

**Studies with Multiple Levels of Clustering**

Course developed by  
Deborah H. Glueck and Keith E. Muller

Slides developed by Jessica R. Shaw, Keith E. Muller,  
Albert D. Ritzhaupt and Deborah H. Glueck

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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.

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**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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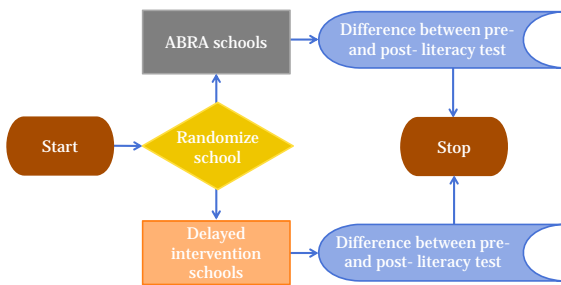
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**Randomization of study conditions took place at the school level**



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 OF LEARNING OBJECTIVES**

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**Can you describe a multilevel study?**

A research design with multiple layers of correlated units.

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**What are multilevel features in studying tobacco counseling by health providers?**

Clinics operate in health systems.

Providers operate in clinics.

Many patients see the same provider.

What should be the Independent Sampling Unit (ISU)?

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