

t-Tests, Chi-squares, Phi, Correlations: It's all the same stuff

In this handout, I provide illustrations of the connection between t-tests and correlations and between chi-square and correlation.

t-Tests and Correlations

Below are the results from the t-test handout, followed by a correlation analysis. The correlation gives the association between the independent and dependent variables. Notice that the p-values are identical in the two analyses.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
satisfaction rating of school	Equal variances assumed	3.200	.111	-3.000	8	.017	-3.00000	1.00000	-5.30600	-.69400
	Equal variances not assumed			-3.000	5.882	.025	-3.00000	1.00000	-5.45882	-.54118

Correlations

		satisfaction rating of school	type school type
satisfaction rating of school	Pearson Correlation	1	.728(*)
	Sig. (2-tailed)		.017
	N	10	10
type school type	Pearson Correlation	.728(*)	1
	Sig. (2-tailed)	.017	
	N	10	10

* Correlation is significant at the 0.05 level (2-tailed).

Chi-square, Phi, and Pearson Correlation

Below are the chi-square results from the 2 X 2 contingency chi-square handout. With SPSS Crosstabs procedure, you can request Phi (for 2 x 2) or Cramer's V (for larger than 2 x 2) as a measure of association. Phi is identical to Pearson's correlation.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	81.940 ^b	1	.000		
Continuity Correction ^a	80.322	1	.000		
Likelihood Ratio	84.606	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	81.776	1	.000		
N of Valid Cases	500				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 110.40.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.405	.000
Nominal	Cramer's V	.405	.000
N of Valid Cases		500	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Correlations

		candidate candidate	party voters party
candidate candidate	Pearson Correlation	1	.405**
	Sig. (2-tailed)		.000
	N	500	500
party voters party	Pearson Correlation	.405**	1
	Sig. (2-tailed)	.000	
	N	500	500

** . Correlation is significant at the 0.01 level (2-tailed).

The significance tests for chi-square and correlation will not be exactly the same, but will very often give the same result. Chi-square tests are based on the normal distribution (remember that $z^2 = \chi^2$), but the significance test for correlation uses the t-distribution. Only with large sample sizes (e.g., N = 120) will the t and the normal be the same (or, at least, very close).