Comparison of Means: Paired Data

A computer scientist is investigating the usefulness of two design languages in improving programming tasks. Twelve expert programmers are asked to code a standard function in each language. The scientist wants to compare the mean programming times in the two design languages. To do so, he computes D, the difference between the programmer's programming time using language 1 and that using language 2. Assuming that these differences follow a normal distribution, he constructs a level 0.95 confidence interval for the mean difference in programming time, μ_D. The data (found in SASDATA.PROGRAM_TIMES) are:

	LANGUAGE		
PROGRAMMER	1 (y_{1i})	2 (y_{2i})	DIFF (d_i)
1	17	18	-1
2	16	14	2
3	21	19	2
4	14	11	3
5	18	23	-5
6	24	21	3
7	16	10	6
8	14	13	1
9	21	19	2
10	23	24	-1
11	13	15	-2
12	18	20	-2

For these data, $\bar{d} = 0.6667$, $s_d = 2.9644$ and $t_{11,0.975} = 2.201$. Then $\hat{\sigma}(\overline{D}) = 2.9644/\sqrt{12} = 0.8558$, so the desired interval is

$$0.6667 \pm (0.8558)(2.201) = (-1.2168, 2.5502).$$

Based on this, we estimate that the mean time to program the function in question using design language 1 is between 2.5502 minutes greater than and 1.2168 minutes less than it takes using design language 2. In particular, since the interval contains 0, we are unable to conclude that there is a difference in mean programming time.