**METRIC: TIME**

**Task 1:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 230.7  
SS1: 10036.1  
s21 = SS1/(N - 1) = 10036.1/(10-1) = 1115.12  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 67  
SS2: 1284  
s22 = SS2/(N - 1) = 1284/(10-1) = 142.67  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 1115.12) + ((9/18) \* 142.67) = 628.89  
  
s2M1 = s2p/N1 = 628.89/10 = 62.89  
s2M2 = s2p/N2 = 628.89/10 = 62.89  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 163.7/√125.78 = 14.6

**Task 2:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 63.4  
SS1: 18158.4  
s21 = SS1/(N - 1) = 18158.4/(10-1) = 2017.6  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 9.2  
SS2: 49.6  
s22 = SS2/(N - 1) = 49.6/(10-1) = 5.51  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 2017.6) + ((9/18) \* 5.51) = 1011.56  
  
s2M1 = s2p/N1 = 1011.56/10 = 101.16  
s2M2 = s2p/N2 = 1011.56/10 = 101.16  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 54.2/√202.31 = 3.81

**Task 3:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 51  
SS1: 10362  
s21 = SS1/(N - 1) = 10362/(10-1) = 1151.33  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 5.8  
SS2: 19.6  
s22 = SS2/(N - 1) = 19.6/(10-1) = 2.18  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 1151.33) + ((9/18) \* 2.18) = 576.76  
  
s2M1 = s2p/N1 = 576.76/10 = 57.68  
s2M2 = s2p/N2 = 576.76/10 = 57.68  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 45.2/√115.35 = 4.21

**Task 4:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 43.7  
SS1: 2578.1  
s21 = SS1/(N - 1) = 2578.1/(10-1) = 286.46  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 14  
SS2: 268  
s22 = SS2/(N - 1) = 268/(10-1) = 29.78  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 286.46) + ((9/18) \* 29.78) = 158.12  
  
s2M1 = s2p/N1 = 158.12/10 = 15.81  
s2M2 = s2p/N2 = 158.12/10 = 15.81  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 29.7/√31.62 = 5.28

**Metric - Number of Clicks:**

**Task1:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 17  
SS1: 66  
s21 = SS1/(N - 1) = 66/(10-1) = 7.33  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 3.9  
SS2: 4.9  
s22 = SS2/(N - 1) = 4.9/(10-1) = 0.54  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 7.33) + ((9/18) \* 0.54) = 3.94  
  
s2M1 = s2p/N1 = 3.94/10 = 0.39  
s2M2 = s2p/N2 = 3.94/10 = 0.39  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 13.1/√0.79 = 14.76

**Task2:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 10.3  
SS1: 182.1  
s21 = SS1/(N - 1) = 182.1/(10-1) = 20.23  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 2  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 20.23) + ((9/18) \* 0) = 10.12  
  
s2M1 = s2p/N1 = 10.12/10 = 1.01  
s2M2 = s2p/N2 = 10.12/10 = 1.01  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 8.3/√2.02 = 5.84

**Task3:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 5.4  
SS1: 14.4  
s21 = SS1/(N - 1) = 14.4/(10-1) = 1.6  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 2  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 1.6) + ((9/18) \* 0) = 0.8  
  
s2M1 = s2p/N1 = 0.8/10 = 0.08  
s2M2 = s2p/N2 = 0.8/10 = 0.08  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 3.4/√0.16 = 8.5

**Task4:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 5.9  
SS1: 26.9  
s21 = SS1/(N - 1) = 26.9/(10-1) = 2.99  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 2  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 2.99) + ((9/18) \* 0) = 1.49  
  
s2M1 = s2p/N1 = 1.49/10 = 0.15  
s2M2 = s2p/N2 = 1.49/10 = 0.15  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 3.9/√0.3 = 7.13

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**Metric: Frequency of user frustration**

**Task 1:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 3.2  
SS1: 15.6  
s21 = SS1/(N - 1) = 15.6/(10-1) = 1.73  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 0.1  
SS2: 0.9  
s22 = SS2/(N - 1) = 0.9/(10-1) = 0.1  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 1.73) + ((9/18) \* 0.1) = 0.92  
  
s2M1 = s2p/N1 = 0.92/10 = 0.09  
s2M2 = s2p/N2 = 0.92/10 = 0.09  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 3.1/√0.18 = 7.24

**Task2:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 1.5  
SS1: 16.5  
s21 = SS1/(N - 1) = 16.5/(10-1) = 1.83  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 0  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 1.83) + ((9/18) \* 0) = 0.92  
  
s2M1 = s2p/N1 = 0.92/10 = 0.09  
s2M2 = s2p/N2 = 0.92/10 = 0.09  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 1.5/√0.18 = 3.5

**Task3:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 0.6  
SS1: 2.4  
s21 = SS1/(N - 1) = 2.4/(10-1) = 0.27  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 0  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 0.27) + ((9/18) \* 0) = 0.13  
  
s2M1 = s2p/N1 = 0.13/10 = 0.01  
s2M2 = s2p/N2 = 0.13/10 = 0.01  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 0.6/√0.03 = 3.67

**Task 4:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 0.8  
SS1: 1.6  
s21 = SS1/(N - 1) = 1.6/(10-1) = 0.18  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 0.1  
SS2: 0.9  
s22 = SS2/(N - 1) = 0.9/(10-1) = 0.1  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 0.18) + ((9/18) \* 0.1) = 0.14  
  
s2M1 = s2p/N1 = 0.14/10 = 0.01  
s2M2 = s2p/N2 = 0.14/10 = 0.01  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 0.7/√0.03 = 4.2

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**Metric: Percentage of errors to success**

**Task1:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 58.76  
SS1: 1842.66  
s21 = SS1/(N - 1) = 1842.66/(10-1) = 204.74  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 0  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 204.74) + ((9/18) \* 0) = 102.37  
  
s2M1 = s2p/N1 = 102.37/10 = 10.24  
s2M2 = s2p/N2 = 102.37/10 = 10.24  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 58.76/√20.47 = 12.99

**Task 2:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 18.33  
SS1: 8028.42  
s21 = SS1/(N - 1) = 8028.42/(10-1) = 892.05  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 10  
SS2: 4000  
s22 = SS2/(N - 1) = 4000/(10-1) = 444.44  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 892.05) + ((9/18) \* 444.44) = 668.25  
  
s2M1 = s2p/N1 = 668.25/10 = 66.82  
s2M2 = s2p/N2 = 668.25/10 = 66.82  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 8.33/√133.65 = 0.72

**Task 3:**

Difference Scores Calculations  
  
Treatment 1  
  
N1: 10  
df1 = N - 1 = 10 - 1 = 9  
M1: 5  
SS1: 2250  
s21 = SS1/(N - 1) = 2250/(10-1) = 250  
  
  
Treatment 2  
  
N2: 10  
df2 = N - 1 = 10 - 1 = 9  
M2: 0  
SS2: 0  
s22 = SS2/(N - 1) = 0/(10-1) = 0  
  
  
T-value Calculation  
  
s2p = ((df1/(df1 + df2)) \* s21) + ((df2/(df2 + df2)) \* s22) = ((9/18) \* 250) + ((9/18) \* 0) = 125  
  
s2M1 = s2p/N1 = 125/10 = 12.5  
s2M2 = s2p/N2 = 125/10 = 12.5  
  
t = (M1 - M2)/√(s2M1 + s2M2) = 5/√25 = 1

**Task 4**

Error. The calculator has not been able to complete the calculation due to a divide by zero occurrence. This normally happens when the standard deviations of the two treatments are zero.