GLOSSARY

alpha (or alpha level) – the probability of making a Type I error; the probability that a result will fall in the rare zone and the null hypothesis will be rejected when the null hypothesis is true; often called significance level; abbreviated α; usually set at .05 or 5%.

alternative hypothesis – abbreviated H_1; a statement that the explanatory variable has an effect on the outcome variable in the population; usually, a statement of what the researcher believes to be true.

analysis of variance (ANOVA) – a family of statistical tests for comparing the means of two or more groups.

apparent limits – what seem to be the upper and lower bounds of an interval in a grouped frequency distribution.

bar graph – a graph of a frequency distribution for discrete data that uses the heights of bars to indicate frequency; the bars do not touch.

beta – the probability of making a Type II error; abbreviated β.

between-group variability – variability in scores that is primarily due to the different treatments that different groups receive.

between-subjects – ANOVA terminology for independent samples.

between-subjects, one-way ANOVA – a statistical test used to compare the means of two or more independent samples when there is just one explanatory variable.

cases – the participants in or subjects of a study.

central limit theorem – a statement about the shape that a sampling distribution of the mean takes if the size of the samples is large and every possible sample were obtained.

central tendency – a value used to summarize a set of scores; also known as the average.

chi-square goodness-of-fit test – a nonparametric, single-sample test used to compare the distribution of a categorical (nominal- or ordinal-level) outcome variable in a sample to a known population value.

chi-square test of independence – a nonparametric test used to determine whether two or more populations of cases differ on a categorical (nominal- or ordinal-level) outcome variable.

clinical significance (or practical significance) – whether the size of the effect is large enough to say the explanatory variable has a meaningful impact on clinical outcome.

coefficient of determination – formal name for the effect size r^2.

Cohen's *d* – a standardized measure of effect used to measure the difference between means.

common zone – the section of the sampling distribution of a test statistic in which the observed outcome should fall if the null hypothesis is true; typically set to be the middle 95%.

confidence interval – a range within which it is estimated, based on a sample value, that a population value falls.

confounding variable – a third variable in correlational and quasi-experimental designs that is not controlled for and that has an impact on *both* of the other variables.

consent rate – the percentage of targeted subjects who agree to participate in a study.

contingency table – a table showing the degree to which a case's value on the outcome variable depends on its category on the explanatory variable.

continuous number – number that answers the question "how much" and can have "in-between" values; the specificity of the number, the number of decimal places reported, depends on the precision of the measuring instrument.

convenience sample – a sampling strategy in which cases are selected for study based on the ease with which they can be obtained.

correlation coefficient – a statistic that summarizes, in a single number, the strength of a relationship between two variables.

correlational design – a scientific study in which the relationship between two variables is examined without any attempt to manipulate or control them.

criterion variable – the outcome variable in a correlational design.

critical value – the value of the test statistic that forms the boundary between the rare zone and the common zone of the sampling distribution of the test statistic.

critical value of *t* – value of *t* used to determine whether a null hypothesis is rejected or not; abbreviated t_{cv}.

crossed – a factorial ANOVA in which each level of each explanatory variable occurs with each level of the other explanatory variable.

cumulative frequency – a count of how often a given value, or a lower value, occurs in a set of data.

cumulative percentage – cumulative frequency expressed as a percentage of the number of cases in the data set.

degrees of freedom (*df*) – the number of values in a sample that are free to vary.

dependent samples – samples in which the selection of cases for one group is related to, influences, or is determined by case selection for another group.

dependent variable – the variable where the effect is measured in an experimental or quasi-experimental study; an outcome variable.

descriptive statistic – a summary statement about a set of cases.

descriptive statistics – statistics used to describe a set of observations.

deviation score – a measure of how far away a score falls from the mean.

difference tests – statistical tests that look for differences among groups of cases.

direct relationship – a relationship in which high scores on *X* are associated with high scores on *Y*. Also called a positive relationship.

discrete number – numbers that answer the question "how many," take whole number values, and have no "in-between" values.

effect size – a measure of the degree of impact of the explanatory variable on the outcome variable.

eta squared (η^2) – an effect size that calculates the percentage of variability in the outcome variable accounted for by the explanatory variable.

experimental design – a scientific study in which an explanatory variable is manipulated or controlled by the experimenter and the effect that is measured in a dependent variable allows for a cause and effect conclusion.

explanatory variable – the variable that causes, predicts, or explains the outcome variable.

extreme percentage – percentage of the normal distribution that is found in the two tails and is evenly divided between them.

factor – term for an explanatory variable in ANOVA.

factorial ANOVA – an analysis of variance in which there is more than one explanatory variable.

frequency distribution – a tally of how often different values of a variable occur in a set of data.

frequency polygon – a frequency distribution for continuous data, displayed in graphical format, using a line connecting dots above interval midpoints to indicate frequency.

grouped frequency distribution – a count of how often the values of a variable, grouped into intervals, occur in a set of data.

grouping variable – the variable that is the explanatory variable in a quasi-experimental design.

histogram – a frequency distribution for continuous data, displayed in graph form, using the heights of bars to indicate frequency; the bars touch each other.

hypothesis – a proposed explanation for observed facts; a statement or prediction about a population value.

hypothesis testing – a statistical procedure in which data from a sample are used to evaluate a hypothesis about a population.

independence – in probability, when the occurrence of one outcome does not have any impact on the occurrence of a second outcome.

independent samples – when the selection of cases for one sample has no impact on the selection of cases for another sample.

independent-samples *t* test – an inferential statistical test used to compare two independent samples on an interval- or ratio-level outcome variable.

independent variable – the variable that is controlled by the experimenter in an experimental design.

individual differences – attributes that vary from case to case.

inferential statistic – using observations from a sample to draw a conclusion about a population.

interaction effect – situation, in factorial ANOVA, in which the impact of one explanatory variable

on the outcome variable depends on the level of another explanatory variable.

interquartile range – a measure of variability for interval- or ratio-level data; the distance covered by the middle 50% of scores; abbreviated *IQR*.

interval estimate – an estimate of a population value that says the population value falls somewhere within a range of values.

interval-level numbers – numbers that provide information about how much of an attribute is possessed, as well as information about same/different and more/less; interval-level numbers have equality of units and an arbitrary zero point.

inverse relationship – a relationship in which high scores on *X* are associated with low scores on *Y*. Also called a negative relationship.

kurtosis – how peaked or flat a frequency distribution is.

least squares criterion – prediction errors are squared and the best-fitting regression line is the one that has the smallest sum of squared errors.

level – ANOVA terminology for a category of an explanatory variable.

linear regression – a predictor variable is used to predict a case's score on another variable and the prediction equation takes the form of a straight line.

longitudinal research (or repeated-measures design) – a study in which the same participants are measured at two or more points in time.

main effect – the impact of an explanatory variable, by itself, on the outcome variable.

Mann–Whitney *U* test – a nonparametric test used to compare two independent samples on an ordinal-level outcome variable.

matched pairs – participants are grouped into sets of two based on their being similar on potential confounding variables.

mean – an average calculated for interval- or ratio-level data by summing all the values in a data set and dividing by the number of cases; abbreviated *M*.

median – an average calculated by finding the score associated with the middle case, the case that separates the top half of scores from the bottom half; abbreviated *Mdn;* can be calculated for ordinal-, interval-, or ratio-level data.

middle percentage – percentage of the normal distribution found around the midpoint, evenly divided into two parts, one just above the mean and one just below it.

midpoint – the middle of an interval in a grouped frequency distribution.

modality – the number of peaks that exist in a frequency distribution.

mode – the score that occurs with the greatest frequency.

multiple linear regression – prediction in which multiple predictor variables are combined to predict an outcome variable.

negative relationship – a relationship in which high scores on *X* are associated with low scores on *Y;* also called an inverse relationship.

negative skew – an asymmetrical frequency distribution in which the tail extends to the left, in the direction of lower scores.

nominal-level numbers – numbers used to place cases in categories; numbers are arbitrary and only provide information about same/different.

nonparametric test – a statistical test for use with nominal- or ordinal-level outcome variables, and for which assumptions about the shape of the population don't have to be met.

nonrobust assumption – an assumption for a statistical test that must be met in order to proceed with the test.

normal distribution – also called the normal curve; a specific bell-shaped curve defined by the percentage of cases that fall in specific areas under the curve.

null hypothesis – abbreviated H_0; a statement that in the population the explanatory variable has no impact on the outcome variable.

one-tailed hypothesis test – hypothesis that predicts the explanatory variable has an impact on the outcome variable in a specific direction.

ordinal-level numbers – numbers used to indicate if more or less of an attribute is possessed; numbers provide information about same/different and more/less.

outcome variable – the variable that is caused, predicted, or influenced by the explanatory variable; the variable in a relationship test, *Y*, that is predicted from the other variable, *X*. Sometimes called the dependent variable.

outlier – an extreme (unusual) score that falls far away from the rest of the scores in a set of data.

***p* value** – the probability of Type I error; the same as alpha level or significance level.

paired samples – case selection for one sample is influenced by, depends on, the cases selected for another sample.

paired-samples *t* test – hypothesis test used to compare the means of two dependent samples; also known as dependent-samples *t* test, correlated-samples *t* test, related-samples *t* test, matched-pairs *t* test, within-subjects *t* test, or repeated-measures *t* test.

parameter – a value that summarizes a population.

parametric test – a statistical test for use with interval- or ratio-level outcome variables, and for which assumptions about the shape of the population must be met.

partial correlation – a correlation between two variables from which the influence of a third variable has been mathematically removed.

Pearson correlation coefficient – a statistical test that measures the degree of linear relationship between two interval/ratio-level variables.

percentile rank – percentage of cases with scores at or below a given level in a frequency distribution.

perfect relationship – a relationship between two variables in which the value of one can be exactly predicted from the other.

point estimate – an estimate of a population value that is a single value.

pooled variance – the average variance for two samples.

population – the larger group of cases a researcher is interested in studying.

positive relationship – a relationship in which high scores on *X* are associated with high scores on *Y;* also called direct relationship.

positive skew – an asymmetrical frequency distribution in which the tail extends to the right, in the direction of higher scores.

post-hoc test – a follow-up test to a statistically significant ANOVA, engineered to find out which pairs of means differ while keeping the overall alpha level at the chosen level.

power – the probability of rejecting the null hypothesis when the null hypothesis should be rejected.

practical significance (or clinical significance) – the size of the effect is large enough to say the explanatory variable has a meaningful impact on the outcome variable (or the clinical outcome).

prediction interval – a range around Y' within which there is some certainty that a case's real value of *Y* falls.

predictor variable – the variable in a relationship test, *X,* that is used to predict the other variable, *Y;* the explanatory variable in a correlation design.

pre-post design – participants are measured on the dependent variable before and after an intervention or manipulation.

probability – how likely an outcome is; the number of ways a specific outcome can occur, divided by the total number of possible outcomes.

quasi-experimental design – a scientific study in which cases are classified into naturally occurring groups and then compared on a dependent variable.

r^2 – an effect size that reveals the percentage of variability in one variable that is accounted for by the other variable; formally called coefficient of determination.

random assignment – every case has an equal chance of being assigned to any group in an experiment; random assignment is the hallmark of an experiment.

random sample – a sampling strategy in which each case in the population has an equal chance of being selected.

range – a measure of variability for interval- or ratio-level data; the distance from the lowest score to the highest score.

rare zone – the section of the sampling distribution of a test statistic in which it is unlikely an observed outcome will fall if the null hypothesis is true; typically, 5% of the sampling distribution.

ratio-level numbers – numbers that have all the attributes of interval-level numbers, plus a real zero point; numbers that provide information about same/different, more/less, how much of an attribute is possessed, and that can be used to calculate a proportion.

real limits – what are really the upper and lower bounds of a single continuous number or of an interval in a grouped frequency distribution.

regression line – the best-fitting straight line for predicting *Y* from *X*.

relationship tests – statistical tests that determine if two variables in a group of cases covary.

repeated-measures ANOVA – a statistical test used to compare two or more dependent samples on an interval- or ratio-level–dependent variable; also called within-subjects ANOVA, dependent-samples ANOVA, or related-samples ANOVA.

repeated-measures design (or longitudinal research) – a study in which the same participants are measured at two or more points in time.

replicate – to repeat a study, usually introducing some change in procedure to make it better.

representative – the attributes of the population are present in the sample in approximately the same proportion as in the population.

residual – the difference between an actual score and a predicted score; the size of the error in prediction.

robust assumption – an assumption for a statistical test that can be violated to some degree and it is still OK to proceed with the test.

sample – a group of cases selected from a population.

sampling distribution – a frequency distribution generated by taking repeated, random samples from a population and generating some value, like a mean, for each sample.

sampling error – discrepancies, due to random factors, between a sample statistic and a population parameter.

self-selection bias – a nonrepresentative sample that may occur when the subjects who agree to participate in a research study differ from those who choose not to participate.

significance level – the probability of Type I error; the same as alpha level or *p* value.

simple linear regression – prediction in which Y' is predicted from a single predictor variable.

single-sample test – a statistical test used to compare the results in a sample to a known population value or a specified value.

single-sample *t* test – a statistical test that compares a sample mean to a population mean when the population standard deviation is not known.

skewness – the degree to which a set of scores is not symmetric but tails off in one direction or the other.

slope – the tilt of the line; rise over run; how much up or down change in *Y* is predicted for each 1-unit change in *X*.

Spearman rank-order correlation coefficient – a nonparametric test that examines the relationship between two ordinal-level variables or one ordinal and an interval/ratio variable.

standard deviation – a measure of variability for interval- or ratio-level data; the square root of the variance; a measure of the average distance that scores fall from the mean.

standard error of the estimate – the standard deviation of the residual scores, a measure of error in regression.

standard error of the mean – the standard deviation of a sampling distribution of the mean.

standard error of the mean difference for difference scores – the standard deviation of the sampling distribution of difference scores, abbreviated s_{M_D}; used as the denominator in the paired-samples *t* test equation.

standard score – raw score expressed in terms of how many standard deviations it falls away from the mean; also known as a *z* score.

statistic – a value that summarizes data from a sample.

statistical significance – the observed difference between sample means is large enough to conclude that it represents a difference between population means.

statistically significant – when a researcher concludes that the observed sample results are different from the null-hypothesized population value.

statistics – techniques used to summarize data in order to answer questions.

stem-and-leaf display – a data summary technique that combines features of a table and a graph.

sum of squares – squaring a set of scores and then adding together the squared scores; abbreviated *SS*.

sum of squares between ($SS_{Between}$) – a sum of the squared deviation scores representing the variability between groups.

sum of squares total (SS_{Total}) – a sum of the squared deviation scores representing all the variability in the scores.

sum of squares within (SS_{Within}) – a sum of the squared deviation scores representing the variability within groups.

treatment effect – the impact of the explanatory variable on the dependent variable.

two-samples *t* test – an inferential statistical test used to compare the mean of one sample to the mean of another sample.

two-tailed hypothesis test – hypothesis that predicts the explanatory variable has an impact on the outcome variable, but doesn't predict the direction of the impact.

Type I error – the error that occurs when the null hypothesis is true but is rejected; *p*(Type I error) = α.

Type II error – the error that occurs when one fails to reject the null hypothesis but should have rejected it; $p(\text{Type II error}) = \beta$.

underpowered – term for a study with a sample size too small for the study to have a reasonable chance to reject the null hypothesis given the size of the effect.

ungrouped frequency distribution – a count of how often each individual value of a variable occurs in a set of data.

variability – how much variety (spread or dispersion) there is in a set of scores.

variables – characteristics measured by researchers.

variance – a measure of variability for interval- or ratio-level data; the mean of the squared deviation scores.

way – term for an explanatory variable in ANOVA.

within-group variability – variability within a sample of cases, all of which have received the same treatment.

within-subjects – ANOVA terminology for dependent samples.

within-subjects design – the same participants are measured in two or more different situations or under two or more different conditions.

***Y*-intercept** – the spot where the regression line would pass through the Y-axis.

***Y* prime** – the value of Y predicted from X by a regression equation; Y'.

***z* score** – raw score expressed in terms of how many standard deviations it falls away from the mean; also known as a standard score.