Studies with Multiple Levels of Clustering

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Learning objectives

Define multilevel study.

Recognize a multilevel study.

Describe the advantages of a multilevel study.

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Learning objectives

Recognize that some authors use the terms group- or cluster-randomized trial or observational cluster or hierarchal study, rather than using the level terminology.

Describe how multilevel studies induce correlation.

3

A multilevel study involves one or more hierarchical groups of observations

Authors use different but equivalent terminology.

Examples:

- "Two-level study"
- "Two-level group design"
- "Two-level cluster design"
- "Two-level hierarchal design"

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Members of a level, also referred to as a group or cluster, share experiences which induce correlation

Multilevel studies involve two or more layers of correlation.

Murray, D. M., 1998

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For example, reading scores from students in the same school are correlated

Shared teacher → induces a correlation

Shared school → induces a correlation

Two level design

Schools	ISU
Classrooms	Level 1
Students	Level 2

Murray, D. M., 1998

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We examine an example of a multilevel, randomized controlled trial

A randomized controlled trial is a study in which participants are randomized into either a study group which receives an intervention or a control group which does not.

May have more than two groups.

It is sometimes better, and sometimes necessary, to randomize two or more participants at a time, i.e., randomize clusters of participants

p.139, Last JM, 2000

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The study assessed the effectiveness of a literacy intervention

Vignette

Researchers conducted a cluster randomized control trial to evaluate the effectiveness of a web-based literacy intervention called ABRACADABRA (ABRA).

Adapted from Piquette, et al., 2014

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The study assessed the effectiveness of a literacy intervention

Vignette, continued

The study included 24 classrooms within 12 elementary schools within a single school district. Researchers assumed that schools within the district were under local control and were therefore independent.

Adapted from Piquette, et al., 2014

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The study assessed the effectiveness of a literacy intervention

Vignette, continued

Schools were randomized into the intervention group or the control group. Change in literacy was evaluated using pre- and post-tests to determine whether ABRA technology significantly improved literacy in elementary school children.

Adapted from Piquette, et al., 2014

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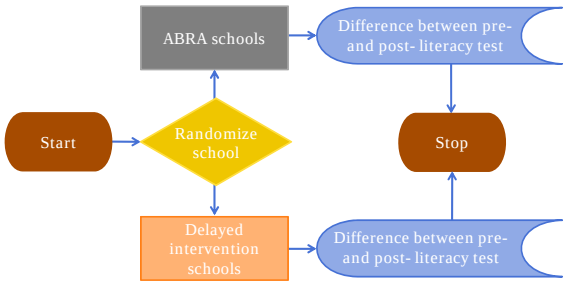
Randomization of study conditions took place at the school level



Adapted from Piquette, et al., 2014

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The goal of the study was to assess the effectiveness of a literacy intervention

Null hypothesis:

There is no significant difference in literacy between elementary students in the intervention group and those in the control group.

Adapted from Piquette, et al., 2014

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Researchers adjusted for correlation to isolate the impact of the intervention

Several sampling features of the design created correlations.

Classrooms within schools are correlated.

Students within each classroom are correlated.

Failure to adjust for correlation would inflate Type I error rate.

Adapted from Piquette, et al., 2014

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Change in literacy scores was chosen as the measure of intervention effectiveness

Independent sampling unit:

School

Unit of observation:

Difference between pre- and post-test performance

Adapted from Piquette, et al., 2014

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The goal of the study was to assess the effectiveness of a literacy intervention

Between-independent sampling unit factor:
Randomization group (scientific focus)

Within-independent sampling unit factor:
Cluster member

No scientific interest in within factor here.
Within factor is interesting in other settings.

Adapted from Piquette, et al., 2014

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ABRACADABRA was associated with greater improvements in early literacy

By accounting for existing organizational groups, the multilevel design enabled researchers to isolate the ABRACADABRA program as the primary cause of literacy improvement.

Adapted from Piquette, et al., 2014

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Review Summary

- Multilevel studies have more than one hierarchical level, inducing multiple layers of correlation (ex. students within classrooms, classrooms within schools)
- We account for the multiple hierarchical levels and the correlation induced, which is a result of the shared experiences within these levels
- Accounting for correlation allows us to isolate factors being explored as primary causes of outcomes we find

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