* Analysis of quantitative data involves the application of statistical techniques. There are several purposes behind the use of statistical analysis procedures:
  + To summarize data and reveal what is typical and atypical
  + To show relative standing of individuals in a group
  + To show relationships among variables
  + To show similarities and differences among groups
  + To identify error inherent in sample selection
  + To test for significance of statistical findings
  + To make inferences about the population
* Parameters are numerical indices that describe a population; statistics are numerical indices that describe a sample.
* Data must be prepared for analysis by being numerically coded, using a codebook, and entered into a database.
* Descriptive statistics are those techniques that simplify, summarize, and describe data.
* Inferential statistics are techniques used to determine the likelihood that the results obtained from a sample are similar to those that would be obtained from an entire population.
* Descriptive statistical techniques include the following categories: frequency distributions, measures of central tendency, measures of dispersion or variability, measures of relationship, and measures of relative position.
  + Arguably, the most commonly used descriptive techniques are measures of central tendency (i.e., mean, median, and mode) and measures of variability (i.e., range, variance, and standard deviation).
* Numerous types of correlational analyses are available, depending on the scale of measurement used with each variable in the analysis.
* Measures of relative standing are based on the location of an individual with a common distribution, based on the normal distribution.
  + The normal distribution has three important characteristics: The distribution is symmetrical; the mean, median, and mode are the same score and located at the exact center of the distribution; and the percentage of cases in each standard deviation is known precisely.
* Visual representations are also a way to describe quantitative data.
* Inferential statistical techniques include tests of relationships and tests of differences between groups.
* Determining statistical significance is the process of concluding that the sample difference is large enough to infer that a real difference also exists in the population.
* The standard error is a measure of the variability of sample means in a distribution.
* Inferential statistics is based largely on the idea of hypothesis testing, where the null hypothesis is tested to determine statistical significance.
* The level of significance, or alpha (α) level, is the value used as the criterion to determine statistical significance. In educational research studies, alpha is typically set at .05 or .01.
* Four possible outcomes can result from a test of statistical significance; two represent correct decisions, and two represent errors.
  + A Type I error has been committed when a researcher concludes that a null hypothesis is false when it is actually true.
  + A Type II error has been committed when a researcher concludes that a null hypothesis is true when it is actually false.
* The *p*-value obtained from the analysis is compared with the α level to determine significance. If *p*is less than α, then the difference or relationship is statistically significant.
* Effect size is important in hypothesis testing and is defined as the amount of difference between two groups (i.e., the treatment effect) in standard deviation units.
* Bivariate tests of relationships include the chi-square test for independence, Pearson correlation coefficient, and linear or simple regression.
* Multivariate tests of relationship include multiple regression, multivariate multiple regression, path analysis, and structural equation modeling.
* There are numerous tests of group differences, including independent samples *t*-test, repeated samples *t*-test, and analysis of variance (ANOVA).
* Several variations of analysis of variance include designs with multiple independent variables, covariates, and multiple dependent variables.
* Tests for prediction of group membership include discriminant analysis and logistic regression.
* Tests underlying structure include factor analysis and principal components analysis.
* Researchers should be cautious not to go overboard when using statistical analysis techniques and to stay focused on their research questions and purposes for their studies.
* Researchers should consider practical significance, as well as statistical significance.