MPPU 1034: Application of Statistic in Educational Research

Independent T-Test

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The Independent T-Test

- The independent t-test compares the means of two unrelated samples.
- However, the data should "passes" these **assumptions**:

1. The dependent variables consist of interval or ratio data.
2. The independent variables consist of **two categorical, independent groups**.
3. There is **no significant outliers**.
4. The dependent variables should be approximately **normally distributed**.
5. There needs to be **homogeneity of variances**.

Example of Independent T-Test

A research study was conducted to examine the differences between teenagers and adults on test anxiety. A pilot study was conducted to examine this hypothesis. Ten teenagers and ten adults were give a test anxiety assessment. Scores on the measure range from 0 to 60 with high scores indicative of high test anxiety, while low scores indicative of low test anxiety. The data are presented in Table 1 in the next slide.

Is there a significant difference in mean between the teenagers and adults?

Use a two-tailed test at 0.05 level of significance.

Example of Independent T-Test

Table 1. Teenagers and adults' scores of test anxiety.

Teenagers	Adults
45	34
38	22
52	15
48	27
25	37
39	41
51	24
46	19
55	26
46	36

4 Steps of Independent T-Test

Step 1: State Hypotheses

Null Hypothesis, H_o: There is no significant difference in mean scores of test anxiety between teenagers and adults.

OR H_o: $\mu_1 - \mu_2 = 0$

Alternative Hypothesis, H_1: there is a significant difference in mean scores of test anxiety between teenagers and adults.

OR H_1: $\mu_1 - \mu_2 \neq 0$

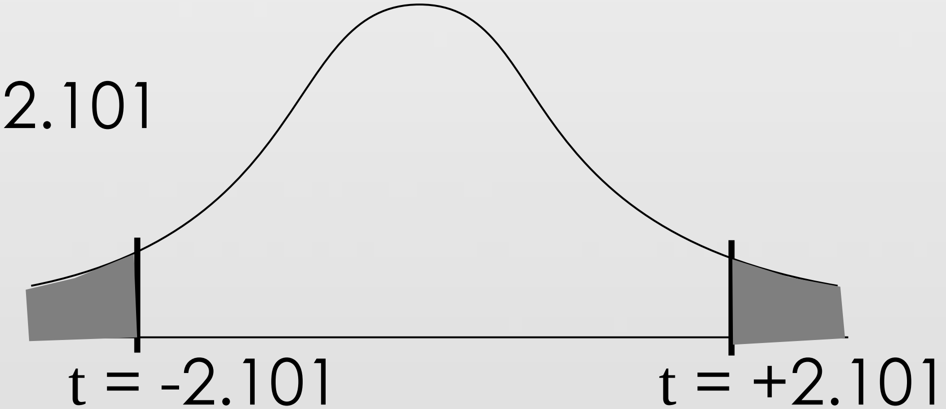
4 Steps in conducting Independent T-Test

Step 2: Locate Critical Region

When $\alpha = 0.05$ and

$$\begin{aligned} df &= df1 + df2 \\ &= (n_1 - 1) + (n_2 - 1) \\ &= 9 + 9 = 18 \end{aligned}$$

from t table → $t = \pm 2.101$



4 Steps of Independent T-Test

Step 3: Compute t Value

$$t = \frac{(M_1 - M_2) - (\mu_1 - \mu_2)}{S_{(M_1 - M_2)}} \quad , \quad S_{(M_1 - M_2)} = \sqrt{\frac{S^2{}_p}{n_1} + \frac{S^2{}_p}{n_2}} \quad ,$$

$$S^2{}_p = \frac{SS_1 + SS_2}{df_1 + df_2} \quad , \quad SS = \sum x^2 - \frac{(\sum x)^2}{n}$$

4 Steps of Independent T-Test

Step 3: Compute t Value (continues)

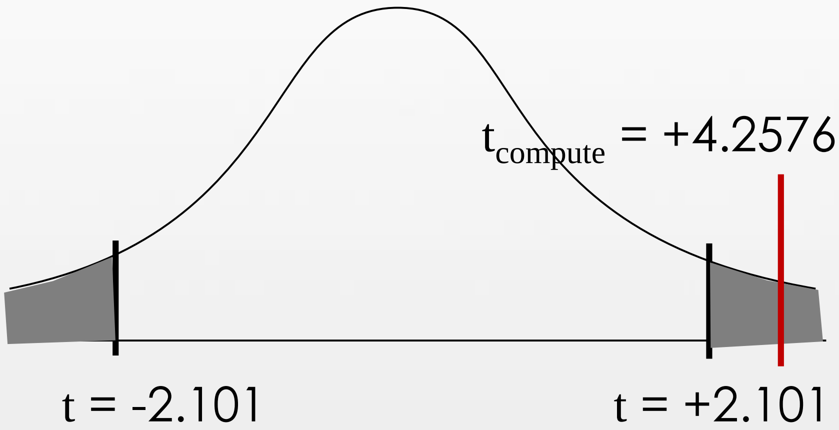
$$S^2_p = \frac{678.5 + 656.9}{9 + 9} = 74.189$$

$$S_{(M_1 - M_2)} = \sqrt{\frac{74.189}{10} + \frac{74.189}{10}} = 3.8519$$

$$t = \frac{(44.5 - 28.1) - (0)}{3.8519} = 4.2576$$

4 Steps of Independent T-Test

Step 4: Make Decision



Since $t_{compute}$ lies in the critical region, we have enough evidence to reject the null hypothesis. Therefore, there is a significant difference in mean scores of test anxiety between teenagers and adults, $t(18) = 4.2576$, $p < 0.05$.

Independent T-Test using SPSS

Table 2. Group statistics

	Grouping	N	Mean	Std. Deviation	Std. Error Mean
Age Groups	Teenagers	10	44.5000	8.68268	2.74570
	Adults	10	28.1000	8.54335	2.70165

Independent T-Test using SPSS

Table 3. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Age Groups	Equal variances assumed	.140	.712	4.258	18	.000	16.4000	3.8520	8.3073	24.4927
	Equal variances not assumed			4.258	17.995	.000	16.4000	3.8520	8.3071	24.4929

Independent T-Test using SPSS

Since the significance value, p = 0.000, less than alpha value of 0.05, we have enough evidence to reject the null hypothesis. Therefore, there is a significant difference in mean scores of test anxiety between teenagers and adults, $t(18)=4.2576$, $p=0.00$.

Thank You