

The Ch. 4 Test will be
Monday, Oct 29th.

[because of that the Proposal
for Response Bias Project can
be turned on Tuesday Oct. 30]

A strategy to help account for variability in the response that is introduced by an uncontrolled variable

Randomized Block Designs

SAT

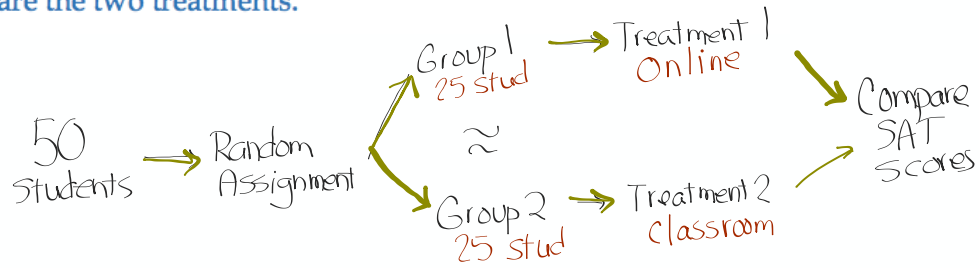
Lesson 4.2: Day 3: Does type of SAT prep matter?1 ABCDE
2
3
4

SHS has decided to offer an SAT prep class again this year. The same one you read about before. It will be offered in two different formats: online or classroom teacher. The counselors want to know which teaching method will yield higher SAT scores so they have allowed us to set up an experiment. 50 students have signed up to take some form of the SAT prep class. (20 seniors and 30 juniors)

1. Outline (meaning a diagram) a completely randomized design to compare the two treatments.

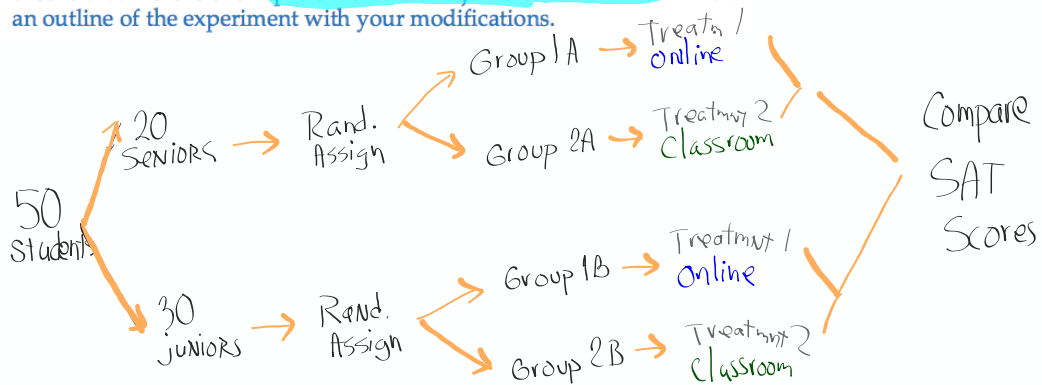
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2. The counselors at SHS hypothesize that the online vs. classroom results could be greatly affected by the grade level of students that were put into each treatment group. They know that seniors generally score better on the SAT than juniors. How could we adjust our experiment to ensure that there is even split of seniors and juniors in each class? Draw an outline of the experiment with your modifications.

2. The counselors at SHS hypothesize that the online vs. classroom results could be greatly affected by the grade level of students that were put into each treatment group. They know that seniors generally score better on the SAT than juniors. How could we adjust our experiment to ensure that there is even split of seniors and juniors in each class? Draw an outline of the experiment with your modifications.



3. The counselors are now worried that a student's GPA is certainly going to affect their SAT score. Let's look only at the Juniors. We want to be sure that the different GPAs are being evenly distributed into the two treatment groups.

How could we be sure the GPAs are evenly distributed?

3. The counselors are now worried that a student's GPA is certainly going to affect their SAT score. Let's look only at the Juniors. We want to be sure that the different GPAs are being evenly distributed into the two treatment groups.

How could we be sure the GPAs are evenly distributed?

- ★ Order all students by GPA from least to greatest.
Take 2 students w/highest GPA and pair them.
- ★ Flip a coin to assign one to online class, one to classroom
- ★ Repeat this process with the next two juniors, repeat until all 30 juniors have been assigned.

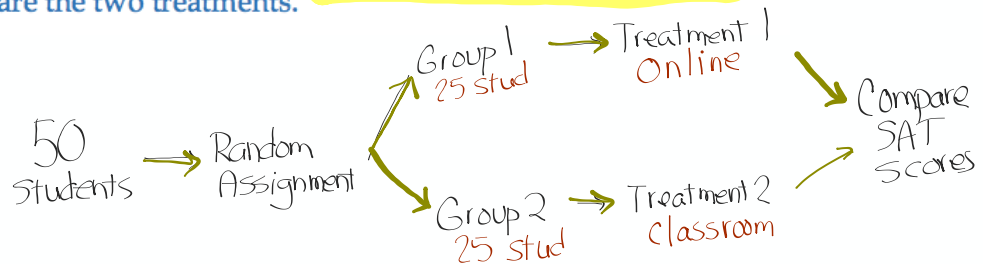
A **block** is a group of experimental units that are known before the experiment to be similar in some way that is expected to affect the response to the treatments.

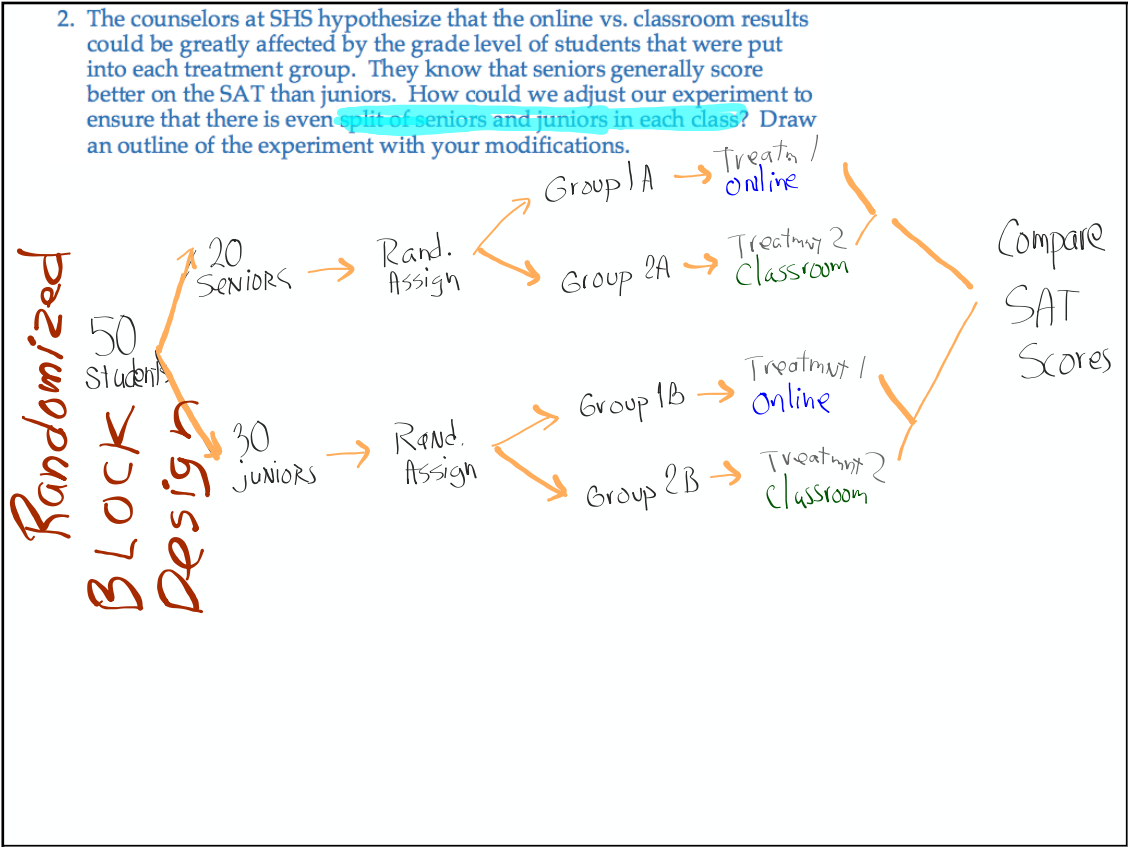
In a **randomized block design**, the random assignment of experimental units to treatments is carried out separately within each block.

Using a randomized block design allows us to account for the variation in the response that is due to the blocking variable. This makes it easier to determine if one treatment is really more effective than the other.

*When blocks are formed wisely,
it is easier to find convincing
evidence that one treatment is
more effective than another.*

1. Outline (meaning a diagram) a completely randomized design to compare the two treatments.





Randomized Block Designs – The Big Ideas



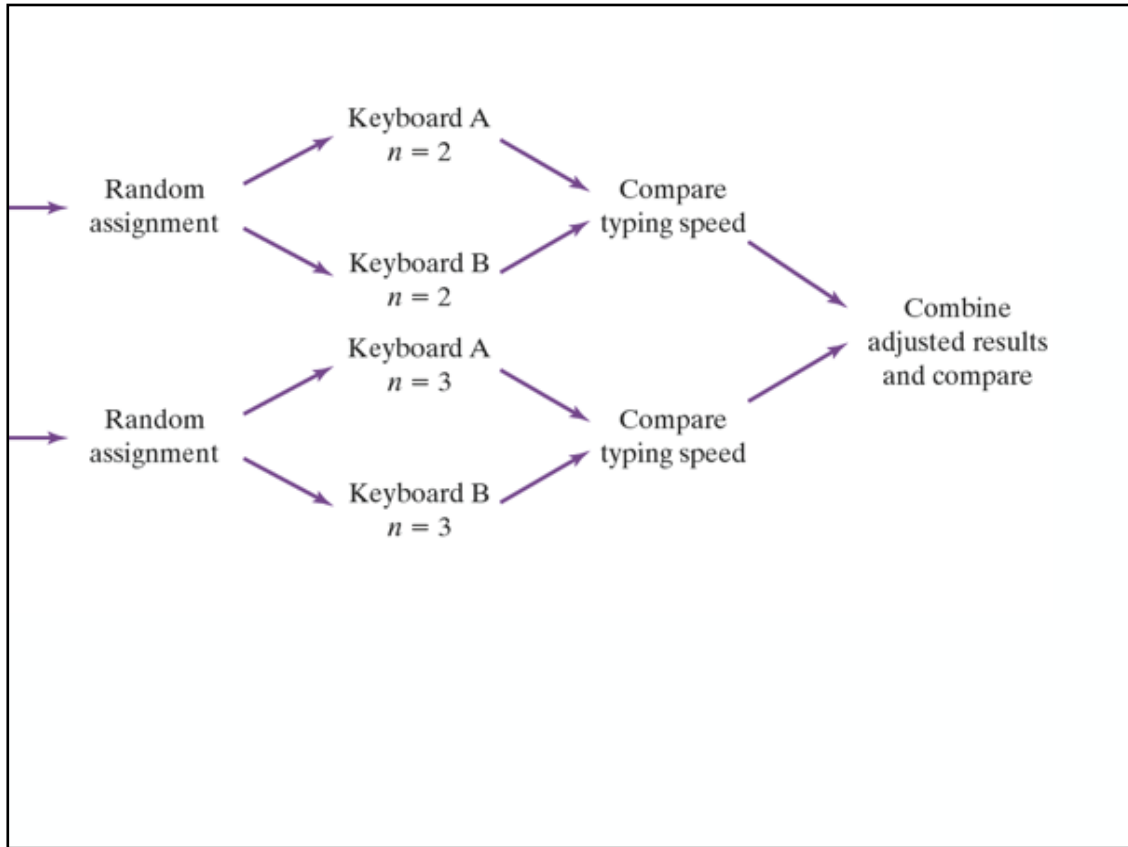
Randomized Block Designs – The Big Ideas

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Randomized BLOCK DESIGN:
- Separate subjects to blocks and then randomly assign to treatments within each block.



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- MATCHED PAIRS DESIGN**
- ★ Order all students by GPA from least to greatest. Take 2 students w/ highest GPA and pair them.
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Randomized Block Designs – The Big Ideas

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MATCHED PAIRS - An experiment used to compare two treatments that uses blocks of size 2.

Randomized Block Designs – The Big Ideas

BLOCK: - group of experimental units that are known to be similar.

Randomized BLOCK DESIGN:

- Separate subjects to blocks and then randomly assign to treatments within each block.

MATCHED PAIRS - An experiment used to compare two treatments that uses blocks of size 2.

Two very similar experimental units are paired and then randomly assigned to a treatment.

↳
top 2 GPAs
next 2
etc

What is the benefit of blocking?

Blocking accounts for a source of _____, just like stratifying. This means that blocking is a good way to increase your chances of finding _____.

In general, how can we determine which variables might be best for blocking?

Use the variables that are most _____ with (that can best predict) the response variable. The units _____ should respond similarly, but differently than the units in other blocks.

What is the benefit of blocking?

Blocking accounts for a source of variability, just like stratifying. This means that blocking is a good way to increase your chances of finding convincing evidence.

In general, how can we determine which variables might be best for blocking?

Use the variables that are most strongly associated with (that can best predict) the response variable. The units within the block should respond similarly, but differently than the units in other blocks.

What are some variables that we can block for in the caffeine experiment?

Anything that would create variability in the response.

(e.g., _____, _____, _____)

What is the difference between blocking and stratifying?

Blocking is to experiments as _____ is to _____/


What are some variables that we can block for in the caffeine experiment?

Anything that would create variability in the response.

(e.g., weight, caffeine intolerance, Age)

What is the difference between blocking and stratifying?

Blocking is to experiments as Stratifying is to Sampling/



7. Possibilities for Matched Pairs

- ~ 2 similar people
- ~ same person, different parts of body (right arm / left arm)
- ~ same person, different day

Could we use matched pairs for the caffeine experiment?

arrange ages \rightarrow pairs

arrange weights \Rightarrow pairs

DO
~~#8~~
S

8. Clockwise or counterclockwise? *Matched pairs design*

A track coach wants to know whether his long-distance runners are faster running the track clockwise or counterclockwise. Design an experiment that uses a **matched pairs design** to investigate this question. Explain your method of pairing.

8. Clockwise or counterclockwise? *Matched pairs design*

A track coach wants to know whether his long-distance runners are faster running the track clockwise or counterclockwise. Design an experiment that uses a matched pairs design to investigate this question. Explain your method of pairing.

A model answer is located
on the bottom of the
last sheet.

Brain
Break

Check Your Understanding:

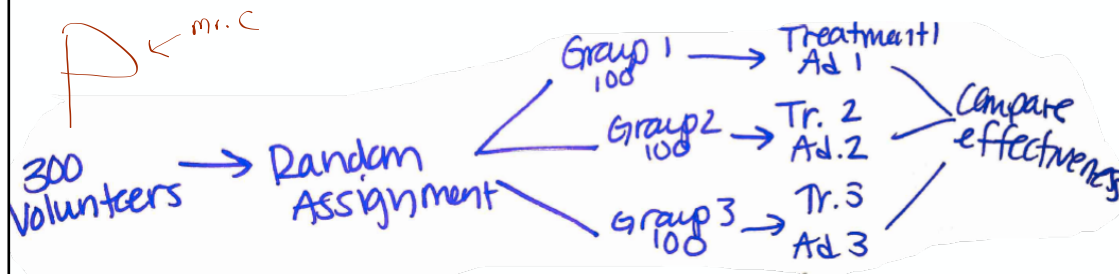
Researchers would like to design an experiment to compare the effectiveness of three different advertisements for a new television series featuring the work of Jane Austen. There are 300 volunteers available for the experiment.

1. Describe a **completely randomized design** to compare the effectiveness of the three advertisements.

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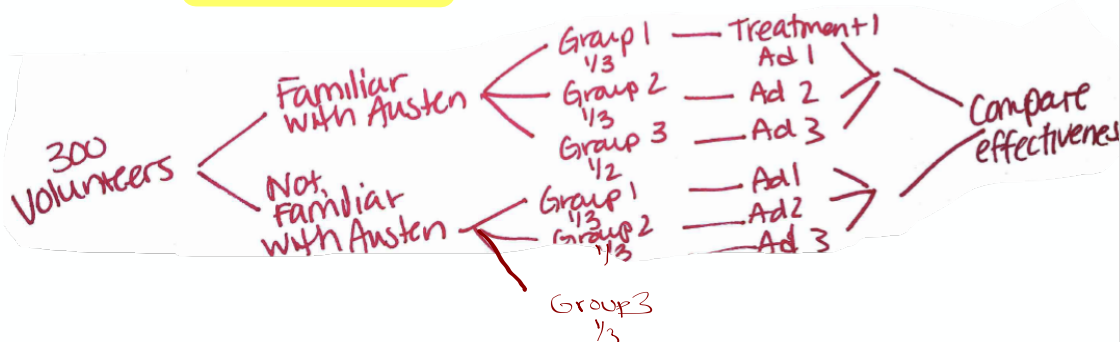
Researchers would like to design an experiment to compare the effectiveness of three different advertisements for a new television series featuring the work of Jane Austen. There are 300 volunteers available for the experiment.

1. Describe a **completely randomized design** to compare the effectiveness of the three advertisements.



2. Describe a **randomized block design** for this experiment. Justify your choice of blocks.

Block by people who are familiar with Austen



3. Why might a randomized block design be preferable in this context?

It minimizes the variability caused by those who have or haven't any familiarity with Austen. The ads may have different effectiveness based on

4.271, 75, 77,79, 83-90

pp. 256-261