Research Basics:
What are the pieces and how do they fit together?

Vygotsky:
Cognitive Development

2 Sources of Knowledge:
- Bottom-up (figured out)
- Top-down (taught)

Bottom-Up: Induction
- Based on
  - Salient experience
  - Anecdotes
- Subject to
  - Human error
  - Illusory correlations
Top Down: Authority

- Accepted if
  - Believable source
  - Relevant information
  - Fits with experience
  - No evidence

Empirical Research

- Knowledge based on observation
- Requires information that is
  - Accurate
  - Diverse
- Confirmed by
  - Multiple assessments/investigations
  - Evaluation of alternatives
  - Peer review

Goals of Research

- Description
- Prediction
- Causation
Goals of Research

- Description
  what does child's movement look like?
- Prediction
  when will child walk?
- Causation
  how can we improve walking?

Research Process

- Develop hypothesis or question
- State specific, testable prediction
- Collect data

Variables

- Basis for research
- Individual elements of hypotheses/predictions
- Must vary
  A variable has levels
  It is a category it is a member of a category
  It can change it cannot change
### Variables vs. Levels

<table>
<thead>
<tr>
<th>Variables vs. Levels</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Test scores</td>
<td>32 inches</td>
</tr>
<tr>
<td>Grade of “A”</td>
<td>Charlie Brown</td>
</tr>
<tr>
<td>Beverages</td>
<td>Pants size</td>
</tr>
<tr>
<td>Popcorn</td>
<td>Vanilla</td>
</tr>
<tr>
<td>Blue</td>
<td>Authors</td>
</tr>
<tr>
<td>Hair color</td>
<td>Cartoon characters</td>
</tr>
<tr>
<td>Ice cream flavor</td>
<td>12 units</td>
</tr>
</tbody>
</table>

### Types of Variables

<table>
<thead>
<tr>
<th>Types of Variables</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation Variables</td>
<td></td>
</tr>
<tr>
<td>Place/Setting</td>
<td>May be pre-existing or created</td>
</tr>
<tr>
<td>Participant/Subject Variables</td>
<td></td>
</tr>
<tr>
<td>Person</td>
<td>Pre-existing</td>
</tr>
<tr>
<td>Response Variables</td>
<td></td>
</tr>
<tr>
<td>Participants’ reaction to situation</td>
<td>Behaviors/Outcomes</td>
</tr>
</tbody>
</table>

Same characteristic may be a different type of variable, depending on question/hypothesis
### Types of Variables

**Subject, Situation, Response**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Situation</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold vs. warm rooms</td>
<td>Time of day</td>
<td></td>
</tr>
<tr>
<td>Tall vs. short people</td>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Happiness</td>
<td># of letters read</td>
<td></td>
</tr>
<tr>
<td>Children vs. adults</td>
<td>Enthusiasm</td>
<td></td>
</tr>
<tr>
<td>GPA</td>
<td>Test scores</td>
<td></td>
</tr>
<tr>
<td>Instructions</td>
<td>Self-esteem</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Hair color</td>
<td>Language</td>
<td></td>
</tr>
</tbody>
</table>

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### Defining Variables

**Conceptual Definitions**

Idea you are trying to test

**Operational Definition**

Thing you are actually measuring

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### Defining Variables

- Social skills
- Communication skills
- Thematic curriculum
Operational Quality: Validity

- Construct validity
  - Measure assess concept
  - Measure doesn’t assess anything else
- Internal validity
  - Study measures cause
  - No other explanation is suggested
- External validity
  - Study applies to real world
  - Results apply to population of interest

Exercise
Identifying and Defining Variables

Expectations

- Hypotheses
  - Statement of possible relationship between conceptual variables
- Prediction
  - Statement of expected relationship between operational variables
## Expectations

- Two kinds of hypotheses
  - Group differences
  - Relationships
- Must specify nature of expectation

## Relations Among Variables

- Linear relations between 2 variables
  - Measured by correlation coefficient
  - Include
    - Predictor variables
    - Criterion variables

## Correlations

- ![Positive Correlation](image1)
- ![Negative Correlation](image2)
  
  Positive
  
  Negative
Correlations

- Weight
- Candy Intake
- Exercise

Relations Among Variables

- Linear relations between 2 variables
- Comparisons between 2 groups
  - Input
    - Experiments = Independent variables
      (created situation)
    - Quasi-experiment = Existing variables
      (pre-existing subject variables)
  - Outcome variables
    (dependent variables / criterion variables)

Between Group Comparisons