Effect Size For An Independent-Samples T-Test

Review of Guide 10

In the last *Guide*, we calculated an independent-samples *t*-test to investigate whether playing video games makes you less anxious. To test this question, we collected a sample of 30 participants and randomly divided them into two groups–one in which participants played a video game and another in which they watched a TV show instead. After this manipulation, we collected anxiety scores for each participant. We calculated the independent-samples *t*-test and found that $t = -1.21$, which—after finding that the *p*-value was only .24—was not statistically significant.

Calculating The Effect Size

As usual, however, we can also calculate the effect size associated with this test to get a sense for practical significance (in addition to statistical significance, which the hypothesis test described above gives us). Let's take a look at the formulas for calculating the effect size associated with an independent-samples *t*-test:

Cohen's d for an independent samples t-test

$$d_{(\bar{x}_1 - \bar{x}_2)} = \frac{\bar{x}_1 - \bar{x}_2}{s_p}$$

where:

Pooled standard deviation

$$s_p = \sqrt{\frac{s_1^2 + s_2^2}{2}}$$

So, the first step in calculating the effect size associated with an independent-samples *t*-test is to tackle s_p, which we call the **pooled standard deviation**. This term (s_p) is essentially an "average" standard deviation that incorporates the variability of both groups of participants. To calculate it, we simply need the sample variances of each group, which we already calculated when doing the independent-samples *t*-test in the last *Guide*!

As a reminder, we determined that the sample variances were $s_1^2 = 7.98$ and $s_2^2 = 6.78$. Let's plug these values into the formula for s_p as follows:

$$s_p = \sqrt{\frac{s_1^2 + s_2^2}{2}} = \sqrt{\frac{7.98 + 6.78}{2}} = 2.72$$

Since we already have the means for each group from the *t*-test ($\bar{x}_1 = 6.87$ and $\bar{x}_2 = 8.07$), let's go ahead and plug these along with s_p, which equals 2.72, into the formula for the effect size:

$$d_{(\bar{x}_1 - \bar{x}_2)} = \frac{\bar{x}_1 - \bar{x}_2}{s_p} = \frac{6.87 - 8.07}{2.72} = -0.44$$

And there you have it! Our effect size associated with this particular independent samples *t*-test is $d = -0.44$. You'll notice that even though the *t*-test did not end up being significant, the effect size tells us that the size of the effect is "medium." With more data, it's possible that this effect would become significant.