SPSS Test Practice Problem 2 **2 way Mixed ANOVA** **ANSWER KEY**

Which factor is within subjects? _____**week**_____

Which factor is between subjects? ___**career path**_____

PART A Assumptions

Explain why Mauchly's test of sphericity was not tested in this example.

____**because the within-subjects factor had just two levels**_____

To test for HOV, look at the Levene's test results:

	F value	prob	signif (y/n)	assumption holds true (y/n)
Week 1	1.35	.276	n	y
Week 15	.52	.598	n	y

PART B Inferential Statistics

Effect tested	df , df	F value	Sig value	Partial eta sq	Signif? y/n
main effect week	1, 27	19.65	<.001	.421	y
main effect of career path	2, 27	8.23	.002	.379	y
week x career path	2, 27	3.94	.032	.226	y

Write down all 3 effects using correct APA statistical notation format.

main effect of week	$F(1,27) = 19.65, p < .001, \eta_p^2 = .421$
main effect of career path	$F(2,27) = 8.23, p = .002, \eta_p^2 = .379$

week X career path	$F(2,27) = 3.94$, $p = .032$, $\eta_p^2 = .226$

PART C Post hoc tests

Was a post hoc test on the between-subjects factor necessary? Explain why or why not.

Yes. The between subjects factor (career path) has three levels and it was significant. That said, we would not look at the post hoc test in this case because the interaction effect was significant. We will focus our attention there.

Was a post hoc test necessary for the within-subjects factor? Explain why or why not.

A post hoc test on the within-subjects factor (week), even though significant, was not necessary because it only has two levels. It needs to have 3 or more levels.

PART D Understanding the Interaction Effect

Simple main effect of week within career path

Describe the effect of week for the clinical path and indicate whether it is significant.

Attitudes were significantly higher at week 15

Describe the effect of week for the research path and indicate whether it is significant.

Attitudes were significantly higher at week 15

Describe the effect of week for the not psych path and indicate whether it is significant.

Attitudes were NOT significantly different between week 1 and week 15

Is the effect of week the same for clinical, research, and not psych? To look for a pattern change, calculate the difference between the means for the two weeks for clinical, the two weeks for research, and the two weeks for not psych.

The effect of week on attitudes is probably different for clinical vs. research vs. not psych career paths. Attitudes went up 5.5 points for clinical, 4.8 for research, and only .4 for not psych.

Simple main effect of career path within week.

Describe the effect of career path for week 1 and indicate whether it is significant.

Attitudes were NOT significantly different between clinical, research, and not psych at week 1.

Describe the effect of career path for week 15 and indicate whether it is significant.

At week 15, attitudes were NOT significantly different between clinical and research, but both clinical and research were significantly different from not psych.

Is the effect of career path the same for week 1 and week 15? To look for a pattern change, calculate the difference between the means for clinical, research, and not psych for week 1. Next, calculate the difference between the means for clinical, research, and not psych for week 15.

The effect of career on attitudes is probably different during week 1 vs week 15. Attitudes were probably not different between careers at week 1 (research was 1.6 points higher than clinical and 1.1 points higher than not psych. Not psych was .5 points higher than clinical).

However, at week 15, both clinical and research had more positive attitudes compared to not psych. Clinical and research probably had the same attitudes.

At week 15, clinical was 4.6 points higher than not psych, while research was 5.5 points higher than not psych. Research was only .9 points higher than clinical.

Descriptive Statistics

	Career	Mean	Std. Deviation	N
week_1	clinical	-.4000	4.08792	10
	research	1.2000	2.69979	10
	not psych	.1000	2.76687	10
	Total	.3000	3.20721	30
week_15	clinical	5.1000	2.51440	10
	research	6.0000	2.58199	10
	not psych	.5000	2.17307	10
	Total	3.8667	3.39100	30

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
week	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Career
Within Subjects Design: week

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
week	Sphericity Assumed	190.817	1	190.817	19.646	<.001	.421	19.646	.990
	Greenhouse-Geisser	190.817	1.000	190.817	19.646	<.001	.421	19.646	.990
	Huynh-Feldt	190.817	1.000	190.817	19.646	<.001	.421	19.646	.990
	Lower-bound	190.817	1.000	190.817	19.646	<.001	.421	19.646	.990
week * Career	Sphericity Assumed	76.433	2	38.217	3.935	.032	.226	7.869	.658
	Greenhouse-Geisser	76.433	2.000	38.217	3.935	.032	.226	7.869	.658
	Huynh-Feldt	76.433	2.000	38.217	3.935	.032	.226	7.869	.658
	Lower-bound	76.433	2.000	38.217	3.935	.032	.226	7.869	.658
Error(week)	Sphericity Assumed	262.250	27	9.713					
	Greenhouse-Geisser	262.250	27.000	9.713					
	Huynh-Feldt	262.250	27.000	9.713					
	Lower-bound	262.250	27.000	9.713					

a. Computed using alpha = .05

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

		Levene Statistic	df1	df2	Sig.[b]
week_1	Based on Mean	1.350	2	27	.276
	Based on Median	1.013	2	27	.376
	Based on Median and with adjusted df	1.013	2	21.461	.380
	Based on trimmed mean	1.271	2	27	.297
week_15	Based on Mean	.524	2	27	.598
	Based on Median	.195	2	27	.824
	Based on Median and with adjusted df	.195	2	23.931	.824
	Based on trimmed mean	.541	2	27	.588

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

a. Design: Intercept + Career
Within Subjects Design: week

b. Confidence Interval: 0%

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	260.417	1	260.417	38.623	<.001	.589	38.623	1.000
Career	111.033	2	55.517	8.234	.002	.379	16.467	.939
Error	182.050	27	6.743					

a. Computed using alpha = .05

1. Career * week SME of career within week

Estimates

Measure: MEASURE_1

Career	week	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
clinical	1	-.400	1.027	-2.508	1.708
	2	5.100	.768	3.523	6.677
research	1	1.200	1.027	-.908	3.308
	2	6.000	.768	4.423	7.577
not psych	1	.100	1.027	-2.008	2.208
	2	.500	.768	-1.077	2.077

Pairwise Comparisons

Measure: MEASURE_1

week	(I) Career	(J) Career	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
1	clinical	research	-1.600	1.453	.280	-4.581	1.381
		not psych	-.500	1.453	.733	-3.481	2.481
	research	clinical	1.600	1.453	.280	-1.381	4.581
		not psych	1.100	1.453	.455	-1.881	4.081
	not psych	clinical	.500	1.453	.733	-2.481	3.481
		research	-1.100	1.453	.455	-4.081	1.881
2	clinical	research	-.900	1.087	.415	-3.130	1.330
		not psych	4.600*	1.087	<.001	2.370	6.830
	research	clinical	.900	1.087	.415	-1.330	3.130
		not psych	5.500*	1.087	<.001	3.270	7.730
	not psych	clinical	-4.600*	1.087	<.001	-6.830	-2.370
		research	-5.500*	1.087	<.001	-7.730	-3.270

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

2. Career * week SME of week within career

Estimates

Measure: MEASURE_1

Career	week	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
clinical	1	-.400	1.027	-2.508	1.708
	2	5.100	.768	3.523	6.677
research	1	1.200	1.027	-.908	3.308
	2	6.000	.768	4.423	7.577
not psych	1	.100	1.027	-2.008	2.208
	2	.500	.768	-1.077	2.077

Pairwise Comparisons

Measure: MEASURE_1

Career	(I) week	(J) week	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
clinical	1	2	-5.500*	1.394	<.001	-8.360	-2.640
	2	1	5.500*	1.394	<.001	2.640	8.360
research	1	2	-4.800*	1.394	.002	-7.660	-1.940
	2	1	4.800*	1.394	.002	1.940	7.660
not psych	1	2	-.400	1.394	.776	-3.260	2.460
	2	1	.400	1.394	.776	-2.460	3.260

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Post Hoc Tests TUKEY

Career

Multiple Comparisons

Measure: MEASURE_1

Tukey HSD

(I) Career	(J) Career	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
clinical	research	-1.2500	.82113	.297	-3.2859	.7859
	not psych	2.0500*	.82113	.048	.0141	4.0859
research	clinical	1.2500	.82113	.297	-.7859	3.2859
	not psych	3.3000*	.82113	.001	1.2641	5.3359
not psych	clinical	-2.0500*	.82113	.048	-4.0859	-.0141
	research	-3.3000*	.82113	.001	-5.3359	-1.2641

Based on observed means.

The error term is Mean Square(Error) = 3.371.

*. The mean difference is significant at the .05 level.

