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EDITION

Statistics for People Who (Think They) Hate Statistics

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Chapter 3 ☺ ☺ ☺ ☺
Viva La Différence: Understanding Variability

What You Will Learn in Chapter 3

- Understanding the value of variability as a descriptive tool
- Computing the range
- Computing the standard deviation
- Computing the variance
- Understanding what the standard deviation and variance have in common and how they are different

Why Understanding Variability Is Important

- *Variability* reflects how scores differ from one another.
- Also called *spread* or *dispersion*

Measures of Variability

- Three measures of variability are commonly used to reflect the degree of variability, including range, standard deviation, and variance.

- Typically report the average and the variability together to describe a distribution

Computing the Range

- Range is the most general estimate of variability

- There are two types of range, although the most commonly used is the exclusive range.

Exclusive Range

- General formula for range
- Also known as the *exclusive range*
- Range = h − l
- Where *h* is the highest score, and *l* is the lowest score

Inclusive Range

- Inclusive Range = h – l + 1
- This type of range is less commonly seen.
- Where *h* is the highest score, and *l* is the lowest score

Computing Standard Deviation

- Most frequently used measure of variability

- SD = s = represents the average amount of variability in a set of scores

$$s = \sqrt{\frac{\sum(X - \bar{X})^2}{n - 1}}$$

Important Symbols

- *s* = standard deviation
- Σ = sigma, which tells you to find the sum of what follows it
- *X* = each individual score
- $\overline{X}$ = X-bar = mean of all of the scores in the sample
- *n* = sample size

Why n – 1?

- Standard deviation is an estimate of the POPULATION standard deviation.
- To make it an *unbiased estimate*, you must subtract 1 from *n*.
- This artificially inflates the SD (it makes it bigger) because it makes the denominator smaller.

Things to Remember . . .

- Standard deviation is computed as the average distance from the mean.
- The larger the standard deviation, the more spread out the values are.
- Like the mean, the standard deviation is sensitive to extreme scores.
- If $s = 0$, then there is no variability among scores, and the scores are essentially identical in value.

Computing Variance

- Variance = standard deviation squared

$$s^2 = \frac{\sum(X-\bar{X})^2}{n-1}$$

- If you take the standard deviation and never complete the last step (taking the square root), you have the variation.

Standard Deviation or Variance

- While the formulas are quite similar, the two are also quite different.
- Standard deviation is stated in original units.
- Variance is stated in units that are squared.

Using the Computer to Compute

Figure 3.1 SPSS Output for the Variable Reaction Time

Statistics

ReactionTime

N	Valid	30
	Missing	0
Std. Deviation		.70255
Variance		.494
Range		2.60

Understanding and Interpreting

Figure 3.2 Output for the Variables Math_Score and Reading_Score

Statistics

		Math_Score	Reading_Score
N	Valid	30	30
	Missing	0	0
Std. Deviation		12.357	18.700
Variance		152.700	349.689
Range		43	76

Real-World Stats

- Stapelberg and colleagues looked at variability in heart rate as it related to coronary heart disease.
- They found decreased heart rate variability in both depressive disorders and coronary heart disease.
- Researchers think that both diseases disrupt control feedback loops that help the heart function efficiently.