

# Statistical Analysis in the first study for signed up students

Table 1: Two-way ANOVA and Scheirer-Ray-Hare in the first study for signed up students

	Sum Sq	Df	F value	Pr(>F)	Sig	Df	Sum Sq	H	p.value	Sig
Interest/Enjoyment.(Intercept)	1327.822	1	950.633	0.000						
Interest/Enjoyment.Type	4.258	1	3.048	0.086		1	1135.350	3.741	0.053	
Interest/Enjoyment.CLRole	0.099	1	0.071	0.791		1	32.781	0.108	0.742	
Interest/Enjoyment.Type:CLRole	2.088	1	1.495	0.227		1	456.963	1.506	0.220	
Interest/Enjoyment.Residuals	78.219	56				56	16281.406			
Perceived Choice.(Intercept)	1583.013	1	1096.130	0.000						
Perceived Choice.Type	14.917	1	10.329	0.002	**	1	1804.017	5.938	0.015	*
Perceived Choice.CLRole	0.280	1	0.194	0.661		1	74.909	0.247	0.620	
Perceived Choice.Type:CLRole	0.001	1	0.000	0.984		1	12.988	0.043	0.836	
Perceived Choice.Residuals	80.874	56				56	16034.087			
Pressure/Tension.(Intercept)	149.507	1	521.300	0.000						
Pressure/Tension.Type	1.071	1	3.736	0.058		1	504.600	1.737	0.187	
Pressure/Tension.CLRole	0.001	1	0.002	0.964		1	9.782	0.034	0.854	
Pressure/Tension.Type:CLRole	1.096	1	3.821	0.056		1	1602.613	5.517	0.019	*
Pressure/Tension.Residuals	16.061	56				56	15021.004			
Effort/Importance.(Intercept)	1825.914	1	1836.826	0.000						
Effort/Importance.Type	3.944	1	3.967	0.051		1	1050.017	3.491	0.062	
Effort/Importance.CLRole	1.849	1	1.860	0.178		1	463.808	1.542	0.214	
Effort/Importance.Type:CLRole	1.411	1	1.419	0.239		1	265.209	0.882	0.348	
Effort/Importance.Residuals	55.667	56				56	15964.465			
Intrinsic Motivation.(Intercept)	1716.406	1	3547.560	0.000						
Intrinsic Motivation.Type	4.319	1	8.927	0.004	**	1	2053.350	6.733	0.009	**
Intrinsic Motivation.CLRole	0.000	1	0.001	0.979		1	0.008	0.000	0.996	
Intrinsic Motivation.Type:CLRole	0.006	1	0.013	0.911		1	35.806	0.117	0.732	
Intrinsic Motivation.Residuals	27.094	56				56	15904.336			

Signif. codes: 0 “\*\*\*” 0.01 “\*\*” 0.05

Table 2: Summary of Tukey post-hoc in the first study for signed up students

	N	mean	lsmean	SE	df	lwr.CI	upr.CI	t.ratio	p.value	p.adj	g	sig	mag
Perceived Choice:non-gamified - ont-gamified	60	-0.994	-0.998	0.311		-1.615	-0.372	-3.214	0.002	0.002	-0.829	**	large
Pressure/Tension:non-gamified.Apprentice - ont-gamified.Apprentice	29	0.538	0.538	0.199		0.011	1.065	2.704	0.009	0.044	0.960	*	large
Effort/Importance:non-gamified - ont-gamified	60	-0.535	-0.513	0.258		-1.051	-0.020	-1.992	0.051	0.042	-0.524	*	medium
Intrinsic Motivation:non-gamified - ont-gamified	60	-0.538	-0.537	0.180		-0.898	-0.178	-2.988	0.004	0.004	-0.777	**	medium

Table 3: Summary of Pair wilcoxon in the first study for signed up students

	Group	N	Median	Mean.Ranks	Sum.Ranks	U	Z	p.value	r	magnitude
Interest/Enjoyment.Type.less.1	non-gamified	30	4.00	26.15	784.5	319.5	-1.93	0.027	0.250	small
Interest/Enjoyment.Type.less.2	ont-gamified	30	4.83	34.85	1045.5	319.5	-1.93	0.027	0.250	small
Interest/Enjoyment.Type:CLRole.less.1	non-gamified.Master	16	3.83	12.53	200.5	64.5	-2.20	0.013	0.395	medium
Interest/Enjoyment.Type:CLRole.less.2	ont-gamified.Master	15	5.00	19.70	295.5	64.5	-2.20	0.013	0.395	medium
Interest/Enjoyment.Type:CLRole.two.sided.1	non-gamified.Master	16	3.83	12.53	200.5	64.5	-2.20	0.027	0.395	medium
Interest/Enjoyment.Type:CLRole.two.sided.2	ont-gamified.Master	15	5.00	19.70	295.5	64.5	-2.20	0.027	0.395	medium
Perceived Choice.Type.less.1	non-gamified	30	4.70	25.02	750.5	285.5	-2.44	0.007	0.315	medium
Perceived Choice.Type.less.2	ont-gamified	30	5.70	35.98	1079.5	285.5	-2.44	0.007	0.315	medium
Perceived Choice.Type.two.sided.1	non-gamified	30	4.70	25.02	750.5	285.5	-2.44	0.014	0.315	medium
Perceived Choice.Type.two.sided.2	ont-gamified	30	5.70	35.98	1079.5	285.5	-2.44	0.014	0.315	medium
Perceived Choice.Type:CLRole.less.1	non-gamified.Apprentice	14	4.40	11.43	160.0	55.0	-2.19	0.014	0.406	medium
Perceived Choice.Type:CLRole.less.2	ont-gamified.Master	15	5.60	18.33	275.0	55.0	-2.19	0.014	0.406	medium
Perceived Choice.Type:CLRole.two.sided.1	non-gamified.Apprentice	14	4.40	11.43	160.0	55.0	-2.19	0.028	0.406	medium
Perceived Choice.Type:CLRole.two.sided.2	ont-gamified.Master	15	5.60	18.33	275.0	55.0	-2.19	0.028	0.406	medium
Perceived Choice.Type:CLRole.less.11	non-gamified.Master	16	5.10	12.97	207.5	71.5	-1.92	0.028	0.345	medium
Perceived Choice.Type:CLRole.less.21	ont-gamified.Master	15	5.60	19.23	288.5	71.5	-1.92	0.028	0.345	medium
Pressure/Tension.Type:CLRole.greater.1	non-gamified.Apprentice	14	2.00	18.82	263.5	158.5	2.43	0.007	0.451	medium
Pressure/Tension.Type:CLRole.greater.2	ont-gamified.Apprentice	15	1.00	11.43	171.5	158.5	2.43	0.007	0.451	medium
Pressure/Tension.Type:CLRole.two.sided.1	non-gamified.Apprentice	14	2.00	18.82	263.5	158.5	2.43	0.014	0.451	medium
Pressure/Tension.Type:CLRole.two.sided.2	ont-gamified.Apprentice	15	1.00	11.43	171.5	158.5	2.43	0.014	0.451	medium
Pressure/Tension.Type:CLRole.less.1	ont-gamified.Apprentice	15	1.00	12.60	189.0	69.0	-1.91	0.028	0.348	medium
Pressure/Tension.Type:CLRole.less.2	ont-gamified.Master	15	2.00	18.40	276.0	69.0	-1.91	0.028	0.348	medium
Effort/Importance.Type.less.1	non-gamified	30	5.00	26.32	789.5	324.5	-1.87	0.031	0.241	small
Effort/Importance.Type.less.2	ont-gamified	30	6.00	34.68	1040.5	324.5	-1.87	0.031	0.241	small
Effort/Importance.Type:CLRole.less.1	non-gamified.Master	16	4.67	12.69	203.0	67.0	-2.11	0.017	0.379	medium
Effort/Importance.Type:CLRole.less.2	ont-gamified.Apprentice	15	6.00	19.53	293.0	67.0	-2.11	0.017	0.379	medium
Effort/Importance.Type:CLRole.two.sided.1	non-gamified.Master	16	4.67	12.69	203.0	67.0	-2.11	0.034	0.379	medium
Effort/Importance.Type:CLRole.two.sided.2	ont-gamified.Apprentice	15	6.00	19.53	293.0	67.0	-2.11	0.034	0.379	medium
Effort/Importance.Type:CLRole.less.11	non-gamified.Master	16	4.67	13.00	208.0	72.0	-1.91	0.028	0.343	medium
Effort/Importance.Type:CLRole.less.21	ont-gamified.Master	15	6.00	19.20	288.0	72.0	-1.91	0.028	0.343	medium
Intrinsic Motivation.Type.less.1	non-gamified	30	5.03	24.65	739.5	274.5	-2.59	0.004	0.335	medium
Intrinsic Motivation.Type.less.2	ont-gamified	30	5.63	36.35	1090.5	274.5	-2.59	0.004	0.335	medium
Intrinsic Motivation.Type.two.sided.1	non-gamified	30	5.03	24.65	739.5	274.5	-2.59	0.009	0.335	medium
Intrinsic Motivation.Type.two.sided.2	ont-gamified	30	5.63	36.35	1090.5	274.5	-2.59	0.009	0.335	medium
Intrinsic Motivation.Type:CLRole.less.1	non-gamified.Apprentice	14	5.10	12.14	170.0	65.0	-1.75	0.042	0.324	medium
Intrinsic Motivation.Type:CLRole.less.2	ont-gamified.Master	15	5.62	17.67	265.0	65.0	-1.75	0.042	0.324	medium
Intrinsic Motivation.Type:CLRole.less.11	non-gamified.Master	16	5.00	13.19	211.0	75.0	-1.78	0.038	0.320	medium

Table 3: *(continued)*

	Group	N	Median	Mean.Ranks	Sum.Ranks	U	Z	p.value	r	magnitude
Intrinsic Motivation.Type:CLRole.less.21	ont-gamified.Apprentice	15	5.72	19.00	285.0	75.0	-1.78	0.038	0.320	medium
Intrinsic Motivation.Type:CLRole.less.12	non-gamified.Master	16	5.00	12.38	198.0	62.0	-2.29	0.010	0.412	medium
Intrinsic Motivation.Type:CLRole.less.22	ont-gamified.Master	15	5.62	19.87	298.0	62.0	-2.29	0.010	0.412	medium
Intrinsic Motivation.Type:CLRole.two.sided.1	non-gamified.Master	16	5.00	12.38	198.0	62.0	-2.29	0.021	0.412	medium
Intrinsic Motivation.Type:CLRole.two.sided.2	ont-gamified.Master	15	5.62	19.87	298.0	62.0	-2.29	0.021	0.412	medium

# 1 Assumptions for Parametric Tests

Table 4: Univariate normality test in the first study for signed up students

	normality.fail	W	p.value
Interest/Enjoyment	FALSE	0.967	0.102
Perceived Choice	FALSE	0.968	0.123
Pressure/Tension	TRUE	0.885	0.000
Effort/Importance	FALSE	0.970	0.141
Intrinsic Motivation	FALSE	0.973	0.202

Table 5: Notes to be taken into account about sample size in the first study for signed up students

	code	description
Interest/Enjoyment	WARN: sample.size	current size is 14 and recommended size is 15 for the group: 'non-gamified:Apprentice'.
Perceived Choice	WARN: sample.size	current size is 14 and recommended size is 15 for the group: 'non-gamified:Apprentice'.
Pressure/Tension	WARN: sample.size	current size is 14 and recommended size is 15 for the group: 'non-gamified:Apprentice'.
Effort/Importance	WARN: sample.size	current size is 14 and recommended size is 15 for the group: 'non-gamified:Apprentice'.
Intrinsic Motivation	WARN: sample.size	current size is 14 and recommended size is 15 for the group: 'non-gamified:Apprentice'.

Recent studies carried out through simulations have indicated that ANOVA is reliable even when the data are non-normally distributed and the sample size is greater than 15 observations for each group. This size value is based on the Reference: Rana, R. K., Singhal, R., & Dua, P. (2016). Deciphering the dilemma of parametric and nonparametric tests. Journal of the Practice of Cardiovascular Sciences, 2(2), 95.

The sample size to carried out any parametric and non-parametric analysis is 5, and it was established using common sense. The warning and fails indicated in this section should be taking into account when a paper or report will be elaborated.