

	control group								Experimental group								
	pre-test				post-test					pre-test				post-test			
	x	x-m	(x-m) ²		y	y-m	(y-m) ²		x-m*y-m	x	x-m	(x-m) ²		y	y-m	(y-m) ²	x-m*y-m
	12	3.97	15.76		15	2.6	6.76		10.32	11	2.63	6.92		14	-1.57	2.46	-4.13
	8	-0.03	0.00		17	4.6	21.16	-0.14	7 <td>-1.37</td> <td>1.88</td> <td></td> <th>19</th> <td>3.43</td> <td>11.76</td> <td>-4.70</td>	-1.37	1.88		19	3.43	11.76	-4.70	
	11	2.97	8.82		13	0.6	0.36	1.78	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>14</th> <td>-1.57</td> <td>2.46</td> <td>0.58</td>	-0.37	0.14		14	-1.57	2.46	0.58	
	15	6.97	48.58		16	3.6	12.96	25.09	10 <td>1.63</td> <td>2.66</td> <td></td> <th>20</th> <td>4.43</td> <td>19.62</td> <td>7.22</td>	1.63	2.66		20	4.43	19.62	7.22	
	8	-0.03	0.00		10	-2.4	5.76	0.07	7 <td>-1.37</td> <td>1.88</td> <td></td> <th>20</th> <td>4.43</td> <td>19.62</td> <td>-6.07</td>	-1.37	1.88		20	4.43	19.62	-6.07	
	7	-1.03	1.06		13	0.6	0.36	-0.62	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>19</th> <td>3.43</td> <td>11.76</td> <td>-1.27</td>	-0.37	0.14		19	3.43	11.76	-1.27	
	5	-3.03	9.18		10	-2.4	5.76	7.27	7 <td>-1.37</td> <td>1.88</td> <td></td> <th>16</th> <td>0.43</td> <td>0.18</td> <td>-0.59</td>	-1.37	1.88		16	0.43	0.18	-0.59	
	7	-1.03	1.06		10	-2.4	5.76	2.47	6 <td>-2.37</td> <td>5.62</td> <td></td> <th>14</th> <td>-1.57</td> <td>2.46</td> <td>3.72</td>	-2.37	5.62		14	-1.57	2.46	3.72	
	9	0.97	0.94		9	-3.4	11.56	-3.30	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>10</th> <td>-5.57</td> <td>31.02</td> <td>2.06</td>	-0.37	0.14		10	-5.57	31.02	2.06	
	9	0.97	0.94		10	-2.4	5.76	-2.33	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>10</th> <td>-5.57</td> <td>31.02</td> <td>2.06</td>	-0.37	0.14		10	-5.57	31.02	2.06	
	6	-2.03	4.12		9	-3.4	11.56	6.90	6 <td>-2.37</td> <td>5.62</td> <td></td> <th>10</th> <td>-5.57</td> <td>31.02</td> <td>13.20</td>	-2.37	5.62		10	-5.57	31.02	13.20	
	6	-2.03	4.12		8	-4.4	19.36	8.93	7 <td>-1.37</td> <td>1.88</td> <td></td> <th>11</th> <td>-4.57</td> <td>20.88</td> <td>6.26</td>	-1.37	1.88		11	-4.57	20.88	6.26	
	6	-2.03	4.12		11	-1.4	1.96	2.84	5 <td>-3.37</td> <td>11.36</td> <td></td> <th>10</th> <td>-5.57</td> <td>31.02</td> <td>18.77</td>	-3.37	11.36		10	-5.57	31.02	18.77	
	7	-1.03	1.06		10	-2.4	5.76	2.47	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>13</th> <td>-2.57</td> <td>6.60</td> <td>0.95</td>	-0.37	0.14		13	-2.57	6.60	0.95	
	7	-1.03	1.06		8	-4.4	19.36	4.53	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>20</th> <td>4.43</td> <td>19.62</td> <td>-1.64</td>	-0.37	0.14		20	4.43	19.62	-1.64	
	6	-2.03	4.12		15	2.6	6.76	-5.28	6 <td>-2.37</td> <td>5.62</td> <td></td> <th>20</th> <td>4.43</td> <td>19.62</td> <td>-10.50</td>	-2.37	5.62		20	4.43	19.62	-10.50	
	7	-1.03	1.06		14	1.6	2.56	-1.65	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>20</th> <td>4.43</td> <td>19.62</td> <td>-1.64</td>	-0.37	0.14		20	4.43	19.62	-1.64	
	8	-0.03	0.00		13	0.6	0.36	-0.02	9 <td>0.63</td> <td>0.40</td> <td></td> <th>18</th> <td>2.43</td> <td>5.90</td> <td>1.53</td>	0.63	0.40		18	2.43	5.90	1.53	
	9	0.97	0.94		18	5.6	31.36	5.43	9 <td>0.63</td> <td>0.40</td> <td></td> <th>17</th> <td>1.43</td> <td>2.04</td> <td>0.90</td>	0.63	0.40		17	1.43	2.04	0.90	
	12	3.97	15.76		14	1.6	2.56	6.35	15 <td>6.63</td> <td>43.96</td> <td></td> <th>17</th> <td>1.43</td> <td>2.04</td> <td>9.48</td>	6.63	43.96		17	1.43	2.04	9.48	
	7	-1.03	1.06		16	3.6	12.96	-3.71	6 <td>-2.37</td> <td>5.62</td> <td></td> <th>18</th> <td>2.43</td> <td>5.90</td> <td>-5.76</td>	-2.37	5.62		18	2.43	5.90	-5.76	
	8	-0.03	0.00		15	2.6	6.76	-0.08	8 <td>-0.37</td> <td>0.14</td> <td></td> <th>20</th> <td>4.43</td> <td>19.62</td> <td>-1.64</td>	-0.37	0.14		20	4.43	19.62	-1.64	
	7	-1.03	1.06		12	-0.4	0.16	0.41	14 <td>5.63</td> <td>31.70</td> <td></td> <th>15</th> <td>-0.57</td> <td>0.32</td> <td>-3.21</td>	5.63	31.70		15	-0.57	0.32	-3.21	

	8	-0.03	0.00		14	1.6	2.56	-0.05		7	-1.37	1.88		15	-0.57	0.32	0.78
	7	-1.03	1.06		12	-0.4	0.16	0.41		8	-0.37	0.14		14	-1.57	2.46	0.58
	6	-2.03	4.12		13	0.6	0.36	-1.22		11	2.63	6.92		14	-1.57	2.46	-4.13
	8	-0.03	0.00		13	0.6	0.36	-0.02		9	0.63	0.40		14	-1.57	2.46	-0.99
	9	0.97	0.94		11	-1.4	1.96	-1.36		11	2.63	6.92		13	-2.57	6.60	-6.76
	8	-0.03	0.00		13	0.6	0.36	-0.02		8	-0.37	0.14		13	-2.57	6.60	0.95
	8	-0.03	0.00		10	-2.4	5.76	0.07		8	-0.37	0.14		19	3.43	11.76	-1.27
total	241		130.97	total	372		209.20	65.60		251		144.97	total	467		349.37	14.77
M	8.03			M	12.40			r=0.40		8.37			M	15.5 7			r=0.07
SD			2.13				2.68					2.24				3.47	

Calculation of t-Test (Hypotheses wise)

H₀₁: There will be no significant difference between mean achievement scores of control group and experimental group in Pre –test.

Experimental group

Control group

$$SD_1 = \sqrt{\frac{\sum(x-m)^2}{n-1}}$$

$$SD_2 = \sqrt{\frac{\sum(x-m)^2}{n-1}}$$

$$= \sqrt{\frac{144.97}{29}}$$

$$= \sqrt{\frac{130.97}{29}}$$

$$= \sqrt{4.998}$$

$$= \sqrt{4.516}$$

$$SD_1 = 2.24$$

$$SD_2 = 2.13$$

$$SE_m1 = \frac{SD_1}{\sqrt{N}}$$

$$SE_m2 = \frac{SD_2}{\sqrt{N}}$$

$$= \frac{2.24}{\sqrt{30}}$$

$$= \frac{2.13}{\sqrt{30}}$$

$$= \frac{2.24}{5.47}$$

$$= \frac{2.13}{5.47}$$

$$SE_m1 = 0.41$$

$$SE_m2 = 0.39$$

$$t = \frac{m_1 - m_2}{\sqrt{(SE_m1)^2 + (SE_m2)^2}}$$

$$= \frac{8.37 - 8.03}{\sqrt{(0.41)^2 + (0.39)^2}}$$

$$= \frac{0.34}{\sqrt{0.17 + 0.15}}$$

$$= \frac{0.34}{\sqrt{0.32}}$$

$$= \frac{0.34}{0.57}$$

$$t = 0.60$$

H₀₂: There will be no significant difference between mean achievement scores of control group and experimental group in post –test.

Experimental group

Control group

$$SD_1 = \sqrt{\frac{\sum(y-m)^2}{n-1}}$$

$$SD_2 = \sqrt{\frac{\sum(y-m)^2}{n-1}}$$

$$= \sqrt{\frac{349.37}{29}}$$

$$= \sqrt{\frac{209.20}{29}}$$

$$= \sqrt{12.047}$$

$$= \sqrt{7.213}$$

$$SD_1 = 3.47$$

$$SD_2 = 2.68$$

$$SE_m1 = \frac{SD_1}{\sqrt{N}}$$

$$SE_m2 = \frac{SD_2}{\sqrt{N}}$$

$$= \frac{3.47}{\sqrt{30}}$$

$$= \frac{2.68}{\sqrt{30}}$$

$$= \frac{3.47}{5.47}$$

$$= \frac{2.68}{5.47}$$

$$SE_m1 = 0.63$$

$$SE_m2 = 0.49$$

$$t = \frac{m_1 - m_2}{\sqrt{(SE_m1)^2 + (SE_m2)^2}}$$

$$= \frac{15.57 - 12.40}{\sqrt{(0.63)^2 + (0.49)^2}}$$

$$= \frac{3.17}{\sqrt{0.40 + 0.24}}$$

$$= \frac{3.17}{\sqrt{0.64}}$$

$$= \frac{3.17}{0.8}$$

$$t = 3.96$$

H₀₃: There will be no significant difference between mean achievement scores of pre –test and post –test of control group.

$$\begin{aligned}
 r &= \frac{x-m*y-m}{\sqrt{\sum(x-m)^2*\sum(y-m)^2}} \\
 &= \frac{65.60}{\sqrt{130.97*209.20}} \\
 &= \frac{65.60}{\sqrt{27398.92}} \\
 &= \frac{65.60}{165.53}
 \end{aligned}$$

$$\mathbf{r = 0.40}$$

$$\begin{aligned}
 t &= \frac{m_1-m_2}{\sqrt{(SE\ m\ 1)^2+(SE\ m\ 2)^2-2r(SE\ m\ 1)*(SE\ m\ 2)}} \\
 &= \frac{12.40-8.03}{\sqrt{(0.39)^2+(0.49)^2-2*(0.40)*(0.39)*(0.49)}} \\
 &= \frac{4.37}{\sqrt{0.15+0.24-2*(0.40)*0.19}} \\
 &= \frac{4.37}{\sqrt{0.39-0.152}} \\
 &= \frac{4.37}{\sqrt{0.238}} \\
 &= \frac{4.37}{0.49}
 \end{aligned}$$

$$\mathbf{t = 8.92}$$

† Here, * = multiplication

H₀₄: There will be no significant difference between mean achievement scores of pre –test and post –test of experimental group.

$$\begin{aligned}
 r &= \frac{x-m*y-m}{\sqrt{\sum(x-m)^2*\sum(y-m)^2}} \\
 &= \frac{14.77}{\sqrt{144.97 * 349.37}} \\
 &= \frac{14.77}{\sqrt{50648.17}} \\
 &= \frac{14.77}{225.05}
 \end{aligned}$$

$$\mathbf{r = 0.07}$$

$$\begin{aligned}
 t &= \frac{m_1 - m_2}{\sqrt{(SEm_1)^2 + (SEm_2)^2 - 2r(SEm_1)*(SEm_2)}} \\
 &= \frac{15.57 - 8.37}{\sqrt{(0.41)^2 + (0.63)^2 - 2*(0.07)*(0.41)*(0.63)}} \\
 &= \frac{7.2}{\sqrt{0.17 + 0.40 - 2*(0.07)*0.26}} \\
 &= \frac{7.2}{\sqrt{0.57 - 0.04}} \\
 &= \frac{7.2}{\sqrt{0.53}} \\
 &= \frac{7.2}{0.73}
 \end{aligned}$$

$$\mathbf{t = 9.86}$$