**01c Hypotheses**

**Hypotheses**

**a. What is a hypothesis?**

A statement of expected outcomes (i.e., educated guess) usually based upon logic or theory

Examples:

* As X increases, then Y decreases.
* There will be a difference in Y between group A and group B.

**b. Wording of Hypotheses**

**b1. Qualitative IVs**

When wording:

* Focus on group differences, not on variable relationships;
* identify all groups/categories of the IV involved; and
* make clear which groups will have more or less of the DV for directional hypotheses.

Example

IV: Sex (males and females)

DV: Weight

**Directional**

Generic:

Group A will have more of the DV than Group B.

Specific to Sex and Weight:

Males will weigh more than females.

**Non-directional**

Generic:

There will be a difference in DV between Group A and Group B.

Specific to Sex and Weight:

There will be a difference in weight between males and females.

**Null**

Generic:

There will be no difference in DV between Group A and Group B.

Specific to Sex and Weight:

There will be no difference in weight between males and females.

**b2. Quantitative IVs**

Focus on relationship between IV, *not on group differences*.

Example

IV: Weight of Car

DV: Miles per Gallon (MPG)

Review positive (time studying and test scores) and negative (car weight and MPG) relationships.

↑↑ = ?

Postive

↑↓ = ?

Negative

↓↓ = ?

Positive relationship, because both variables are moving in same direction.

**Directional**

Generic:

There is a positive association between IV and DV

or

The higher the IV, the higher will be the DV.

Specific to Weight and MPG:

There is a negative association between car weight and MPG.

or

The heavier the car, the lower will be MPG.

**Non-directional**

Generic:

There will be an association between the IV and DV.

Specific to Weight and MPG:

There will be an association between car weight and MPG.

**Null**

Generic:

There will be no association between the IV and DV.

Specific to Weight and MPG:

There will be no association between car weight and MPG.

**b3. Important Points**

With qualitative IVs one there are groups to compare, so focus is on group differences, how the DV differs across categories of the IV, e.g.,

* There will be a *difference* in scores between boys and girls.

With quantitative IVs one focuses on the nature of the *relationship* among the IVs and DVs, e.g.,

* The more hours one studies, the better the performance on tests, or
* There is a positive relationship between hours spent studying and performance on tests

**b4. Common Mistakes**

1. Forcing incorrect comparisons, i.e., incorrectly comparing IV to DV; remember, when the IV and qualitative, one compares the DV across categories of the IV

Example

 There will be a difference between sex and reading test scores.

Revised

There will be a difference in reading test scores between females and males.

2. Inventing groups to compare that are not part of the variable provided

Example

 IV = Types of peer instruction (think-pair-share vs. peer tutoring)

 DV = science scores

Those who receive peer instruction will obtain higher science scores than those who do not receive peer instruction.

What’s the problem here?

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Incorrectly created a new variable: Peer instruction (yes received vs. not received)

Revised

Those who participate in peer tutoring will obtain higher science scores than those who participate in think-pair-share.

3. Artificially creating comparisons for quantitative variables

Example

 IV = Number of hours of studied before science test

 DV = science scores

Those who study many hours will obtain higher science scores than those who study few hours.

What’s wrong with this one?

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* Comparing many vs. few hours of study, yet this is quantitative variable with a wide range of hours studied
* Omitted those in middle – what about them?
* How are these arbitrary categories defined?
* If worded correctly, there is no need to be concerned with these arbitrary categories.

or

Those who study will obtain higher science scores than those who do not study.

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* Comparing those who studied vs. those who did not.
* Ignores nature of relationship – is it positive or negative?
* Many categories ignored.
* If worded correctly, there is no need to be concerned with these issues.

Revised

The more hours one studies, the higher will be obtained science scores.

4. Ambiguous differences; group differences not specified

Example (supposed to be non-directional)

 IV = Type of instruction (cooperative learning or self-paced)

 DV = student scores

Type of instruction (cooperative learning or self-paced) affects student scores.

also

Type of instruction (cooperative learning or self-paced) is related to student scores.

How are these hypotheses ambiguous; how are they poorly worded?

Hypothesis is ambiguous about possible group differences.

Should not use affects, relates, association, relationship, or similar wording when the IV is qualitative; when I*V is qualitative, always focus on group differences*.

Do these hypotheses clearly state which group will perform better or whether differences in scores will exist between groups?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Pretest Scores | Treatment | PosttestScores |  | Gains? | Instruction Affect DV? | Group Difference? |
| 20 | Cooperative Learning | 50 |  | Yes = 30 | Yes | No |
| 20 | Self-paced | 50 |  | Yes = 30 | Yes | No |

Revised:

Student scores will differ between cooperative learning and self-paced instruction.

**2. Practice Exercises**

Do the following:

* identify the IV and DV;
* the categories of the IV if the IV is qualitative; and
* whether the hypothesis is directional, non-directional, or null.

1. Class size and student performance are not related.

What are the IVs and DVs, and is the IV qual or quan? If qual, what are the categories of the IV? Is this hypothesis directional, non-directional, or null?

IV = class size

DV = student performance,

IV = quan,

hypothesis = null.

Rewrite this hypothesis in directional form:

The larger the class size, the lower will be student performance.

or

Class size is negatively related to student performance.

Rewrite this hypothesis in non-directional form.

There is a relationship between class size and student performance.

2. There will be a difference in verbal scores between the sexes.

What are the IVs and DVs, and is the IV qual or quan? If qual, what are the categories of the IV? Is this hypothesis directional, non-directional, or null?

IV = sex,

DV = verbal scores,

IV = qual (categories are male and female).

hypothesis = non-directional.

Rewrite this hypothesis in directional form.

Males will have lower verbal scores than females.

Rewrite this hypothesis in null form.

There will be no difference in verbal scores between males and females.

or

There will be no difference in verbal scores between the sexes.

3. Students whose parents are educators will earn higher scores on a test than students whose parents are not educators.

What are the IVs and DVs, and is the IV qual or quan? If qual, what are the categories of the IV? Is this hypothesis directional, non-directional, or null?

IV = occupation of parents,

DV = test scores,

IV = qual (educator vs. non-educator).

hypothesis = directional (test scores will be higher for children of educators).

Rewrite this hypothesis in non-directional form.

There will be a difference in test scores between students whose parents are educators and students whose parents are not educators.

Rewrite this hypothesis in null form.

There will be no difference in test scores between students whose parents are educators and students whose parents are not educators.

4. There is a relationship between age and eagerness to complete a degree.

What are the IVs and DVs, and is the IV qual or quan? If qual, what are the categories of the IV? Is this hypothesis directional, non-directional, or null?

IV = age,

DV = eagerness to complete a degree,

IV = quan,

hypothesis = non-directional

Rewrite this hypothesis in directional form.

The older the student, the more eager the student to complete a degree.

Re-write this hypothesis in null form.

There is no relationship between age and eagerness to complete a degree.

5. One’s academic performance in school is independent of one's hours spent studying prior to the test.

What are the IVs and DVs, and is the IV qual or quan? If qual, what are the categories of the IV? Is it direct, non, or null?

IV = hours spent studying prior to test,

DV = academic performance,

IV is quan.

hypothesis is null.

In this hypothesis the term **independent** means unrelated, therefore this is a null hypothesis. The two variables are unrelated.