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## **Week 3 Lecture - Claims & Validity**

Undergraduate Research Methods in Psychology

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Quinton Quagliano, M.S., C.S.P

Department of Psychology

## Table of Contents

<b>1</b>	<b>Last Week Review</b>	<b>1</b>
1.1	Last Week Content . . . . .	1
1.2	Announcements and Due Dates . . . . .	2
<b>2</b>	<b>Quiz 1 Review</b>	<b>3</b>
2.1	Areas for Review . . . . .	3
<b>3</b>	<b>Quiz 2</b>	<b>3</b>
3.1	Quiz Content . . . . .	3
3.2	Quiz Rules . . . . .	3
<b>4</b>	<b>Learning Objectives</b>	<b>4</b>
4.1	Textbook Objectives . . . . .	4
4.2	Professor's Objectives . . . . .	4
<b>5</b>	<b>Variables</b>	<b>5</b>
5.1	Definition . . . . .	5
5.2	Scales of Measurement . . . . .	5
5.3	Measured vs Manipulated Variables . . . . .	5
5.4	Constructs to Operational Variables . . . . .	6
<b>6</b>	<b>The 3 Types of Claims</b>	<b>6</b>
6.1	Definition . . . . .	6
6.2	Frequency Claims . . . . .	7
6.3	Association Claims . . . . .	7
6.4	Causal Claims . . . . .	8
6.5	Claims Are Not Always Research . . . . .	8
<b>7</b>	<b>Assessing Claims with 4 Types of Validity</b>	<b>8</b>
7.1	Overview . . . . .	8
7.2	Claim Types and Validity . . . . .	10
7.3	How to Prioritize Certain Validities . . . . .	10

## 1 Last Week Review

### 1.1 Last Week Content

[1] "hello"

- Covered how to perform a literature search through GVSU provided resources, and how to obtain full-text PDFs and citations for scientific articles.

- Discussed the differences between sources of information, like personal experience, intuition, authority, and empirical research.
- Determined the primary reasons why empirical research is the strongest foundation for evidence in our research and writing, and why the sources are relatively weak.
- Went over the core sections of most research papers, and what each of those sections contain.

## 1.2 Announcements and Due Dates

- First reading evidence was due by 09/10 (today) at 6:00pm EST - Should be on chapters 1, 2, or 3.
    - You should still turn in even if late - for marginal points.
    - If you took good notes on all 3, submit all of them to the I - III Reading Evidence portals on Blackboard to get a bunch of points early on!
    - Please read my overall notes and feedback, as well as my comments throughout your submitted notes. Even if I gave you full points I may commentate on some of your thoughts or points out certain resources and ideas.
  - Recall that the remainder of the reading evidence submissions (II - IV) are all due on Nov 26 at 6:00pm EST
    - *However*, if you turn them in sooner, I will give you grades and feedback promptly. This may aid you in quizzes and exam preparation. Therefore, I strongly recommend that you submit them consistently throughout the semester, rather than all at once near the end.
    - Reading Evidences II - IV will likely get less suggestions and feedback, unless I feel you need to improve the quality somehow. But, I'll still make note of things, so please make sure to still look through them!
    - You *should* continue to take high quality notes for the chapters, even if you do not plan on submitting them for reading evidence!
  - We are now in a slow period for due dates, but don't let those later big things sneak up on you! Make sure you are reviewing content, taking good notes, preparing for quizzes, and practicing the skills from class.
  - I cannot hold my usual office hours next Friday, September 13, my apologies. Please feel free email me any concerns or question you have.
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## 2 Quiz 1 Review

### 2.1 Areas for Review

- My late grading policy is **25%** of *earned* points deducted per each day late.
- A **research consumer** is someone who is reading published research and integrating it in an applied environment.
- Peer-reviewed scientific journal articles are *always* the **gold-standard** method for communicating scientific results. Other methods may be valid, but should come second to published articles.
- A **digital object identifier (DOI)** link is a valid addition to citation, but it is not *required*. Some works may not necessarily be assigned a DOI, as it has to be applied for. The author, date of publication, and journal/outlet of publication are required components of a citation.

## 3 Quiz 2

### 3.1 Quiz Content

Covers all content from 09/03 class meeting, including but not limited to:

- Chapter 2 of Morling Textbook
- Lecture on Chapter 2
- First lecture & demonstration on literature searching

*Any last minute questions?*

### 3.2 Quiz Rules

*From the Syllabus:*

- Each quiz is 10 multiple-choice questions, 1 point for each question
  - Quizzes will be taken at the start of the class period on the Blackboard LMS
  - Quizzes will be on content covered in the previous lecture and the associated reading for that lecture
  - Quizzes are timed, 23 minutes only (previously was 15 minutes)
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- Quizzes are open-note and open-book, that is, you are allowed to use those resources during the quizzes. Thus, they reward good structure in thoughtfulness in your notes and preparation
- You may not collaborate with others during the quizzes, or discuss questions with other students after the quiz. You cannot use AI tools or the internet to help you during the quiz.
- Quizzes and exam will be ended early if all students are clearly finished and content with their answers
- Quizzes will be graded promptly and reviewed the following week

## **4 Learning Objectives**

### **4.1 Textbook Objectives**

- Differentiate the three types of claims: frequency, association, and causal.
- Ask appropriate questions to help you interrogate each of the four big validities: construct validity, statistical validity, external validity, and internal validity.
- Explain which validities are most relevant for each of the three types of claims.

### **4.2 Professor's Objectives**

- Be able to identify types of variables, their scales of measurement, and the levels/values of a given variable. Understand what variables are likely to be manipulated vs. observed.
  - Be able to identify and write frequency, association, and causal claims. Be able to assess what type of claim a certain article is attempting to make. Understand which scale of measurement variables are normally associated with each claim.
  - Be able to assess what source a claim comes from, and whether the weight of evidence for a claim is valid. Understand how to approach claims through the lens of the four validities we discuss.
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## 5 Variables

### 5.1 Definition

- Some measurement that can vary, with at least 2 levels/values
  - Contrast with a **constant**, which does not vary at all
- Important in both the hypothesis and the data stages of the theory-hypothesis-data cycle
- Variables (and their definitions within the context of the study) are core, important parts of a study - and will play an important role in the validity of the results

### 5.2 Scales of Measurement

*Likely a review from statistics course*

- Every variable has some scale of how it is measured:
- **Interval/Ratio/Continuous:** A variable has consistent, known distances between each level/value, arranged in *known* order.
  - Example: Age, height in centimeters, point score on test.
- **Ordinal:** A variable has *unknown* distances between each level/value, arranged in a *known*.
  - Example: Place in a foot race, Class rank
- **Categorical/Discrete:** A variable's levels/values are entirely separate from one another, arbitrary (no) arrangement of order
  - Example: Experimental group vs. Control group

### 5.3 Measured vs Manipulated Variables

- **Measured/Observed Variable:** a measurement of something that is not modified or *directly* caused by the experimenter (but may be the result of something an experimenter did).
    - Often, due to ethical or practical constraints, or simply because it is simply impossible to directly change
    - Example: SAT score, hair color, class enrollment
  - **Manipulated/Experimental Variable:** a measurement of something that is *directly* changed by an experimenter
    - Example: putting an individual in an intervention or control group.
  - Some variables *can* be either, depending on the setup of the study.
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## 5.4 Constructs to Operational Variables

- **Construct/Conceptual/Latent Variables:** Abstract variables usually representing some concept or notion that cannot be explicitly and directly measured
  - However, these usually *are* the concepts we actually care to draw conclusions on.
  - Example: Depression, Academic achievement/aptitude
- **Operational/Measured Variables:** Concrete variables as measured through some tool or sense
  - This is what we can directly collect in the study
  - Example: PHQ-9, test score
- In most research, we *operationalize* the construct to some direct measurement tool. However, the focus of our conclusions is *not* the measured variable, but rather, the construct that it purports to measure.
  - Example: when I assign a test, do I care *only* about the plain number of items correct a student has? NO! I care about the content mastery that the items are representative of.
- Generally, when we talk about theories, we are discussing constructs; and when we are talking about study-specific hypotheses, we discuss operational variables.
- Side note: The gap between operational to latent variables is an extremely important area that deals with measure validity, which is different from the validity we will be discussing shortly. This area of study deals with Measurement and Test Theories, as well as psychometrics (my favorite).

## 6 The 3 Types of Claims

### 6.1 Definition

- A **claim**, simply, is any argument for some idea, interaction, or relationship between two or more objects.
  - Claims can be derived from scientific evidence, or any of the sources of knowledge we discussed previously
    - But remember the pitfalls of some sources of information, and prioritize research!
  - Claims come in 3 flavors: frequency, association, and causal
    - All three have varying requirements to be valid, which more strict requirements moving from frequency -> association -> causal
    - Good evidence of any claim is a function of the scale of measurement and the design of the study
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- Good examples of each claim type on pg. 166, Table 3.3, and good keywords to look for in each claim on pg. 174, Table 3.4

## 6.2 Frequency Claims

- A **frequency claim** is one that deals with the rate, percent, or proportion of a certain characteristic or phenomenon.
  - Hint: a percent sign is oftentimes a dead giveaway for this type of claim - but keep in mind that a “claim” is not necessarily made every time you see a percent.
  - Example: “roughly 25% of college students report feeling stressed about an upcoming assessment”
- These claims are usually only made upon some single observed and categorical variable or measurement, and often describes a yes-no proposition.
  - Example: 20 of 50 students like the dining hall food -> 20 students say yes to liking the food, 50 said no to the same question
- These claims are normally dealing with a categorical scale of measurement
  - Stats sidebar: testing for claims of frequency are normally done with tests such  $\chi^2$  or Fisher’s exact tests
- Graphically represented by pie charts or bar charts

## 6.3 Association Claims

- An **association claim** is made regarding two or more variables, attempting to describe or quantify the relationship between them, *without* explain which one might cause the other
    - Hint: look for words like “correlate”, “predict”, “associated with”, and/or “covary” to identify these claims
  - An association between two variables can either be described as *positive*, *negative*, or *non-existent/zero*:
    - Positive -> as one variable increases, so does the other
    - Negative -> as one variable increases, the other decreases
    - Non-existent/zero -> both variables do not consistently covary
  - Variables in this claim usually have to be at least ordinal, but are more commonly continuous in nature. In most cases, variables in this sort of study would only be observed.
    - Stats sidebar: testing for these claims is usually done with some form of correlation test (e.g., Pearson’s  $r$ , Spearman’s  $\rho$ , Kendall’s  $\tau - b$ ) or regression (e.g., linear - OLS, curvilinear)
  - Graphically represented by scatter-plots (one variable on x-axis, other on y-axis)
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## 6.4 Causal Claims

- Similar to an association claim, with the added caveat that these claims make some determination on which of two or more variables causes another.
  - This claim requires the most powerful and substantial evidence of all three claim types. Whereas a claim of association or frequency are largely *descriptive*, a causal claim is more *inferential*.
- Similar to associative claims, a causal claim is likely to describe the movement of one variable in relation to another, but must meet three additional criteria:
  - The two variables are correlated (valid association claim)
  - One variable clearly came before the other (temporal precedence)
  - The relationship or change cannot be described by some other factor/confound (internal validity - more on this later)
- For solid causal claims, experiments are really the most (and maybe only) acceptable design (but we will cover that later)
- In causal claims, we are most likely to encounter observed continuous data as our outcome, and some form of categorical experimental/manipulated variable.
  - Stats sidebar: because of the scale of measurement just described, we are usually thinking about some sort of t-test or ANOVA, to test means between two or more groups.

## 6.5 Claims Are Not Always Research

- Claims can appear in personal experience, appeals to authority, and intuition; just because a claim is made, does not mean that they are based in research
  - Example: “I swear this happens to me every day”, “This all happened because [insert reason here]”
  - What types of claims are those two above?
- If a claim is made, ask yourself, “what is the source of the claim?” Hopefully an empirical article!

# 7 Assessing Claims with 4 Types of Validity

## 7.1 Overview

- Alongside the theory-hypothesis-data framework we discussed early in the semester, and the reading strategy I offered for empirical articles - these 4 validities will make up the backbone on how you approach critiquing scientific claims.
  - An overview table of the 4 validity types can be found on pg. 69, Table 3.5
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## Construct Validity

- **Construct validity** is all about how well the variables under study are operationalized, manipulated, and measured. This is often closely related to the operational measures one chooses to capture the latent/construct variables.
- Faults in construct validity imply a failure to properly represent the constructs under study, and will lead to a disconnect between the study and the theory under study
- We will discuss more about “good” measurement practices in chapter 5 and its accompanying lecture

## External Validity

- **External validity**, also sometimes called **generalizability**, is all about how well the claims and results of a study/hypothesis apply to the broader population and other contexts. This tends to be primarily determined by how tightly controlled a study is (more control = less generalizable to daily life) and how individuals were sampled for a study (more on this in chapter 7).
- Faults in external validity lead to limitations in how well a claim can be extrapolated and abstracted outside the context of a study.
- Example: is a tightly-controlled clinical study on mice in a lab cage readily applicable to the average person in their daily life? No!

## Statistical Validity

*This will be covered further in-depth in PSY-350*

- **Statistical Validity** is all about whether the estimates, p-values, effect sizes, and analysis methods support the hypothesis in question.
  - Helpful questions to ask:
    - Did the authors state an  $\alpha$  level in the methods?
    - Did the paper report adequate statistical information to assess significance? (e.g., p-values, confidence intervals, effect sizes - ideally all 3)
    - Did the authors themselves actually interpret this information correctly?
    - Was the analysis powerful enough to detect an effect? (e.g., big enough sample)
  - Failures in this type of validity compromise the conclusions made in the discussion, which comes from the results.
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## Internal Validity

- **Internal validity** is most closely related to how well confounds are controlled for and noted in a study. Researchers may use a combination of design controls (which we will discuss in this class) and statistical controls (which are more relevant to PSY-350).
- Failure to properly address these will result in uncertainty on the actual causation/association mechanism between two or more variables.
- This tends to be one of the trickiest validities to fully meet, and one that many people fail to account for in intuition and personal experience. This is where the famous phrase comes from: "Correlation does not equal causation" - because people fail to account for all the necessary 3 components for causal claims.

## 7.2 Claim Types and Validity

- The Morling textbook provides examples of navigating each claim and its validities (on pgs. 69 to 77) with the rough, following priority:
  - **For frequency claims:** Construct + External > Statistical > Internal
  - **For association claims:** Construct + External + Statistical > Internal
  - **For causal claims:** Internal > Construct + External + Statistical
- In my opinion, the validities, as I explained before, don't necessarily need a tailor-made application to each type of claim. The one exception is that internal validity is not really applicable to frequency claims.
  - Regardless, walk through the book examples as they are good examples on thinking your way through more applied problems.

## 7.3 How to Prioritize Certain Validities

- As we have discussed before, *no study can be so well-made that it satisfies all validities and answers all questions about a phenomenon*. Instead, it is our goal to balance practicality and our available resources to create a reasonably sound study that provides evidence for a part of a broader question.
    - This is important to remember both as we create research (research producer) and as we read and assess existing research (research consumer)!
  - I propose 4 areas to consider when choosing how to prioritize:
    - Type of claim to be made (frequency, association, causal) - see previous sections for discussions on those.
    - Practicality: time, resources, funding
    - Ethics: sampling method, interventions
    - Impact: how important and imperative are our findings
-