- Dependent variable – outcome or response variable. In non-exp. design, “endogenous”

Relationships Between Variables

- Linear
  - Positive – Values for both variables increase or decrease together
  - Negative – Values of variables change in opposite direction
- Non-Linear
  - No easy way to describe how values of endogenous variable are affected by changes in values of exogenous variable.
- No relationship
  - Changes in values of variables not due to influence of one upon another.
To Establish Causality Between Variables

- Time order – The cause must exist before the effect.
- Co-variation – A change in the cause produces a change in the effect.
- Non-spuriousness – No rival cause for the effect can be found.

Classifying variables

<table>
<thead>
<tr>
<th>Endogenous variable</th>
<th>Observed outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influences</td>
<td>Intervening variables</td>
</tr>
<tr>
<td>Exogenous variable</td>
<td>Manipulated or life experience</td>
</tr>
</tbody>
</table>

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Non-causal relationships

Variable A

Variable Z

Variable B

Why do variables change together?