Solution *Section* 1.4 – Design of Experiments

Exercise

A school psychologist wants to test the effectiveness of a new method for teaching reading. She recruits 500 first-grade students in District 203 and randomly divides them into two groups. Group 1 is taught by means of the new method, while group 2 is taught by traditional methods. The same teacher is assigned to teach both groups. At the end of the year, an achievement test is administered and the results of the two groups are compared.

a) What is the response variable in this experiment?
b) Think of some of the factors in the study. How are they controlled?
c) What are the treatments? How many treatments are there?
d) How are the factors that are not controlled dealt with?
e) Which group serves as the control group?
f) What type of experimental design is this?
g) Identify the subjects.

Solution

a) The response variable is the achievement test scores.
b) Some factors are teaching methods, grade level, intelligence, school district, and teacher.
Fixed: grade level, school district, teacher
Set at predetermined levels: teaching method.
c) The treatments are the new teaching method and the traditional method. There are 2 levels of treatment.
d) The factors that are not controlled are dealt with by random assignment into the two treatment groups.
e) Group 2, using the traditional teaching method, serves as the control group.
f) This experiment has a completely randomized design.
g) The subjects are the 500 first-grade students from District 203 recruited for the study.

Exercise

A pharmaceutical company has developed an experimental drug meant to relieve symptoms associated with the common cold. The company identifies 300 adult males 25 to 29 years old who have a common cold and randomly divides them into 2 groups. Group 1 is given the experimental drug, while group 2 is given a placebo. After 1 week of treatment, the proportions of each group that still have cold symptoms are compared.

a) What is the response variable in this experiment?
b) Think of some of the factors in the study. How are they controlled?
c) What are the treatments? How many treatments are there?
d) How are the factors that are not controlled dealt with?
e) What type of experimental design is this?
f) Identify the subjects.

Solution

a) The response variable is the proportion of subjects with a cold.

b) Some factors are gender, age, geographic location, overall health, and drug intervention,

Fixed: gender, age, location

Set at predetermined levels: drug intervention

c) The treatments are the experimental drug and the placebo. There are 2 levels of treatment

d) The factors that are not controlled are dealt with by random assignment into the two groups.

e) This experiment has a completely randomized design.

f) The subjects are the 300 adult males aged 25 to 29 who have the common cold.

Exercise

Researchers wanted to compare the effectiveness and safety of an extract of St. John's wort with placebo in outpatients with major depression. To do this, they recruited 200 adult outpatients diagnosed as having major depression and having a baseline Hamilton Rating Scale for Depression (HAM-D) score of at least 20. Participants were randomly assigned to receive either St. John's wort extract, 900 *mg* per day (*mg/d*) for a weeks, increased to 1200 *mg/d* in the absence of an adequate response thereafter, or a placebo for 8 weeks. The response variable was the change on the HAM-D over the treatment period. After analysis of the data, it was concluded that St. John's wort was not effective for treatment of major depression.

a) What type of experimental design is this?

b) What is the population that is being studied?

c) What is the response variable in this study?

d) What are the treatments?

e) Identify the experimental units.

f) What is the control group in this study?

Solution

a) This experiment has a completely randomized design

b) The population being studied is adult outpatients diagnosed as having major depression and having a baseline HAM-D score of at least 20.

c) The response variable is the change in the HAM-D over the treatment period.

d) The explanatory variable is the type of drug. The treatments are St. John's wort extract and the placebo.

e) The experimental units are the 200 adults outpatients diagnosed with depression.

f) The control group is the placebo group.

Exercise

Researchers wanted to evaluate whether ginkgo, an over-the-counter herb marketed as enhancing memory, improves memory in elderly adults as measured by objective tests. To do this, they recruited 96 men and 132 women older than 60 years and in good health. Participants were randomly assigned to receive ginkgo, 40 *mg* 3 times per day, or a matching placebo. The measure of memory improvement was determined by a standardized test of learning and memory. After 6 weeks of treatment, the data indicated that ginkgo did not increase performance on standard tests of learning, memory, attention, and concentration. These data suggest that, when taken following the manufacturer's instructions, ginkgo

provides no measurable increase in memory or related cognitive function to adults with healthy cognitive function.

a) What type of experimental design is this?
b) What is the population being studied?
c) What is the response variable in this study?
d) What is the factor that is set to predetermined levels? What are the treatments?
e) Identify the experimental units.
f) What is the control group in this study?

Solution

a) This experiment has a completely randomized design.
b) The population being studied is adults over 60 years old and in good health.
c) The response variable is the standardized test of learning and memory.
d) The factor set to predetermined levels (explanatory variable) is the drug. The treatments are 40 *mg* of ginkgo 3 times per day and the matching placebo.
e) The experimental units are the 98 men and 132 women over60 years old and in good health.
f) The control group is the placebo group.