

Independent Samples t-test: Invisibility Cloak Data

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2025-11-10

The following table is loaded from the csv file found in FA8 Instructions.

```
library(knitr)  
  
df <- read.csv("InvisibilityCloak.csv", header = TRUE)  
kable(df, caption = "Invisibility Cloak Dataset")
```

Table 1: Invisibility Cloak Dataset

Participant	Cloak	Mischief
1	0	3
2	0	1
3	0	5
4	0	4
5	0	6
6	0	4
7	0	6
8	0	2
9	0	0
10	0	5
11	0	4
12	0	5
13	1	4
14	1	3
15	1	6
16	1	6
17	1	8
18	1	5
19	1	5
20	1	4
21	1	2
22	1	5
23	1	7
24	1	5

Assumption 1: Dependent Variable Must Be Continuous

The dependent variable Mischief represents the number of mischievous behaviors. Even though Mischief is technically count data, the range (0–8) and multiple numeric values allow us to treat it as continuous for a t-test.

Assumption 1 is satisfied.

```
suppressMessages(library(dplyr))
suppressMessages(library(knitr))

mischief_summary <- df %>%
  summarise(
    Min = min(Mischief),
    `1st Quartile` = quantile(Mischief, 0.25),
    Median = median(Mischief),
    Mean = mean(Mischief),
    `3rd Quartile` = quantile(Mischief, 0.75),
    Max = max(Mischief),
    SD = sd(Mischief)
  )

kable(mischief_summary, caption = "Descriptive Statistics for Mischief")
```

Table 2: Descriptive Statistics for Mischief

Min	1st Quartile	Median	Mean	3rd Quartile	Max	SD
0	3.75	5	4.375	5.25	8	1.860633

Assumption 2: Independent Variable Must Have Two Independent Groups

The independent variable Cloak has exactly two groups:

0 = Without Cloak
1 = With Cloak

Additionally, there are equal number of participants in each group (12 participants each) and no participant belongs to both groups.

Assumption 2 is satisfied.

```
suppressMessages(library(dplyr))
suppressMessages(library(knitr))

cloak_summary <- df %>%
  group_by(Cloak) %>%
  summarise(`Number of Participants` = n()) %>%
  mutate(Group = ifelse(Cloak == 0, "Without Cloak", "With Cloak")) %>%
```

```

  select(Group, `Number of Participants`)

kable(cloak_summary, caption = "Number of Participants per Cloak Group")

```

Table 3: Number of Participants per Cloak Group

Group	Number of Participants
Without Cloak	12
With Cloak	12

Computation

1. Levene's Test for Equality of Variances

```

library(lawstat)
levene_result <- levene.test(df$Mischief, df$Cloak)

levene_table <- data.frame(
  "Test Statistic" = round(levene_result$statistic, 3),
  "p-value" = round(levene_result$p.value, 3)
)

knitr::kable(levene_table, caption = "Levene's Test for Equality of Variances")

```

Table 4: Levene's Test for Equality of Variances

	Test.Statistic	p.value
Test Statistic	0.27	0.609

This table shows whether the variances of Mischief are equal between the two groups. Since $p = 0.609 > 0.05$ then variances are not significantly different, so we can assume equal variances for the t-test.

2. Independent Samples t-test

```

t_result <- t.test(Mischief ~ factor(Cloak), data = df, var.equal = TRUE)

group_means <- t_result$estimate
mean_diff <- diff(group_means)
ci_lower <- t_result$conf.int[1]
ci_upper <- t_result$conf.int[2]
t_value <- t_result$statistic
df_val <- t_result$parameter

```

```

p_val <- t_result$p.value

t_table <- data.frame(
  "Group" = c("Without Cloak", "With Cloak"),
  "Mean" = round(group_means, 2)
)

t_summary <- data.frame(
  "t-value" = round(t_value, 3),
  "df" = df_val,
  "p-value" = round(p_val, 3),
  "Mean Difference" = round(mean_diff, 3),
  "95% CI Lower" = round(ci_lower, 3),
  "95% CI Upper" = round(ci_upper, 3)
)

knitr::kable(t_table, caption = "Group Means for Mischief")

```

Table 5: Group Means for Mischief

	Group	Mean
mean in group 0	Without Cloak	3.75
mean in group 1	With Cloak	5.00

```
knitr::kable(t_summary, caption = "Independent Samples t-test Results")
```

Table 6: Independent Samples t-test Results

	t.value	df	p.value	Mean.Difference	X95..CI.Lower	X95..CI.Upper
t	-1.713	22	0.101	1.25	-2.763	0.263

These tables clearly summarize the group means and t-test results, including mean difference, confidence interval, and p-value. The t-test shows no significant difference between groups ($t(22) = -1.713$, $p = 0.101$), with a mean difference of 1.25 and 95% CI [-2.763, 0.263].