Investigating the validity of Dunbar's Number using t-tests

In order to evaluate Robin Dunbar's claim that humans only have the capacity to keep track of a maximum of 150 people at a time, a collection of data on Facebook usage among 383 college students at a large university will first be used to conduct a two tailed one-sample t-test to determine whether individuals have more friends than would be expected by Dunbar's maximum number of 150. As such, the dependent variable would be a ratio value of each participant's number of Facebook friends. Hence, the null hypothesis (H_0) for this experiment states that the population mean (μ) = 150 friends while the alternative hypothesis (H_a) for this experiment states that $\mu \neq 150$ friends.

Two Tailed One-Sample t-test

Null Hypothesis (H_0) : $\mu = 150$ friends
= H_0 : *population mean* (μ) - *comparison value* (m_0) = 0
= H_0 : $\mu - m_0 = 0$

Alternative Hypothesis (H_a) : $\mu \neq 150$ friends
= H_a : *population mean* (μ) - *comparison value* (m_0) $\neq 0$
= H_a : $\mu - m_0 \neq 0$

Test Statistic (t): $t = \frac{\bar{X} - \mu}{\frac{s}{\sqrt{N}}} = \frac{435.7311 - 150}{\frac{275.6507}{\sqrt{383}}} = 20.28606443$

Degree of Freedom (df): N – 1 = 383 – 1 = 382

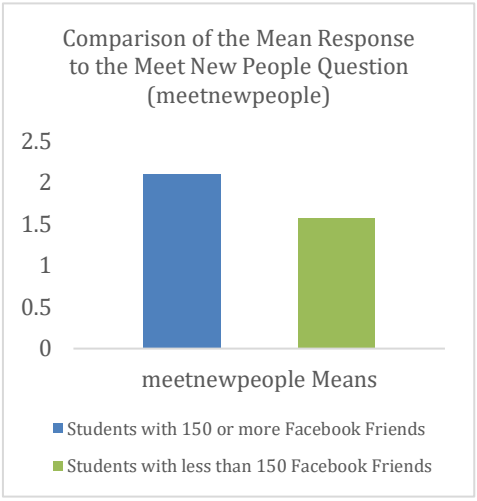
p – value: p = 2*pt (t, df) = 2*pt (20.28606443, 382) = 1.28899e-62

Effect Size: Cohen's $d = \frac{\bar{X} - \mu}{s} = \frac{435.7311 - 150}{275.6507} = 1.03656947$

As per the results from the two-tailed one sample t-test, the p-value of 1.28899e-62 shows that the result is extremely statistically significant since the p-value is well under 0.05. As such, we can reject the null hypothesis and accept the alternative hypothesis. Additionally, the results are also practically significant since the effect size is large with a Cohen's d of 1.03656947. Hence, the results do not support Dunbar's claim that humans only have the capacity to keep track of a maximum of 150 people at a time but rather support the claim that individuals have more friends than would be expected by Dunbar's maximum number. In addition, the chances of a Type II error are small as well since the effect size is large. However, the limitation that can be observed here is that the experiment does not truly attempt to evaluate the original claim made by Dunbar since it uses Facebook friends as a proxy instead of actual friends when measuring the number of people one can keep track of at a certain point in time.

Nevertheless, students who have more than 150 friends may be using Facebook in fundamentally different ways compared to others such as using the platform to meet new people. Therefore, with the use of a two-tailed two sample t-test, Facebook users who have 150 Facebook friends or more will be compared to those who have fewer in order to observe if they agreed with the notion "I use Facebook to meet new people" differently. As such, the dependent variable would be the student's response to the notion "I use Facebook to meet new people" from a scale of 1 to 5 with 5 corresponding to "Very Likely" while the independent variable is the number of Facebook friends the student has: <150 or >=150. Hence, the null hypothesis (H_0) for this experiment states that the mean response for students with fewer than 150 Facebook friends (μ_B) subtracted from the mean response for student with 150 or more Facebook friends (μ_A) would equal to 0 while the alternative hypothesis (H_a) for this experiment states that $\mu_A - \mu_B \neq 0$.

Two Tailed Two-Sample t-test



Null Hypothesis (H_0) : $\mu_A - \mu_B = 0$

Alternative Hypothesis (H_a) : $\mu_A - \mu_B \neq 0$

Test Statistic (t): $t = \frac{\overline{X_A} - \overline{X_B}}{\sqrt{\frac{s_A^2}{N_A} + \frac{s_B^2}{N_B}}} = \frac{2.101449 - 1.578947}{\sqrt{\frac{1.165703^2}{345} + \frac{1.00355^2}{38}}}$

$\therefore t = 2.994701367$

Degree of Freedom (df): $N_A + N_B - 2 = 345 + 38 - 2 = 381$

p – value: $p = 2*pt(t, df) = 2*pt(2.994701367, 381) = 0.002926539$

Effect Size: Cohen's $d = \frac{\overline{X_A} - \overline{X_B}}{\sqrt{\frac{df_A s_A^2 + df_B s_B^2}{df_A + df_B}}} = \frac{2.101449 - 1.578947}{\sqrt{\frac{(344)(1.165703^2) + (37)(1.00355^2)}{344+37}}}$

$\therefore$ Cohen's $d = 0.4539714504$

As per the results from the two-tailed two sample t-test, the p-value of 0.002926539 shows that the result is statistically significant since the p-value is well under 0.05. As such, we can reject the null hypothesis and accept the alternative hypothesis once again. Additionally, the results are practically significant as well since the effect size is medium as per the experiment's Cohen's d of 0.4539714504. Hence, as observed on the bar graph, the results may not immediately support the belief that individuals who have more friends on Facebook would use the website to meet new people since the mean for both groups border on 2 ('Unlikely'). However, with the null hypothesis being rejected and the t-test resulting in a medium effect size, there is ample evidence to suggest those with more friends on Facebook are more likely to use it to meet new friends relative to those who have fewer friends on Facebook as observed by the discrepancy between each group's mean response in the bar graph as well. In addition, the chances of a Type I error are small as well since the effect size is medium. Nonetheless, the limitation that can be observed here is that the effect size is relatively too small to ensure such an effect will be observed often. As such, a greater sample size should be measured to reduce chances of a Type II error and ensure the validity of the results through an increase in the effect size.