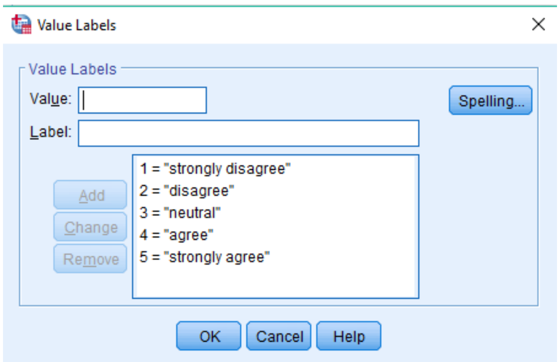
SPSS Workshop (Solutions)

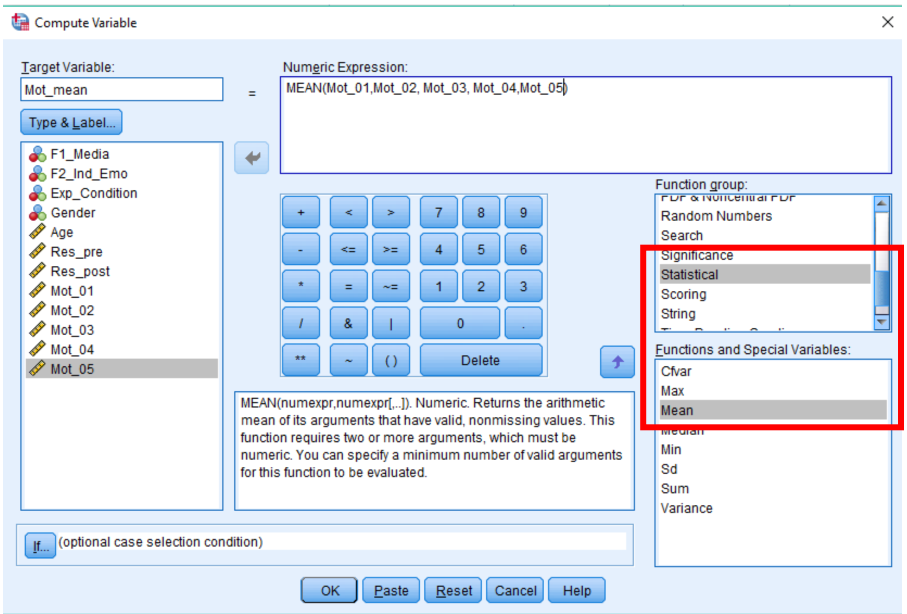
While you do the tasks, save your commands in a syntax and annotate it reasonably. Put your results together in one Word document (only relevant information, not the whole output).

1) Add the data from this additional participant:
    a) Media: Book
    b) Ind_Emo: Joy
    c) Gender: Male
    d) Age: missing
    e) Res_pre: 50
    f) Res_post: 60
    g) Mot_01: 1
    h) Mot_02: 2
    i) Mot_03: missing
    j) Mot_04: 1
    k) Mot_05: 3
    ➔ Define missing values for variables d) and i)

2) Define values (labels) for the motivation items
    ➔ For example: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

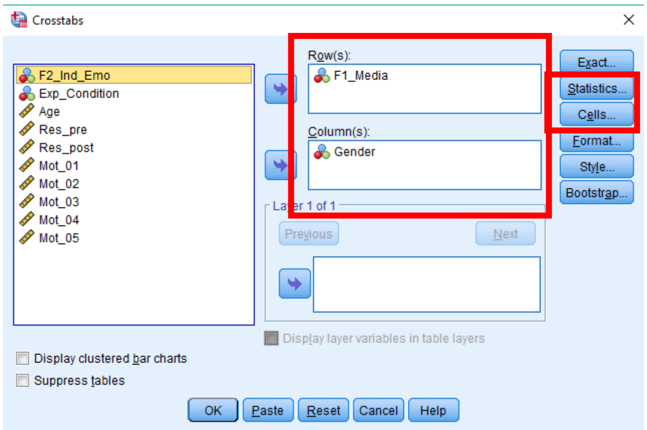


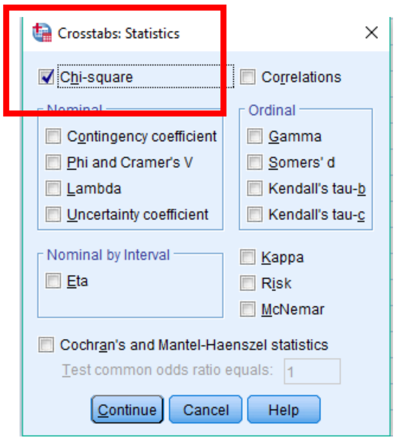
3) Compute a new variable: mean of all motivation items
    ➔ Transform > Compute Variable

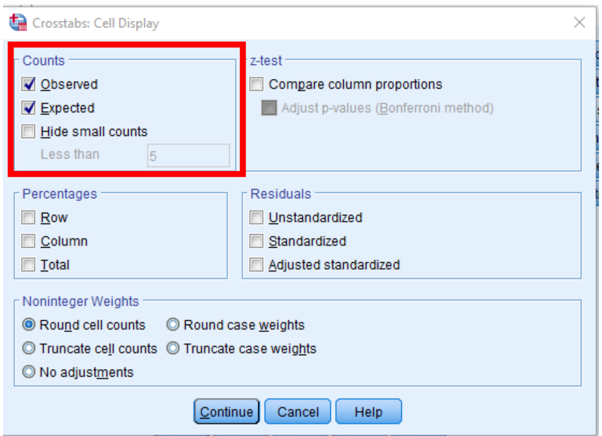


4) Check if the distribution of 'gender' is significantly associated with (or independent of) the 'media' factor and report the key results / numbers in one sentence.

- ➔ We need a chi² test
- ➔ Analyze > Descriptive statistics > Crosstabs







F1_Media * Gender Crosstabulation

			Gender		
			Male	Female	Total
F1_Media	Tablet	Count	4	4	8
		Expected Count	5,2	2,8	8,0
	Book	Count	7	2	9
		Expected Count	5,8	3,2	9,0
Total		Count	11	6	17
		Expected Count	11,0	6,0	17,0

Chi-Square Tests

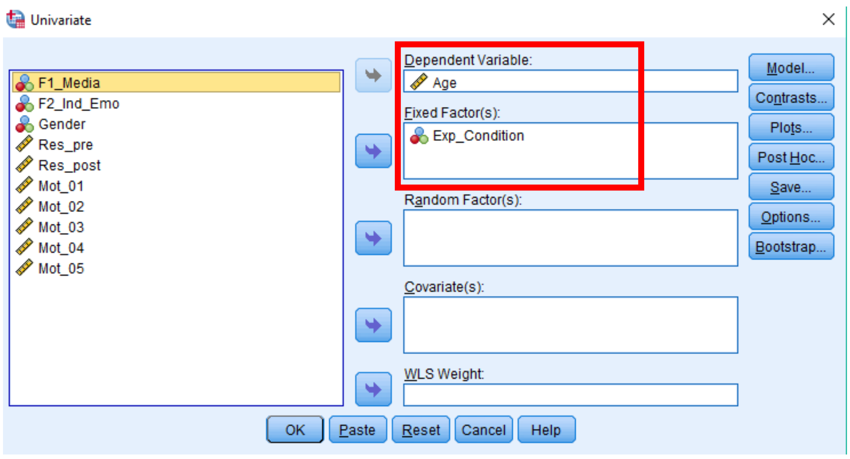
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1,431[a]	1	,232		
Continuity Correction[b]	,473	1	,492		
Likelihood Ratio	1,449	1	,229		
Fisher's Exact Test				,335	,247
Linear-by-Linear Association	1,347	1	,246		
N of Valid Cases	17				

a. 2 cells (50,0%) have expected count less than 5. The minimum expected count is 2,82.

b. Computed only for a 2x2 table

- ➔ χ^2 (1) = 1.431, *p* = .232. There was no significant association between Gender and F1_Media.
  But: Warning 'a' (small cell count) → better report Fisher's exact test
- ➔ There was no significant association between F1_Media and Gender: p= .335 (Fisher's Exact Test, two-sided)

5) Check if there are age differences between experimental conditions and report the key results / numbers in one sentence.
   - ➔ We need a one-way univariate ANOVA with exp. condition as IV
   - ➔ Analyze > General linear model > Univariate



Levene's Test of Equality of Error Variances[a]

Dependent Variable: Age

F	df1	df2	Sig.
1,187	3	12	,356

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Exp_Condition

Tests of Between-Subjects Effects

Dependent Variable: Age

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12,250[a]	3	4,083	,238	,868	,056
Intercept	9506,250	1	9506,250	555,109	,000	,979
Exp_Condition	12,250	3	4,083	,238	,868	,056
Error	205,500	12	17,125			
Total	9724,000	16				
Corrected Total	217,750	15				

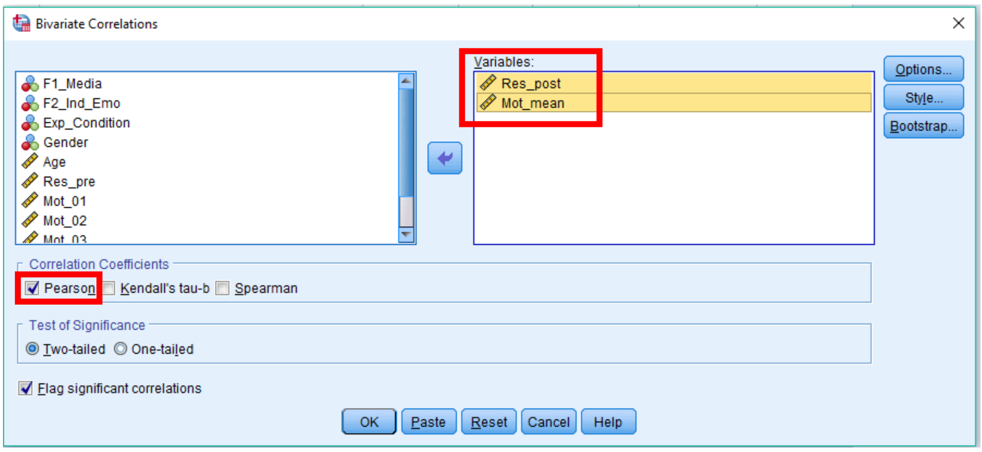
a. R Squared = ,056 (Adjusted R Squared = -,180)

➔ *F* (3, 12) = .238, *p* = .868, η^2 = .056. There was no significant difference between exp. condition regarding age.

6) Check if the post-test results are significantly related to the amount of reported motivation, report the key results / numbers in one sentence, and display the relationship visually in a scatter plot.

➔ We need a Pearson correlation

➔ Analyze > Correlate > Bivariate



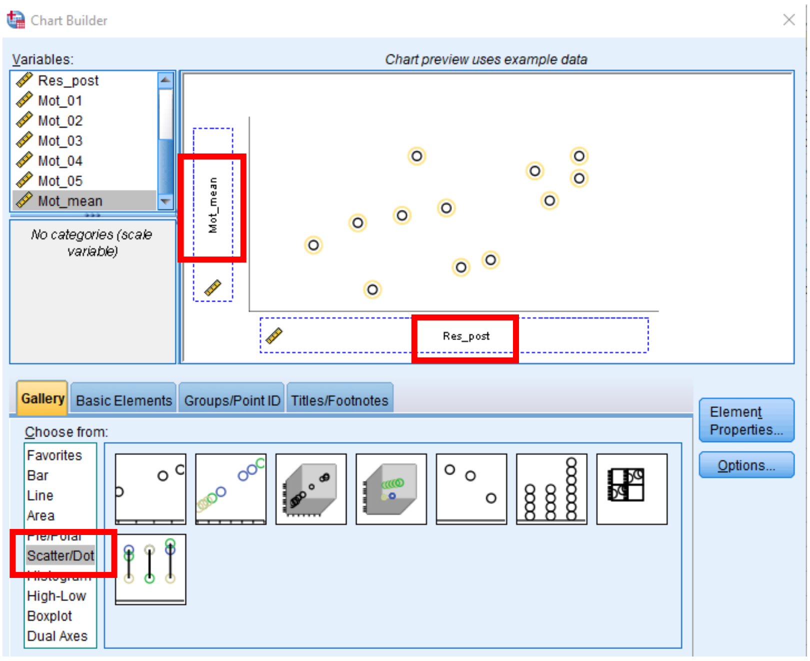
Correlations

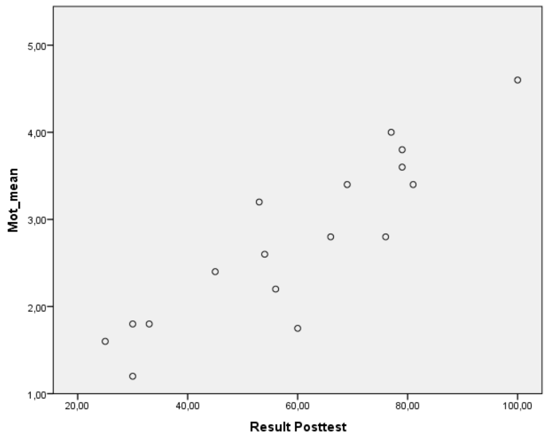
		Res_post	Mot_mean
Res_post	Pearson Correlation	1	,894**
	Sig. (2-tailed)		,000
	N	17	17
Mot_mean	Pearson Correlation	,894**	1
	Sig. (2-tailed)	,000	
	N	17	17

**. Correlation is significant at the 0.01 level (2-tailed).

➔ *r* (15) = .894, *p* = .000. There was a strong positive and significant Pearson correlation between motivation and post-test results.

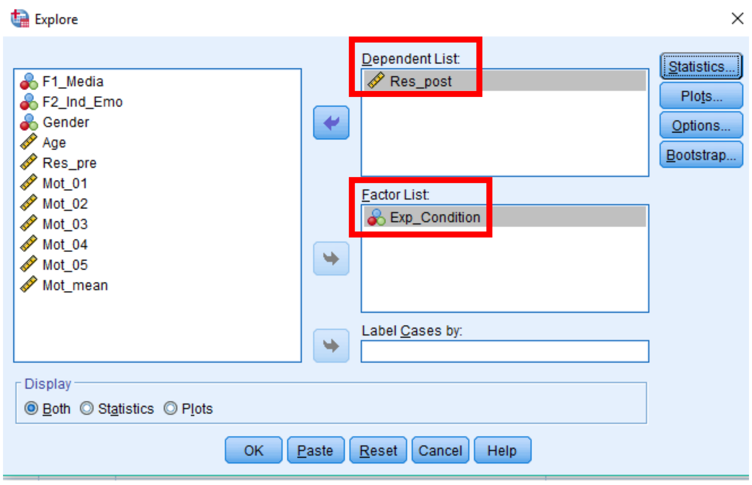
➔ For the scatter plot: Graphs > Chart builder





7) Report means and standard deviations for post-test results for each experimental group in a table

➔ Analyze > Descriptive Statistics > Explore



➔ Easier way: Via the ANOVA menu → includes nice table:

Descriptive Statistics

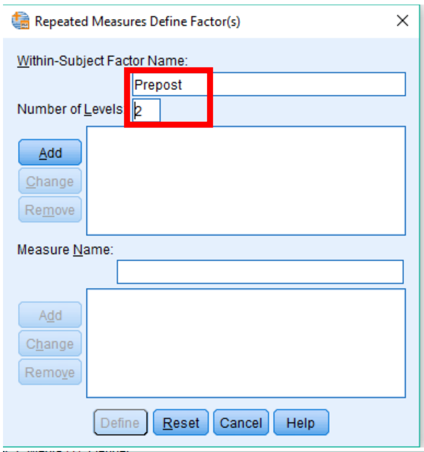
Dependent Variable: Res_post

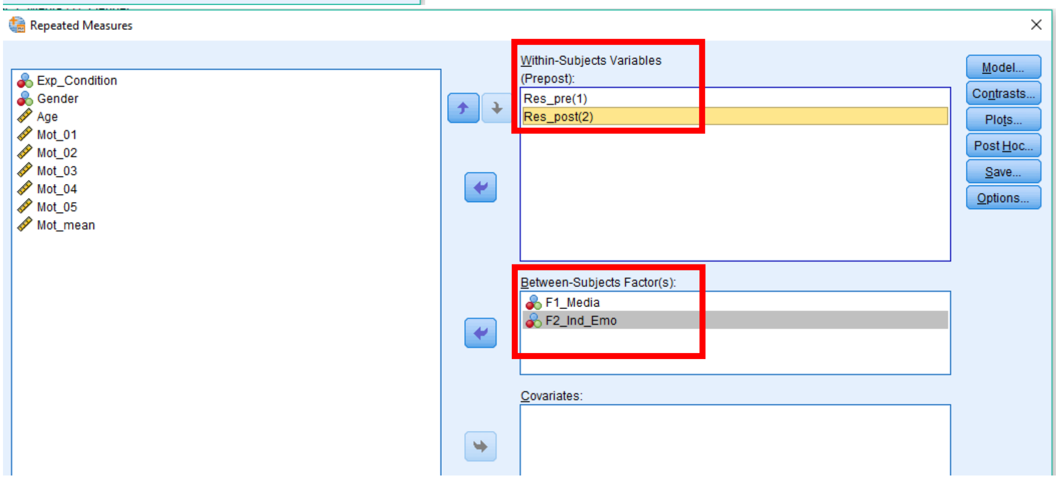
Exp_Condition	Mean	Std. Deviation	N
Tablet+Joy	73,7500	7,36546	4
Tablet+Sadness	40,2500	23,94960	4
Book+Joy	74,4000	17,52997	5
Book+Sadness	46,2500	9,70824	4
Total	59,5882	21,65369	17

8) Check if learning gain was affected by factor 1 (media), or factor 2 (induced emotion), and if there was an interaction between the factors. Briefly report the key results / numbers.

➔ We need a two-way repeated measures ANOVA

➔ Analyze > General linear model > Repeated measures





Tests of Within-Subjects Effects

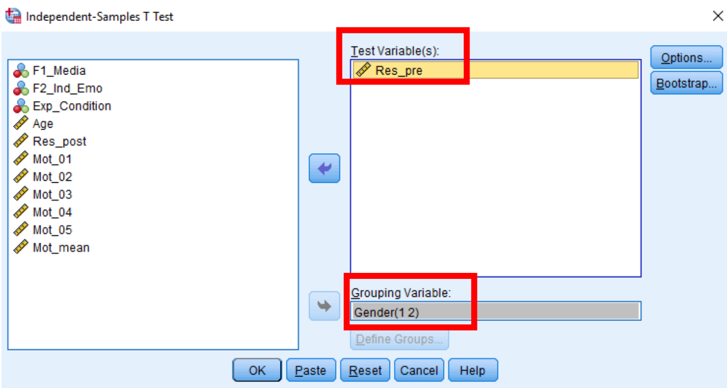
Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Prepost	Sphericity Assumed	64,847	1	64,847	,526	,481	,039
	Greenhouse-Geisser	64,847	1,000	64,847	,526	,481	,039
	Huynh-Feldt	64,847	1,000	64,847	,526	,481	,039
	Lower-bound	64,847	1,000	64,847	,526	,481	,039
Prepost * F1_Media	Sphericity Assumed	182,084	1	182,084	1,477	,246	,102
	Greenhouse-Geisser	182,084	1,000	182,084	1,477	,246	,102
	Huynh-Feldt	182,084	1,000	182,084	1,477	,246	,102
	Lower-bound	182,084	1,000	182,084	1,477	,246	,102
Prepost * F2_Ind_Emo	Sphericity Assumed	245,558	1	245,558	1,992	,182	,133
	Greenhouse-Geisser	245,558	1,000	245,558	1,992	,182	,133
	Huynh-Feldt	245,558	1,000	245,558	1,992	,182	,133
	Lower-bound	245,558	1,000	245,558	1,992	,182	,133
Prepost * F1_Media * F2_Ind_Emo	Sphericity Assumed	192,005	1	192,005	1,557	,234	,107
	Greenhouse-Geisser	192,005	1,000	192,005	1,557	,234	,107
	Huynh-Feldt	192,005	1,000	192,005	1,557	,234	,107
	Lower-bound	192,005	1,000	192,005	1,557	,234	,107
Error(Prepost)	Sphericity Assumed	1602,850	13	123,296			
	Greenhouse-Geisser	1602,850	13,000	123,296			
	Huynh-Feldt	1602,850	13,000	123,296			
	Lower-bound	1602,850	13,000	123,296			

- ➔ There was no sign. interaction between point in time × media on learning gain: F (1, 13) = 1.477, p = .246, η^2 = .102
- ➔ There was no sign. interaction between point in time × emotion induction on learning gain: F (1, 13) = 1.992, p = .182, η^2 = .133
- ➔ There was no sign. interaction between point in time × media × emotion induction on learning gain: F (1, 13) = 1.557, p = .234, η^2 = .107

9) Check if there was a difference in the pre-test scores between males and females and report the key results / numbers in one sentence.

- ➔ We need a t-test for independent samples
- ➔ Analyze > Compare means > Independent samples t-test
- ➔ Effect size: Calculate e.g. here: https://www.psychometrica.de/effect_size.html



Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Res_pre	Male	11	47,0000	15,89339	4,79204
	Female	6	72,3333	20,05659	8,18807

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Res_pre	Equal variances assumed	,374	,550	-2,870	15	,012	-25,33333	8,82688	-44,14738	-6,51928
	Equal variances not assumed			-2,670	8,512	,027	-25,33333	9,48726	-46,98387	-3,68279

2. Comparison of groups with different sample size (*Cohen's d, Hedges' g*)

Analogously, the effect size can be computed for groups with different sample size, by adjusting the calculation of the pooled standard deviation with weights for the sample sizes. This approach is overall identical with d_{Cohen} with a correction of a positive bias in the pooled standard deviation. In the literature, usually this computation is called *Cohen's d* as well. Please have a look at the remarks bellow the table.

Additionally, you can compute the confidence interval for the effect size and chose a desired confidence coefficient (calculation according to Hedges & Olkin, 1985, p. 86).

	Group 1	Group 2
Mean	47	72,33
Standard Deviation	15,89	20,06
Sample Size (N)	11	6
Effect Size d_{Cohen} g_{Hedges} *	1.456	

Confidence Coefficient	---
Confidence Interval	

➔ There was a significant difference in the pre-test scores between males and females with *t* (15) = -2.870, *p* = .012, *d* = 1.46 and a large effect. Females scored significantly higher.