4.2 Experiments

**Blocking**

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.

Example:

A drug company wants to test a new drug, statsium, to determine if it improves memory in young adults. There will be two treatments: a daily 20 mg pill and a daily placebo. Since male and female physiology is significantly different, a block design makes sense. Outline the design for a study involving 60 male students and 90 female students.

Example #2:

A study wants to examine the effect of technology on student learning. Participants will be provided a laptop, a tablet or no technology. It is thought that the grade level may be a factor in the study. The subjects consist of 30 sophomores, 45 juniors and 60 seniors. The study will last for one school year and the improvement in GPA for that year will be used to measure the results. Outline an experimental design for this study.

**Matched Pairs**

A **matched-pairs design** is a randomized blocked experiment in which each block consists of a matching pair of similar experimental units.

Chance is used to determine which unit in each pair gets each treatment.

Sometimes, a “pair” in a matched-pairs design consists of a single unit that receives both treatments. Since the order of the treatments can influence the response, chance is used to determine with treatment is applied first for each unit.

Example #3:

A hypothetical medical experiment involves 1000 subjects who each receive one of two treatments - a [placebo](http://stattrek.com/Help/Glossary.aspx?Target=Placebo) or a cold vaccine. The 1000 subjects are grouped into 500 matched pairs. Each pair is matched on gender and age. Describe how the experiment would work.

Example #4:

A TV producer of game shows wants to determine which of two potential hosts would be more popular with viewers. He puts together a focus group of 50 viewers. Describe how the experiment would work.

**Other types of experimental design**

**Double-blind**

The logic of a randomized comparative experiment depends on our ability to treat all the subjects the same in every way except for the actual treatments being compared. A response to a dummy treatment is called a **placebo effect**.

In a **double-blind experiment,** neither the subjects nor those who interact with them and measure the response variable know which treatment a subject received.

**Three Principles of Experimental Design**

1. **Control** for lurking variables that might affect the response: Use a comparative design and ensure that the only systematic difference between the groups is the treatment administered.
2. **Random assignment**: Use impersonal chance to assign experimental units to treatments. This helps create roughly equivalent groups of experimental units by balancing the effects of lurking variables that aren’t controlled on the treatment groups.
3. **Replication**: Use enough experimental units in each group so that any differences in the effects of the treatments can be distinguished from chance differences between the groups. If the treatments are given to groups that differ greatly, *bias* will result. The solution to the problem of bias is **random assignment.**

**Example**

The Physicians' Health Study, a large medical experiment involving 22,000 male physicians, divided randomly into two groups, attempted to determine whether aspirin could help prevent heart attacks. In this study, one group of about 11,000 physicians took an aspirin every other day, while a control group took a placebo. After several years, it was determined that the physicians in the group that took aspirin had significantly fewer heart attacks that the physicians in the control. Explain how each of the three principles of experimental design was used in the study.