

## Key concepts and objectives

### Statistics

- Why do we need statistics?
  - Variability
  - Chance
- Descriptive vs. inferential statistics
  - Samples and population
- Variables
- Levels of measurement
  - Practical
  - Formal (nominal, ordinal, interval, ratio)
- Tables, bar charts, scatter plots
  - Function
  - Name, caption, placement
- Central tendency
  - Mean, median, mode
- Variance
  - Sample variance
  - Estimated variance
  - Degrees of freedom
- Histograms
- Normal (Gaussian) curve
  - Skewness
  - Kurtosis
  - Bimodal, multimodal
  - Percentiles
- Standard deviation
  - Sample sd
  - Estimated sd
  - Degrees of freedom
- Z scores
  - Standard normal z-distribution
  - Must understand and be able to use it
  - (see Significance Table 5.1 in textbook)
- Relationship between variables
  - Diagrams and tables
  - Cross-tabulation
  - Three types of relationship and corresponding diagram
- Correlation coefficients
  - When is it necessary?
  - Why is it necessary?
  - Pearson (product moment) correlation
    - Range of values (and what they mean)
    - Sign of values (and what they mean)
    - Why move from covariance to  $r$ ?
    - Coefficient of determination ( $R^2$ )

- Parametric vs. Non-parametric tests
  - Why? What is the difference?
  - Which is Pearson's  $r$ ?
  - Which is Spearman's  $Rho$ ?
- SIGNIFICANCE TESTING: Samples and populations
  - More in-depth understanding
  - Characteristics of Random samples
    - Must understand tables 9.1 to 9.3 in textbook as well as the two random sample mean demos (excel and minitab files) provided.
  - Confidence intervals
- Null hypothesis, alternative hypothesis, research hypothesis
  - E.g.: In a statistical analysis of the relationship between two ratio-level scores (music and maths), what is the value of the Pearson correlation coefficient *according to the Null hypothesis*?
  - E.g.: When testing whether the scores in a group are statistically different from another group the null hypothesis states that "both groups are taken from the same \_\_\_\_\_"
- Significance Level
- SIGNIFICANCE TESTING: Correlation coefficient
  - Must understand tables 10.1 and 10.2 in textbook along with the random correlation demo (excel file) provided
  - Must understand and be able to use significance table 10.1 in textbook.
  - What are critical values? (e.g. For a sample size of 10 what is (are) the critical value(s) of Pearson correlation at the 5% significance level?).
- Standard error
  - Must understand Tables 11.1 and 11.2 in textbook as well as the two random sample mean demos (excel and minitab files) provided.
  - Sampling distribution
  - Estimated (estimating what?) standard deviation, standard error, and degrees of freedom (again!)

### **Research Methods**

- Correlational vs. Experimental designs
  - What you can and cannot do in each
  - Causal explanations
  - Controlling factors; manipulation
  - When is an experiment a quasi-experiment?
  - Confounding factors (variables)
  - Counter-balancing
  - Independent and dependent variables