

Looking back(wards) at independent and dependent variables for Research Methods

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Independent & dependent variables

- **Fundamental concepts** in undergraduate Research Methods
 - Causal relations
 - Experimental design
 - Hypotheses
 - Predictions
- Common difficulty: independent & dependent variables
 - **Terms:** independent ↔ dependent
 - Identifying
 - Defining

Framework for retention + application

1. Lecture framing
 2. Group activity
 3. Homework assignment
 4. Seminar/discussion activity
- based on students' **intuitions about cause & effect**

1. Lecture framing

1. Define a **variable**
 - has measurable features
 - can have different possible values

Examples: Vocabulary size, Age
2. **Causal relations** between variables
 - A variable can **cause** change: **"changer"**
(Independent variable – term **not** yet introduced)
 - A variable can **be** changed: **"change-ee"**
(Dependent variable – term **not** yet introduced)

★ **Relation is NOT reversible**
Template:
 ✓ As **changer** changes, **change-ee** changes = **"forwards"**
 ✗ As **change-ee** changes, **changer** changes = **"backwards"**

e.g. As **age** changes, **vocabulary** changes (**forwards**, "ok")
 As **vocabulary** changes, **age** changes (**backwards**, "weird")

3. Note on 3rd variables: correlation/causation

2. Lecture activities (group)

- In groups:**
1. Think of 3 other cause-and-effect relations
 2. Identify "changer" and "change-ee"
 3. Using the relation template:
("As ___ changes, ___ changes")
 - State the "forwards" direction
 - State the "backwards" direction
- Lecture:**
- introduce "independent variable" for "changer" and "dependent variable" for "change-ee"
- In groups:**
4. For 3 relations, identify IVs and DVs

3. Homework assignment (individual)

1. Find 3 recent news articles with cause-and-effect relations
- For each article:
2. Identify "changer" and "change-ee"
 3. Using the relation template:
("As ___ changes, ___ changes")
 - State the "forwards" direction
 - State the "backwards" direction
 4. Identify IV and DV
- Relate concepts to personal/recent experiences
- Reflect on intuitions
- Topics 2017-2024:
- climate change
 - COVID lockdowns
 - public health
 - personal relationships

4. Seminar activity (group + individual)

- Aims:**
- reinforce IV/DV concepts
 - link to data visualization
- Individually:**
1. Plot "forwards" and "backwards" relations from assignment
- "forwards" relationship**

correct "backwards" relationship

(swapped x & y axes)

incorrect "backwards" relationship

(changed effect direction)
- In groups:**
2. Compare plots – guess effects from forwards and backwards plots
 - Identify/clarify misunderstandings
 3. Share favorite backwards plot

Future directions: AI considerations

- Homework assignment**
- currently: easily AI-able
 - aim: understand independent/dependent variables
- ✗ Option 1: re-develop to be un-AI-able
- ✓ Option 2: incorporate AI to achieve aim
- Same assignment steps 1-3 (2 articles)
 - **Additionally** (1 article):
 5. in prompt to ChatGPT (or preferred):
 - a. **Explain** "changer"/"change-ee" and "forward"/"backwards"
 - b. Provide article, generate response to step 3
 - *engagement with prompt, content*
 5. **Compare** genAI output to own output
 - *assessment of genAI output*

→ Submit: screenshot of prompt and output,

 - Assessment: prompt match with responses in 1-3
- Seminar activity**
- Similarly: plot relations, then generate & assess plots