Experimental Design for

Influential Factors of Rates on Massive Open Online Courses

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Abstract: Nowadays, more and more people began to learn MOOC (massive open online course), which is so different from traditional classes. Such a situation put forward a challenge to us: how to improve a MOOC? In this paper, we will use CRD (Completely Randomized Design), RBD (Randomized Block Design), CRF (Completely Randomized Factorial Design), RBF (Randomized Block Factorial Design) and CRAC (Completely Randomized Analysis of Covariance) in order to investigate which factors will affect people's rate on an MOOC. We will also put our recommendations forward to improve MOOC.

Keywords: Massive Open Online Courses (MOOC); Experimental Design; Influencing Factors

1 Introduction and Data Collection

Coursera, a leading MOOC platform, has newly formed Course Success team with purpose of gathering specialists to understand how to "achieve high learner success, optimizing for a range of metrics, including enrollment, completion, learner experience, and learning outcomes". This stimulated our interest in investigating which factors would affect people's rate on online courses.

Firstly, we designed a survey including five background questions, eight questions about interviewees' opinions about a course and one question about their rates on a course. Then we distributed questionnaire among our friends and classmates, and posted the link of Google survey via Facebook, MOOC forums and Weibo. Before conducting analysis, we collected 51 effective responses. Finally, after initial CRF, analysis by using each factors with rate, we decided to thoroughly analyze the following potential influencing factors and rate dependent variable (Table 1.1) in our analysis.

Table 1.1 Potential influencing factors and rate dependent variable

Variable	Type	Meaning	Value	Meaning
Improvement	Independent	How would you rate your improvement in this course?	1	Excellent improvement
			2	Good improvement
			3	Slightly improvement
			4	Not at all
Difficulty	Independent	How difficulty did you feel about MOOC?	1	So hard that I couldn't continue
			2	Hard but can be handled
			3	Not hard or easy
			4	Relative easy
			5	Too easy to stick on
Stimulation	Independent	How many ways the professor took to stimulate your interest?	0	None
			1	Only one
			2	More than one
Career	Independent	How helpful do you think this course will be in advancing your career?	1	Extremely helpful
			2	Good helpful
			3	Slightly helpful
			4	Not at all
Percentage	Block	How many percentages finished for MOOC?	1	Just begin
			2	25%
			3	50%
			4	75%
			5	100%
Work Experience	Block	How long have you been working at your job?	1	No experience
			2	< 1 year
			3	1 ~ 3 years
			4	> 3 years
Education	Covariance	The highest level of education you've achieved?	1	High School
			2	College degree
			3	Bachelor degree
			4	Masters degree
			5	Doctorate degree or higher
Rate	Dependent	For this MOOC you took, how will you rate it?	1	Highly recommend
			2	Recommend
			3	Not bad
			4	Bad

Our analysis demonstrates that improvement, stimulation methods and career development have effects on people's evaluation about MOOC. Therefore, professors of MOOC can ameliorate these three aspects to improve rates on their courses.

2 Completely Randomized Design (CRD)

Exploratory Data Analysis / Model Assumptions

Level of impr	N	rt	
		Mean	Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.88980952	2.12711565	4.40	0.0009
Error	43	20.79646499	0.48363872		
Corrected Total	50	35.68627451			

The exploratory data analysis indicates differences among treatments. These differences generates from practical importance if they occurred in the populations. Improvement is the treatment meaning interviewees' improvement level. As the number decreases from 4 to 1, the improvement increases. Therefore, the improvement level 4 means no improvement. The dependent variable is rate of course.

ANOVA Omnibus F-test

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	10.98257703	3.66085901	6.96	0.0006
Error	47	24.70369748	0.52561058		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.307754	32.15173	0.724990	2.254902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Improvement	3	10.98257703	3.66085901	6.96	0.0006

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Improvement	3	10.98257703	3.66085901	6.96	0.0006

In the F table with 3 degrees of freedom numerator and 47 denominator, according to the Type III analysis, p-value is less than 0.01; and the p-value corresponding to F= 6.96 is 0.0006; so we reject the null hypothesis that the means for the four groups are equal. Also the null hypothesis for the block, H0: u1=u2=u3=u4 could be rejected since p value is less than 0.05.

Multiple Comparisons

Comparisons significant at the 0.05 level are indicated by ***.

Improvement Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
a4 - a3	0.7941	-0.6987	2.2870	
a4 - a2	1.4600	-0.0075	2.9275	
a4 - a1	1.9286	0.3274	3.5297	***
a3 - a4	-0.7941	-2.2870	0.6987	
a3 - a2	0.6659	0.0381	1.2937	***
a3 - a1	1.1345	0.2376	2.0313	***
a2 - a4	-1.4600	-2.9275	0.0075	
a2 - a3	-0.6659	-1.2937	-0.0381	***
a2 - a1	0.4686	-0.3854	1.3225	
a1 - a4	-1.9286	-3.5297	-0.3274	***
a1 - a3	-1.1345	-2.0313	-0.2376	***
a1 - a2	-0.4686	-1.3225	0.3854	

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for Rate

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	47
Error Mean Square	0.525611
Harmonic Mean of Cell Sizes	5.393157

Note: Cell sizes are not equal.

Number of Means	2	3	4
Critical Range	1.0198694	1.0684568	1.1758725

Means with the same letter are not significantly different.

REGWQ Grouping		Mean	N	Improvement
	A	3.5000	2	a4
	A			
B	A	2.7059	17	a3
B				
B	C	2.0400	25	a2
	C			
	C	1.5714	7	a1

From REGWQ comparison tests we can see that 'Improvement =4' has the highest value and 'Improvement=1' is the lowest. 'Improvement=1' is different from 'Improvement=3' and 'Improvement=4'. 'Improvement=2' is different from Improvement'=4'. 'Improvement =3' is different from 'Improvement=1'. 'Improvement=4' is different from 'Improvement=2'and 'Improvement=1'. The same outcomes could also be found in the significant comparison table generated from the Bonferroni (Dunn) t Tests for Rate: there are six comparison significant at the 0.05 level. They are a4-a1, a3-a2, a3-a1, and vice versa.

Orthogonal Contrasts

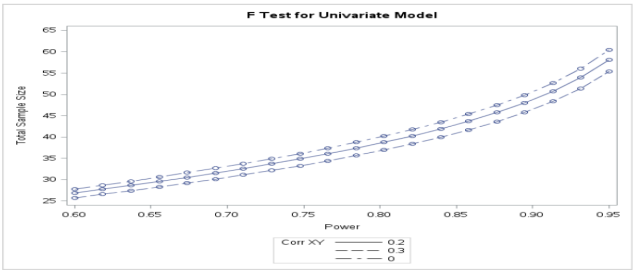
Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
1 vs 2	1	1.20071429	1.20071429	2.28	0.1374
3 vs 4	1	1.12848297	1.12848297	2.15	0.1495

The result is correspondent to the comparison tests.

Strength of Association, Effect Size and Power calculations

The power and sample size indicates that we need 50 samples to reject hypothesis with 90% confidence. If we increase sample size from 25 to 35, the power will increase by 0.75; however, if we increase sample size from 50 to 60, the power will only increase by 0.05.

The GLMPOWER Procedure



Partial Eta-Square
0.3078

The GLMPOWER Procedure

Fixed Scenario Elements	
Dependent Variable	Rate
Source	Improvement
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Test Degrees of Freedom	3
Error Degrees of Freedom	47

Computed Power
Power
0.903

Summary

The null hypothesis is rejected since the p-value is less than 0.05, so not all the means are equal. For every improvement level, the rates are significantly different. The score of improvement and rate are positive correlated. So it is very important to help students improve themselves if teachers want to get an excellent course rate.

3 Randomized Block Design (RBD)

Exploratory Data Analysis / Model Assumptions

There are 51 observations. The percentage has 5 levels. It means how many percentages a student finished for the course. 1 means 20% and 5 means 100%. Percentage is the block factor. Improvement has 4 levels. It is the treatment which means how many improvement a student got. 1 means the best level and 4 means the worst level. The dependent variable is rate of course.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.88980952	2.12711565	4.40	0.0009
Error	43	20.79646499	0.48363872		
Corrected Total	50	35.68627451			

Level of impr	N	rt	
		Mean	Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

The H0 hypothesis is u1=u2=u3=u4; H1 is not all treatments are same.

ANOVA Omnibus F-test

Source	DF	Type I SS	Mean Square	F Value	Pr > F
per	4	5.78789789	1.44697447	2.99	0.0290
impr	3	9.10191163	3.03397054	6.27	0.0013

Source	DF	Type III SS	Mean Square	F Value	Pr > F
per	4	3.90723249	0.97680812	2.02	0.1086
impr	3	9.10191163	3.03397054	6.27	0.0013

According to the Type III analysis, the null hypothesis for the treatment, u1=u2=u3=u4, could be rejected since the p value of impr is less than .05. Also the null hypothesis for the block, H0: $\sigma_{\pi}^2 = 0$ could be rejected since p value is less than 0.05.

Multiple Comparisons

From two comparison tests we can see that ‘impr =4’ is highest and ‘impr=1’ is lowest. ‘impr=1’ is different from ‘impr=3’ and ‘impr=4’. ‘impr=2’ is different from impr’=4’. ‘impr =3’ is different from ‘impr=1’. ‘impr=4’ is different from’impr=2’and ‘impr=1’.

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for rt

The GLM Procedure
t Tests (LSD) for rt

Means with the same letter are not significantly different.

REGWQ Grouping		Mean	N	impr
	A	3.5000	2	4

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Results: SAS Program for RB-4 Design.sas

	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

Comparisons significant at the 0.05 level are indicated by ***.

impr Comparison	Difference Between Means	95% Confidence Limits		
4 - 3	0.7941	-0.2543	1.8425	
4 - 2	1.4600	0.4294	2.4906	***
4 - 1	1.9286	0.8041	3.0531	***
3 - 4	-0.7941	-1.8425	0.2543	
3 - 2	0.6659	0.2250	1.1068	***
3 - 1	1.1345	0.5046	1.7643	***
2 - 4	-1.4600	-2.4906	-0.4294	***
2 - 3	-0.6659	-1.1068	-0.2250	***
2 - 1	0.4686	-0.1312	1.0683	
1 - 4	-1.9286	-3.0531	-0.8041	***
1 - 3	-1.1345	-1.7643	-0.5046	***
1 - 2	-0.4686	-1.0683	0.1312	

Orthogonal Contrasts

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
1&2 vs 3&4	1	7.99112306	7.99112306	16.52	0.0002
1 vs 3&4	1	7.08704033	7.08704033	14.65	0.0004
1 vs 2	1	0.96142397	0.96142397	1.99	0.1658
3 vs 4	1	1.05896691	1.05896691	2.19	0.1462

The result is similar to comparison result.

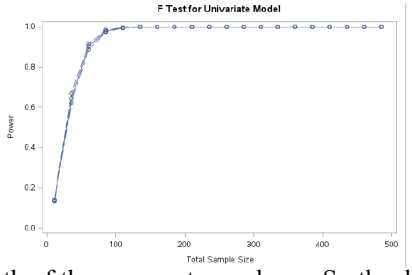
Strength of Association, Effect Size and Power calculations

When the improvement value increases, the rate of course increases correspondingly. There is a strong positive association of improvements and rates.

Source	DF	Type III SS	Partial Eta-Square
per	4	3.90723249	0.1582
impr	3	9.10191163	0.3044

Fixed Scenario Elements	
Dependent Variable	rt
Source	impr
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Test Degrees of Freedom	3
Error Degrees of Freedom	47

Computed Power
Power
0.903



The effective size of per is smaller than impr's. And both of them are not very large. So the difference between the mean of a group and the overall mean are not big.

The power calculation shows if we want to reject assumption of improvement with 90% confidence, we need about 80 samples. Besides, when we have 90 samples and achieve 95% confidence, with increasing sample size, the increasing rate of power will decrease.

Summary

For every improvement level, the rate is significantly different. The score of improvement and rate are positive correlated. It correctly rejects the H0 when t is false. So it is very important to help students improve themselves when teachers want to get an excellent course rate.

4 CRF (Completely Randomized Factorial Design)

Exploratory Data Analysis / Model Assumptions

Level of Difficulty	N	Rate	
		Mean	Std Dev
1	3	3.00000000	0.00000000
2	11	2.18181818	0.98164982
3	33	2.21212121	0.81996859
4	4	2.25000000	0.95742711

Level of Improvement	N	Rate	
		Mean	Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

In this design, we used difficulty and improvement as factors and rate of course as dependent. The means of each level are as follows:

H0: all treatments are not significantly different. H1: at least two pair is significantly different.

$$H_0: \mu_{jk} - \mu_{j'k} - \mu_{jk'} + \mu_{j'k'} = 0 \text{ for all } j \text{ and } k \qquad \text{or} \qquad H_0: (\alpha\beta)_{jk} = 0 \text{ for all } j \text{ and } k$$

ANOVA Omnibus F-test

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Difficulty	3	1.78475936	0.59491979	1.19	0.3256
Improvement	3	10.13062423	3.37687474	6.76	0.0009
Difficult*Improvemen	5	4.29653195	0.85930639	1.72	0.1527

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Difficulty	3	2.01015770	0.67005257	1.34	0.2748
Improvement	3	3.64781389	1.21593796	2.44	0.0793
Difficult*Improvemen	5	4.29653195	0.85930639	1.72	0.1527

Because all of H0 cannot be rejected in type III analysis, this sample is not very perfect to be analyzed. However it reflects the reality that the rates for different groups are quite similar.

Multiple Comparisons

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for Rate

Means with the same letter are not significantly different.

REGWQ Grouping	Mean	N	Difficulty
A	3.0000	3	1
A			
A	2.2500	4	4
A			
A	2.2121	33	3
A			
A	2.1818	11	2

The GLM Procedure
Tukey's Studentized Range (HSD) Test for Rate

Means with the same letter are not significantly different.

Tukey Grouping	Mean	N	Difficulty
A	3.0000	3	1
A			
A	2.2500	4	4
A			
A	2.2121	33	3
A			
A	2.1818	11	2

It is clear 4 treatments of difficulty are similar. I suppose the difficulty is not n influential variable for the rates.

Means with the same letter are not significantly different.

REGWQ Grouping		Mean	N	Improvement
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

Means with the same letter are not significantly different.

Tukey Grouping		Mean	N	Improvement
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B		2.0400	25	2
B				
B		1.5714	7	1

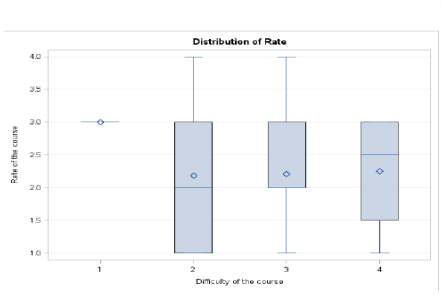
The improvement results for two tests are different. Anyway we are sure that ‘improvement=4’ got the highest rate score.

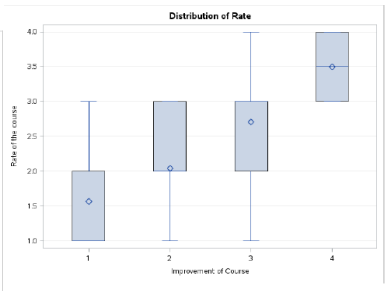
Orthogonal Contrasts

The result is same as comparison test.

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Improvement 1 2 vs 3 & 4	1	6.83614125	6.83614125	12.65	0.0009
Improvement 1 vs 2	1	1.76557211	1.76557211	3.27	0.0775
Improvement 3 vs 4	1	0.27457579	0.27457579	0.51	0.4797
Difficulty 1 & 2 vs 3 & 4	1	0.83743126	0.83743126	1.55	0.2197
Difficulty1 vs 2	1	0.37680415	0.37680415	0.70	0.4081
Difficulty3 vs 4	1	0.02675821	0.02675821	0.05	0.8249

Strength of Association, Effect Size and Power calculations



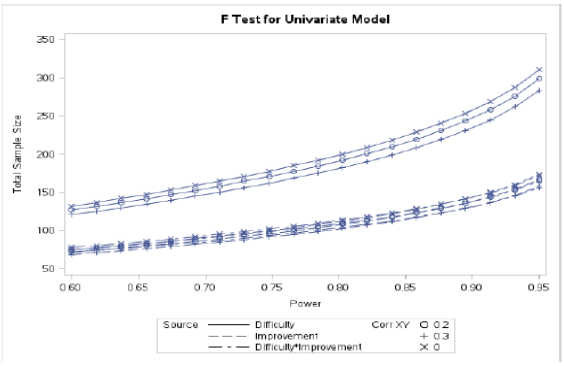


Fixed Scenario Elements	
Dependent Variable	Rate
Source	Improvement
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Test Degrees of Freedom	3
Error Degrees of Freedom	47

Computed Power
Power
0.903

For difficulty there is little strength of association. For improvement there is an obvious association.

Source	DF	Type III SS	Partial Eta-Square
Difficulty	3	2.01015770	0.0936
Improvement	3	3.64781389	0.1578
Difficult*Improvemen	5	4.29653195	0.1807



The effective sizes of three sources are quit small. So the difference between the mean of a group and the overall mean are not big. The power calculation told us if we want to 90% reject the assumption of improvement, we should at least have about 110 samples.

Summary

The result is contrast to our original idea that difficulty relates to rate. Difficulty treatments are not significantly different and the interaction of difficulty and improvement doesn't make strong effects. The reason may be that the course which is either too easy or too hard makes student loss interest.

5 Randomized Block Factorial Design

In randomized block factorial design, we used number of stimulation method(ST) and improvement level (IMPR) as factors, year of work experience (WO) as block factor, and rate of course (RT) as dependent.

Exploratory Data Analysis / Model Assumptions

We have the following assumptions: 1)H0: The 9 treatments means are equal (Some combinations of ST and IMPR do not exist); 2)H0: The factors do not interact; 3)H0: No difference between ST levels; 4)H0: No difference between IMPR levels. Figure 5.1 is a shared axis panel. It compares the negative relation between ST and RT with the positive relation between IMPR and RT.

ANOVA Omnibus F-test

Figure 5.1

Based on table 5.2, since p-value is smaller than 0.05, the difference among treatments is statistically significant.

Table 5.2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	17.73800970	1.61254634	3.50	0.0018
Error	39	17.94826481	0.46021192		
Corrected Total	50	35.68627451			

But in Table 5.3, the Type I analysis reveals that the differences of various block level and interaction level are insignificant, because their p-values are larger than 0.05.

Table 5.3

Source	DF	Type I SS	Mean Square	F Value	Pr > F	Noncentrality Parameter				Total Variation Accounted For				Partial Variation Accounted For			
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	90% Confidence Limits	
wo	3	3.74877451	1.24959150	2.72	0.0578	4.73	4.47	0.000	18.3	0.1050	0.0655	0.0000	0.2107	0.1728	0.0916	0.0000	0.2645
st	2	9.19235317	4.59617659	9.99	0.0003	16.95	16.03	5.962	38.4	0.2576	0.2288	0.0797	0.3926	0.3387	0.2606	0.1047	0.4293
impr	3	4.70257920	1.56752640	3.41	0.0269	6.69	6.33	0.622	21.8	0.1318	0.0919	0.0000	0.2444	0.2076	0.1240	0.0121	0.2997
st*impr	3	0.09430282	0.03143427	0.07	0.9765	-2.81	-2.65	0.000	0.0	0.0026	-0.0356	0.0000	0.0000	0.0052	-0.0580	0.0000	0.0000

Since (SS(ST*IMPR | ST, IMPR)) is insignificant, type II is more powerful than type III. According to the type II in table 5.4, the (SS(ST | IMPR) and (SS(IMPR | ST) are significant.

Table 5.4

Source	DF	Type II SS	Mean Square	F Value	Pr > F	Noncentrality Parameter				Total Variation Accounted For				Partial Variation Accounted For			
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	90% Confidence Limits	
wo	3	1.78586217	0.59528739	1.29	0.2902	0.682	0.645	0.000	10.5	0.0500	0.0112	0.0000	0.1281	0.0905	0.0170	0.0000	0.1711
st	2	4.84895932	2.42447966	5.27	0.0094	7.996	7.564	1.459	23.6	0.1359	0.1087	0.0074	0.2658	0.2127	0.1434	0.0278	0.3161
impr	3	4.70257920	1.56752640	3.41	0.0269	6.694	6.332	0.622	21.8	0.1318	0.0919	0.0000	0.2444	0.2076	0.1240	0.0121	0.2997
st*impr	3	0.09430282	0.03143427	0.07	0.9765	-2.806	-2.654	0.000	0.0	0.0026	-0.0356	0.0000	0.0000	0.0052	-0.0580	0.0000	0.0000

Multiple comparisons, contrasts and estimations

According to the Tukey and Bonferroni comparisons, we found that group 9(ST=2 IMPR=2) is different from group 4(ST=0 IMPR=4).

Least Squares Means for effect st*impr
Pr > |t| for H0: LSMean(i)=LSMean(j)
Dependent Variable: rt

i/j	1	2	3	4	5	6	7	8	9
1		0.9995	0.9740	0.4188	0.9984	1.0000	0.9974	0.8684	0.7910
2	0.9995		0.9955	0.5561	0.6468	0.9908	1.0000	0.4078	0.2028
3	0.9740	0.9955		0.8390	0.2499	0.6586	0.9998	0.2046	0.0601
4	0.4188	0.5561	0.8390		0.0789	0.2717	0.7026	0.0697	0.0068
5	0.9984	0.6468	0.2499	0.0789		0.9246	0.5057	0.9752	0.9860
6	1.0000	0.9908	0.6586	0.2717	0.9246		0.9436	0.6307	0.4938
7	0.9974	1.0000	0.9998	0.7026	0.5057	0.9436		0.3161	0.1610
8	0.8684	0.4078	0.2046	0.0697	0.9752	0.6307	0.3161		1.0000
9	0.7910	0.2028	0.0601	0.0068	0.9860	0.4938	0.1610	1.0000	

Figure 5.5 Adjustment for Multiple Comparisons: Tukey-Kramer

The REGWQ of ST (Figure 5.6) also shows that ST0 is different from ST2, and ST1 is different form ST0. Besides, the REGWQ of IMPR (Figure 5.7) also demonstrates differences between some groups.

Means with the same letter are not significantly different.

REGWQ Grouping	Mean	N	st
A	2.6190	21	0
A			
A	2.1538	26	1
B	1.0000	4	2

Figure 5.6 Comparison for ST

Means with the same letter are not significantly different.

REGWQ Grouping		Mean	N	impr
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

Figure 5.7 Comparison for IMPR

Based on aforementioned line, we contrasted various levels as table 5.8 (ST) and table 5.9 (IMPR). The differences of all contrasted groups are significant.

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
0&1 vs 2	1	6.91133193	6.91133193	13.67	0.0006
0 vs 2	1	8.67030140	8.67030140	17.15	0.0001
1 vs 2	1	4.55819198	4.55819198	9.02	0.0044

Parameter	Estimate	Standard Error	t Value	Pr > |t|
0&1 vs 2	1.45380953	0.39315586	3.70	0.0006
0 vs 2	1.65331646	0.39918757	4.14	0.0001
1 vs 2	-1.25430261	0.41768044	-3.00	0.0044

Table 5.8 Contrast and estimation for ST

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
1&2 vs 3&4	1	8.37550782	8.37550782	16.10	0.0002
1 vs 4	1	6.10436133	6.10436133	11.73	0.0013
1 vs 3	1	4.21896855	4.21896855	8.11	0.0067
2 vs 4	1	4.25802120	4.25802120	8.18	0.0064
2 vs 3	1	2.50016739	2.50016739	4.81	0.0337

Parameter	Estimate	Standard Error	t Value	Pr > |t|
1&2 vs 3&4	2.56879218	0.64022767	4.01	0.0002
1 vs 4	-2.03900123	0.59526235	-3.43	0.0013
1 vs 3	-0.96075116	0.33737960	-2.85	0.0067
2 vs 4	-1.60804102	0.56208793	-2.86	0.0064
2 vs 3	-0.52979095	0.24167462	-2.19	0.0337

Table 5.9 Contrast and estimation for IMPR

Strength of Association

In table 5.10, the absolute value of Pearson correlation is less than 0.3, so the correlation between ST and IMPR is insignificant.

Table 5.10

Statistic	Value	ASE
Gamma	-0.4458	0.1273
Kendall's Tau-b	-0.2640	0.0804
Stuart's Tau-c	-0.2296	0.0716
Somers' D C|R	-0.2872	0.0878
Somers' D R|C	-0.2427	0.0740
Pearson Correlation	-0.2954	0.0817
Spearman Correlation	-0.2813	0.0866
Lambda Asymmetric C|R	0.0938	0.0987
Lambda Asymmetric R|C	0.1864	0.1113
Lambda Symmetric	0.1382	0.0928
Uncertainty Coefficient C|R	0.0688	0.0200
Uncertainty Coefficient R|C	0.0941	0.0276
Uncertainty Coefficient Symmetric	0.0795	0.0239

Power calculation and sample size

Figure 5.11 shows the relation between sample size and power. We have 51 records, so the power of our model is about 0.07. We need a very large sample to reject assumptions in a high confidence interval. As the sample size increase from 10 to 500, the change of power's increasing rate is insignificant.

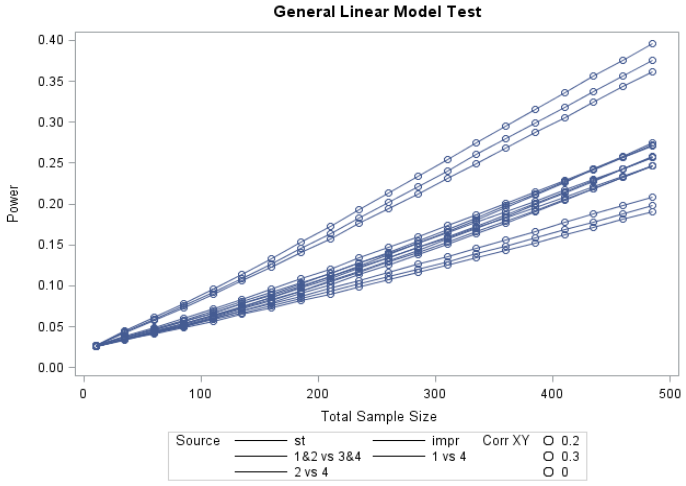


Figure 5.11

Summary

The differences of block factor and interaction are insignificant, but the means of ST and IMPR are unequal. Therefore, stimulation method and improvement will affect people's rate on courses. However, ST negatively relates to RT. The probable reason is if a course have more stimulation method, which will take up the time of professional knowledge, people will have less time to improve their knowledge in the field, finally causing them to decrease their rate on the course.

6 Completely Randomized Analysis of Covariance

Exploratory Data Analysis / Model Assumptions

In this section, we would like to use the variable refers to the usefulness of course in career, and set education level as covariate in this model. Then we performs an ANOVA for the career and rate with the following null hypothesis for treatment career can be rejected: H0:U.1=U.2=U.3=U.4, then F=8.05, and P value is 0.0002. here the type 1 SS is different from type III SS.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Career	3	12.10893246	4.03631082	8.05	0.0002

This result reveals that the ominous F test reject the initial hypothesis, the differences among the variable Career are significant.

After that, we test the relationship between our covariate and the dependent variable, the model accounts for a no that significant amount of the variation in the experiment. The coefficient of determination, R-Square, indicates only 6.3 percent of the variance in the dependent variable, Rate, could be accounted for by the covariate, X. it is might be due to the sample size.

R-Square	Coeff Var	Root MSE	Rate Mean
0.063372	36.62760	0.825916	2.254902

These results suggest that Education is a very useful covariate. The equation for predicting Rate from Education is Rate = –3.659 + 0.164Education.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	2.26151261	2.26151261	3.32	0.0747

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	3.346666667	0.61065711	5.48	<.0001
Education	-0.331428571	0.18202312	-1.82	0.0747

The regression program also was run for each level of treatment Career. The results are shown next.

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	3.000000000	2.91547595	1.03	0.4909
Education	-0.500000000	0.86602540	-0.58	0.6667

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	2.957746479	0.76687522	3.86	0.0007
Education	-0.302816901	0.22137781	-1.37	0.1835

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	2.977272727	0.78332747	3.80	0.0017
Education	-0.068181818	0.24555273	-0.28	0.7851

The equation for predicting Rate from Education for Career1 is: Rate = 3.0-0.5* Education. For Career1 is Rate = 2.96-0.30*

Education. For Career1 is Rate =2.98-0.06* Education.

This step is for test the homogeneity of the within-groups population. One of the assumptions of analysis of covariance is homogeneity of the within-groups population regression coefficients: H0: B1 = B2 = B3.

The 3 (4th is deleted for no values for analysis) sample regression coefficients shown next are similar and consistent with the homogeneity assumption: B1=-0.5, B2=-0.3, B3=-0.06

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Career	3	0.00028669	0.00009556	0.00	1.0000
Education*Career	4	1.16729083	0.29182271	0.56	0.6929

A significant Education*Career interaction indicates that the population regression slopes are homogeneous.

The F statistic for the Type III analysis of covariance is not significant: F= 7.20 P value is 0.0005. Recall that the F statistic for the analysis of variance was significant: P=0.0002. Hence, if the Covariate, Education, is not taken into account, a researcher still correctly conclude that at least one Contrast among the methods of teaching arithmetic is significant.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	0.83176803	0.83176803	1.68	0.2011
Career	3	10.67918789	3.55972930	7.20	0.0005

Differences among the unadjusted and adjusted means are shown next.

Level of Career	N	Rate		Education	
		Mean	Std Dev	Mean	Std Dev
1	3	1.33333333	0.57735027	3.33333333	0.57735027
2	27	1.92592593	0.72990652	3.40740741	0.63604906
3	17	2.76470588	0.66421116	3.11764706	0.69663055
4	4	3.00000000	0.81649658	3.25000000	0.50000000

Career	Rate LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	1.34139137	0.40603153	0.0019	1
2	1.94920469	0.13651306	<.0001	2
3	2.72844474	0.17282383	<.0001	3
4	2.99093471	0.35166192	<.0001	4

When the means are adjusted for the covariate, the differences among the arithmetic achievement means for career level become negligible. These results are consistent with the no significant F test of the

Omnibus null hypothesis: H0: μ.1 = μ.2 = μ.3 = μ.4.

Career	Rate LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	1.34139137	0.40603153	0.0019	1
2	1.94920469	0.13651306	<.0001	2
3	2.72844474	0.17282383	<.0001	3
4	2.99093471	0.35166192	<.0001	4

Strength of Association, Effect Size and Power calculations

The effect of the interaction is greater than the effect of the other 2 variables.

Career	Rate LSMEAN	Standard Error	H0:LSMEAN=0	H0:LSMean=Control
			Pr > |t|	Pr > |t|
1	1.34139137	0.40603153	0.0019	
2	1.94920469	0.13651306	<.0001	0.2934
3	2.72844474	0.17282383	<.0001	0.0068
4	2.99093471	0.35166192	<.0001	0.0082

Statistic	DF	Value	
Chi-Square	12	12.2547	
Likelihood Ratio Chi-Square	12	14.4986	
Mantel-Haenszel Chi-Square	1	1.5353	

Cross tabulation table the associated p-value is not very small, which means that the evidence of an association between the relationships is not that significant

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Career	3	0.00028669	0.00009556	0.00	1.0000
Education	1	0.24814891	0.24814891	0.48	0.4939
Education*Career	3	0.33552280	0.11184093	0.21	0.8857

The power is about 0.89 for the test of the Career effect. In other words, there is a probability of 0.89 that the test of the Variety effect will produce a significant result (given the assumptions for the means and error standard deviation). The power is 0.186 for the test of the Education effect.

Fixed Scenario Elements	
Dependent Variable	Rate
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Error Degrees of Freedom	46

Computed Power			
Index	Source	Test DF	Power
1	Career	3	0.894
2	Education	1	0.186

8 Conclusion

Base on our statistical analysis in this report, we found that factors affecting course evaluation include “improvement of your understanding after the course”, “number of stimulation methods taken” and “helpful for your career”. These three factors positively relates to rate. As a result, it is important for professors of MOOC to really help students to improve their knowledge in certain field in order to increase course rate. Furthermore, professors are suggested to take more methods to stimulate students’ interest in courses. Last but not least, it is also necessary to teach more knowledge widely used in industry.

To improve our analysis, we should take two measures in data collection. Firstly, we need asking interviewees to take a psychological questionnaire to test their tolerance degree, because tolerance degree is more suitable than education to serve as covariate in CRAC. Secondly, we would better to increase our sample size and expand the range of interviewees. An above 100-sample size is more appropriate. And the interviewees should not be limited to our friends and classmates.

Appendix

SAS Codes

CRD

```
Title 'SAS Program for CR-4 Design';
Options Linesize = 80;
*;
Data Table421;
Input Improvement $ Rate @@;
Label Improvement = 'Improvementment'
Rate = 'Course rate socres';
*;
Datalines;
a2 2
a1 3
a3 3
a4 3
a1 2
a2 3
a4 4
a1 1
a1 1
a1 1
a2 1
a2 1
a2 2
a2 2
a2 2
a2 2
a2 2
a2 2
a2 3
a2 3
a2 3
a3 2
a3 2
```

```
a3 2
a3 3
a3 3
a3 3
a3 3
a3 3
a3 3
a3 4
a2 2
a2 3
a3 3
a1 2
a2 1
a2 1
a2 2
a2 2
a2 3
a3 3
a2 1
a2 1
a2 2
a2 2
a2 3
a3 2
a3 3
a3 3
a3 1
a1 1
;
Proc Sort data = Table421;
      By improvement;
run;
*;
Proc Print Data = Table421;
*;
Proc GLM Data = Table421;
Class Improvement;
```

```
Model Rate = Improvement;
Means Improvement;
Means Improvement/bon tukey scheffe cldiff;
Means Improvement/regwq;
Means Improvement/hovtest=bartlett;
Means Improvement/hovtest=bf;*;
      contrast '1 vs 3' Improvement 1 0 -1 0;
      contrast '2 vs 4' Improvement 0 1 0 -1;

      estimate '1 vs 3' Improvement 1 0 -1 0;
      estimate '2 vs 4' Improvement 0 1 0 -1;

Proc Sort Data = Table421;
By Improvement;
*;
Proc Univariate Data = Table421 Normal Plot;
Var Rate;
By Improvement;
ID Improvement;
*;
Run;
*;
Proc GLM Data = Table421;
Class Improvement;

Model Rate =Improvement/ Effectsize;
;

proc glmpower data=table421 plotonly;
Class Improvement;
Model Rate = Improvement;

    power
      nfractional
      stddev      = 0.84
      ncovariates = 1
      corrxy      = 0.2 0.3 0
```

```
      alpha        = 0.05
      ntotal       = .
      power        = .6;
   plot x=power min=0.6 max=0.95;
run;

proc glmpower data=Table421 ;
Class Improvement;

Model Rate =Improvement;
Power
Alpha = 0.05
StdDev = 0.84
NTotal = 51
Power = . ;

run;
Quit;
```

RBD

```
Title 'SAS Program for RB-4 Design';
Title2 "Factors Effecting People's Rate of MOOC --Stimulation & Improvement";

Options Linesize = 80;
*;
Data Rbd;
    Input per $ impr $ rt @@;
      Label per = 'Percentage'
            impr = 'Improvement'
            rt = 'Rate';
*;
*Block: Percentage      Factor: Improvement  Dependent: Rate;
Datalines;
1 2 2
3 1 3
```

3 3 3

2 4 3

5 1 2

2 2 3

5 4 4

2 1 1

3 1 1

5 1 1

4 2 1

5 2 1

2 2 2

1 2 2

1 2 2

4 2 2

1 2 2

1 2 2

5 2 3

1 2 3

5 2 3

4 3 2

2 3 2

1 3 2

3 3 3

1 3 3

5 3 3

1 3 3

1 3 3

4 3 3

1 3 4

5 2 2

2 2 3

2 3 3

5 1 2

5 2 1

4 2 1

3 2 2

2 2 2

```
3 2 3
1 3 3
3 2 1
5 2 1
3 2 2
4 2 2
2 2 3
2 3 2
1 3 3
1 3 3
4 3 1
4 1 1
;
*;
Proc Print Data = Rbd;
*;
Proc Sort Data = Rbd;
    By impr;
*;
Proc Means Data = Rbd;
      By impr;
Proc Univariate Data = Rbd plot;
      By impr;
Run;
* Multiple Comparisons;
proc glm Data = Rbd plot=meanplot(cl);
   class per impr;
   model rt = per impr/ ss1 ss2 ss3 effectsize alpha=0.1;
   lsmeans per impr /  pdiff adjust=tukey;
   lsmeans per impr /  pdiff adjust=bon;
run;
proc glm Data = rbd;
    Class per impr;
      Model rt = per impr;
      Means impr;
      means impr/lsd alpha = .05;
      means impr/bon alpha = .05;
```

```
      means impr/regwq alpha = .05;
      contrast '1&2 vs 3&4' impr  1 1 -1 -1;
    contrast '1 vs 3&4' impr  2 0 -1 -1;
    contrast '1&2 vs 3' impr  -1 -1 3 0;

    contrast '1 vs 2' impr  1 -1 0 0;
    contrast '3 vs 4' impr  0 0 1 -1;

run;
* Strength of Association;
Proc freq data=rbd order=data ;
      weight rt;
      tables per*impr/measures;
run;
* ower calculation and sample size;
proc glmpower data=rbd plotonly;
    class impr;
    model rt = impr;
    weight rt;
    power
      nfractional
      stddev      = 0.84
      ncovariates = 1
      corrxy      = 0.2 0.3 0
      alpha       = 0.05
      ntotal      = 51
      power       = .;
   plot x=n min=10 max=500;
run;
proc glmpower data=rbd ;
Class impr;

model rt = impr;
Power
Alpha = 0.05
StdDev = 0.84
NTotal = 51
```

```
Power = . ;
*Alpha = 0.05
StdDev = 1.58
NTotal = 32
Power = . ;

run;
Proc GLM Data = Rbd
            Plots = (Diagnostics Residuals)
            Plots(Unpack) = Residuals;;
    Class per impr;
      Model rt = per impr;
      Means impr/regwq;
*     Means Alt/regwq hovtest = bf;
*;
Proc GLM Order = Data;
      Class per impr;
      Model rt = per impr;
      Output Out = New p = Yhat;
*;
Proc Print Data = New;
*;
Proc GLM Order = Data;
      Class per impr;
      Model rt = per impr Yhat*Yhat/ss1;
      Title "Tukey's Test for Non-Additivity";
*;
*;
Run;
quit;
*;
```

CRF

```
Title 'SAS Program for CRF-33 Design';
Options Linesize = 80;
*;
Data Table932;
```

```
    Input Difficulty $ Improvement $ Rate @@;
      Label Difficulty = 'Difficulty of the course'
            Improvement = 'Improvement of Course'
            Rate = 'Rate of the course';
*;
Datalines;
3 2 2
1 1 3
1 3 3
1 4 3
2 1 2
2 2 3
2 4 4
3 1 1
3 1 1
3 1 1
3 2 1
3 2 1
3 2 2
3 2 2
3 2 2
3 2 2
3 2 2
3 2 2
3 2 3
3 2 3
3 2 3
3 3 2
3 3 2
3 3 2
3 3 3
3 3 3
3 3 3
3 3 3
3 3 3
3 3 3
3 3 4
```

```
4 2 2
4 2 3
4 3 3
2 1 2
2 2 1
2 2 1
2 2 2
2 2 2
2 2 3
2 3 3
3 2 1
3 2 1
3 2 2
3 2 2
3 2 3
3 3 2
3 3 3
3 3 3
4 3 1
2 1 1
;
*;
Proc Print Data = Table932;
*;
Proc GLM Data = Table932;
    Class Difficulty Improvement;
      Model Rate = Difficulty Improvement Difficulty*Improvement/ss1 ss2 ss3
effectsize alpha=0.1;
      Means Difficulty Improvement/regwq tukey;
      Means Difficulty Improvement Difficulty*Improvement;
      lsmeans Difficulty Improvement /  pdiff adjust=tukey;
    *lsmeans Difficulty Improvement /  pdiff adjust=regwq;
run;

Proc glm Data = Table932;
    Class Difficulty Improvement;
      Model Rate = Difficulty Improvement;
      Means Difficulty Improvement;
```

```
      contrast '1 &* 2 vs 3 & 4' Improvement 1 -1 -1 -1;
      contrast '1 vs 2' Improvement 1 -1 0 0;
      contrast '3 vs 4' Improvement 0 0 1 -1;

      estimate  '1 &* 2 vs 3 & 4' Improvement 1 -1 -1 -1;
      estimate '1 vs 2' Improvement 1 -1 0 0;
      estimate '3 vs 4' Improvement 0 0 1 -1;

      contrast '1 &* 2 vs 3 & 4' Difficulty 1 -1 -1 -1;
      contrast '1 vs 2' Difficulty 1 -1 0 0;
      contrast '3 vs 4' Difficulty 0 0 1 -1;

      estimate  '1 &* 2 vs 3 & 4' Difficulty 1 -1 -1 -1;
      estimate '1 vs 2' Difficulty 1 -1 0 0;
      estimate '3 vs 4' Difficulty 0 0 1 -1;
*;
Proc Sort Data = Table932;
      By Difficulty Improvement;
*;
Proc Univariate Data = Table932;
      Var Rate;
      By Difficulty Improvement;
      ID Difficulty Improvement;
*;
*;
Run;
*;
proc glmpower Data = Table932 plotonly;
    Class Difficulty Improvement;
    Model Rate = Difficulty Improvement Difficulty*Improvement;


   power
      nfractional
      stddev      = 0.84
      ncovariates = 1
      corrxy      = 0.2 0.3 0
```

```
      alpha        = 0.05
      ntotal       = .
      power        = .6;
   plot x=power min=0.6 max=0.95;
run;

proc glmpower data=Table932;
Class Improvement;

Model Rate =Improvement;
Power
Alpha = 0.05
StdDev = 0.84
NTotal = 51
Power = . ;

run;

*Power
Alpha = 0.05
StdDev = 7.91
NTotal = 45
Power = . ;
*run;
ODS Graphics Off;
*;
Quit;
```

RBF

```
*;
* ODS LISTING;
*;
  ODS Graphics On;

*;
Title 'SAS Program for Randomized Block Factorial Design';
```

```
Title2 "Factors Effecting People's Rate of MOOC --Stimulation & Improvement";
Options Linesize = 80;
*;
Data Rbf;
    Input wo $ st $ impr $ rt @@;
      Label wo = "Work Experience"
              st = 'Stimulation'
            impr = 'Improvement'
            rt = 'Rate';
*;
*Block: Working_experience    Factor1: Stimulation  Factor2: Improvement
      Dependent: Rate;
Datalines;
1      1      2      2
2      0      1      3
3      0      3      3
2      0      4      3
1      1      1      2
2      1      2      3
2      0      4      4
2      0      1      1
3      2      1      1
2      1      1      1
1      1      2      1
2      2      2      1
4      0      2      2
1      1      2      2
3      1      2      2
4      1      2      2
4      1      2      2
4      1      2      2
3      0      2      3
1      0      2      3
3      0      2      3
1      0      3      2
3      1      3      2
3      1      3      2
2      0      3      3
```

```
2	1	3	3
3	1	3	3
3	0	3	3
3	1	3	3
1	1	3	3
3	0	3	4
1	1	2	2
3	1	2	3
3	0	3	3
1	1	1	2
2	2	2	1
2	2	2	1
4	1	2	2
1	1	2	2
3	1	2	3
1	1	3	3
3	1	2	1
4	0	2	1
2	0	2	2
3	0	2	2
2	0	2	3
1	1	3	2
1	0	3	3
1	0	3	3
2	0	3	1
4	1	1	1
;
*;
Proc Print Data = rbf;
*;
Proc Sort Data = rbf;
      By st impr;
run;
*;
Proc Means Data = rbf;
      by st impr;
run;
```

```
*Shared axis panel comparing relations between factors and dependents;
proc sgscatter data=rbf;
  compare y = rt
 x= (st impr)
         / group=wo;
run;

Proc Univariate Data = rbf plot;
      By st impr;
Run;
*;
* Multiple Comparisons;
proc glm Data = rbf plot=meanplot(cl);
   class wo st impr;
   model rt = wo st impr st*impr/ ss1 ss2 ss3 effectsize alpha=0.1;
   lsmeans wo st*impr /  pdiff adjust=tukey;
   lsmeans wo st*impr /  pdiff adjust=bon;
   lsmeans wo st*impr /  pdiff adjust=scheffe;

run;
*proc glm Data = rbf plot=meanplot(cl);
*   class wo st impr;
*   model rt = wo st impr/ ss1 ss2 ss3 effectsize alpha=0.1;
*   lsmeans wo st*impr /  pdiff adjust=tukey;
*   lsmeans wo st*impr /  pdiff adjust=bon;
*   lsmeans wo st*impr /  pdiff adjust=scheffe;
*run;
*proc glm Data = rbf plot=meanplot(cl);
*   class wo st impr;
*   model rt = st impr/ ss1 ss2 ss3 effectsize alpha=0.1;
*   lsmeans wo st*impr /  pdiff adjust=tukey;
*   lsmeans wo st*impr /  pdiff adjust=bon;
*   lsmeans wo st*impr /  pdiff adjust=scheffe;

run;

*;
```

```
* Contrasts and estimations of stimulation;
Proc glm Data = rbf;
    Class wo st;
      Model rt = wo st;
      Means st;
      means st/lsd alpha = .05;
      means st/bon alpha = .05;
      means st/regwq alpha = .05;
      contrast '0&1 vs 2' st  1 1 -2;
    contrast '0 vs 2' st  1 0 -1;
    contrast '1 vs 2' st  0 -1 1;

      estimate '0&1 vs 2' st  1 1 -2 / divisor = 2;
    estimate '0 vs 2' st  1 0 -1;
    estimate '1 vs 2' st  0 -1 1;

run;
*;
* Contrasts and estimation of improvement;
Proc glm Data = rbf;
    Class wo impr;
      Model rt = wo impr;
      Means impr;
      means impr/bon alpha = .05;
      means impr/regwq alpha = .05;
    contrast '1&2 vs 3&4' impr -1 -1 1 1;
      contrast '1 vs 4' impr  1 0 0 -1;
    contrast '1 vs 3' impr  1 0 -1 0;
    contrast '2 vs 4' impr  0 1 0 -1;
    contrast '2 vs 3' impr  0 1 -1 0;


      estimate '1&2 vs 3&4' impr -1 -1 1 1;
      estimate '1 vs 4' impr  1 0 0 -1;
    estimate '1 vs 3' impr  1 0 -1 0;
    estimate '2 vs 4' impr  0 1 0 -1;
    estimate '2 vs 3' impr  0 1 -1 0;
```

```
run;
*;
* Strength of Association;
Proc freq data=rbf order=data ;
      weight rt;
      tables st*impr/measures;
run;
* ower calculation and sample size;
proc glmpower data=rbf plotonly;
    class st impr;
    model rt = st impr;
    weight rt;
    contrast '1&2 vs 3&4' impr -1 -1 1 1;
    contrast '1 vs 4' impr  1 0 0 -1;
    contrast '2 vs 4' impr  0 1 0 -1;
    power
      nfractional
      stddev      = 3.5
      ncovariates = 1
      corrxy      = 0.2 0.3 0
      alpha       = 0.025
      ntotal      = 10
      power       = .;
   plot x=n min=10 max=500;
run;
ODS Graphics Off;
*;
Quit;
```

CRAC

```
*;
* ODS LISTING;
*;
  ODS Graphics On;
*;
Title 'SAS Program for Two-way ANCOVA Design';
```

```
Options Linesize = 80;
*;
Data ANCOVA_1;
    Input Education Career $ Rate @@;
      Label Education = "Education level"
              Career="Career Improvement"
            Rate = "Final Rate";
*;
Datalines;
3      2      2
4      2      2
4      4      3
3      2      2
4      2      1
3      4      3
4      2      1
4      3      1
3      2      2
4      3      3
3      2      2
3      2      2
3      3      3
4      1      1
3      2      1
3      2      2
4      3      3
5      2      1
4      2      3
4      3      2
4      2      2
4      2      2
4      2      1
4      2      2
2      2      3
3      3      3
3      2      1
3      3      3
```

```
3       4       4
3       4       2
3       2       1
3       2       3
3       1       2
1       3       2
3       1       1
4       2       2
4       2       3
3       3       2
3       3       4
3       2       2
3       2       2
3       3       3
3       2       3
3       2       3
3       3       3
3       3       3
3       3       3
3       3       3
3       3       3
3       3       3
3       2       1

;

*;
Proc Print Data =ANCOVA_1;

*;
Proc GLM Data = ANCOVA_1;
    Class Career;
      Model Rate=Career;

Proc GLM Data = ANCOVA_1;
    Class Career;
      Model Rate=Career Education Career*Education/SS3 effectsize alpha=0.1;
```

```
      RUN;
*The sums of squares for the interaction are more than twice as la
rge, but it is not clear how experimental variability might affect this. The
followin
g statements perform the same analysis as before, but add the EFFECTSIZE option to
the
MODEL statement
also, with ALPHA=0.1 option displays 90% confidence intervals, ensuring that
inferences based on the -values at
the 0.05 levels will agree with the lower confidence limit.;

Proc GLM DATA=ANCOVA_1;
      Model Rate=Education;

Proc Sort DATA=ANCOVA_1;
      By Career;

Proc GLM DATA=ANCOVA_1;
      Model Rate=Education;
      By Career;

Proc GLM DATA=ANCOVA_1;
      Class Career;
      Model Rate= Career Career*Education;
      RUN;

Proc GLM DATA=ANCOVA_1;
      Class Career;
      Model Rate =Education  Career;
      Means  Career;
      lsmeans  Career/StdErr pdiff  adjust=tukey;
      lsmeans  Career/StdErr pdiff  adjust=Bon;
      lsmeans  Career/StdErr pdiff  adjust=Dunnett;

*;

Proc freq data=ANCOVA_1 order=data;
weight Rate;
```

```
tables  Career*Education/chisq;
*crosstabulation table The associated p-value is 0.3655, which means that there is
no significant
evidence of an association between internship status and program enrollment.;

Run;
proc glmpower data=ANCOVA_1 plotonly;
    Class Career;;
    Model Rate=Career Education Career*Education;

    power
      nfractional
      stddev      = 0.84
      ncovariates = 1
      corrxy      = 0.2 0.3 0
      alpha       = 0.05
      ntotal      = 51
      power       = .;
   plot x=n min=10 max=500;
run;

proc glmpower data=ANCOVA_1;
    Class Career;;
    Model Rate=Career Education Career*Education;


Power
Alpha = 0.05
StdDev = 0.84
NTotal = 51
Power = . ;

run;


Quit;
```

Obs	Improvement	Rate
1	a1	3
2	a1	2
3	a1	1
4	a1	1
5	a1	1
6	a1	2
7	a1	1
8	a2	2
9	a2	3
10	a2	1
11	a2	1
12	a2	2
13	a2	2
14	a2	2
15	a2	2
16	a2	2
17	a2	2
18	a2	3
19	a2	3
20	a2	3
21	a2	2
22	a2	3
23	a2	1
24	a2	1
25	a2	2
26	a2	2
27	a2	3
28	a2	1
29	a2	1
30	a2	2
31	a2	2
32	a2	3
33	a3	3
34	a3	2

Obs	Improvement	Rate
35	a3	2
36	a3	2
37	a3	3
38	a3	3
39	a3	3
40	a3	3
41	a3	3
42	a3	3
43	a3	4
44	a3	3
45	a3	3
46	a3	2
47	a3	3
48	a3	3
49	a3	1
50	a4	3
51	a4	4

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
Improvement	4	a1 a2 a3 a4

Number of Observations Read	51
Number of Observations Used	51

The GLM Procedure

Dependent Variable: Rate Course rate socres

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	10.98257703	3.66085901	6.96	0.0006
Error	47	24.70369748	0.52561058		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.307754	32.15173	0.724990	2.254902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Improvement	3	10.98257703	3.66085901	6.96	0.0006

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Improvement	3	10.98257703	3.66085901	6.96	0.0006

The GLM Procedure

Level of Improvement	N	Rate	
		Mean	Std Dev
a1	7	1.57142857	0.78679579
a2	25	2.04000000	0.73484692
a3	17	2.70588235	0.68599434
a4	2	3.50000000	0.70710678

The GLM Procedure

Tukey's Studentized Range (HSD) Test for Rate

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	47
Error Mean Square	0.525611
Critical Value of Studentized Range	3.76660

Comparisons significant at the 0.05 level are indicated by *.**				
Improvement Comparison	**Difference Between Means**	**Simultaneous 95% Confidence Limits**		
a4 - a3	0.7941	-0.6493	2.2376	
a4 - a2	1.4600	0.0411	2.8789	***
a4 - a1	1.9286	0.3804	3.4768	***
a3 - a4	-0.7941	-2.2376	0.6493	
a3 - a2	0.6659	0.0589	1.2729	***
a3 - a1	1.1345	0.2673	2.0016	***
a2 - a4	-1.4600	-2.8789	-0.0411	***
a2 - a3	-0.6659	-1.2729	-0.0589	***
a2 - a1	0.4686	-0.3571	1.2943	
a1 - a4	-1.9286	-3.4768	-0.3804	***
a1 - a3	-1.1345	-2.0016	-0.2673	***
a1 - a2	-0.4686	-1.2943	0.3571	

The GLM Procedure

Bonferroni (Dunn) t Tests for Rate

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Error Degrees of Freedom	47
Error Mean Square	0.525611
Critical Value of t	2.75454

Comparisons significant at the 0.05 level are indicated by *.**

Improvement Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
a4 - a3	0.7941	-0.6987	2.2870	
a4 - a2	1.4600	-0.0075	2.9275	
a4 - a1	1.9286	0.3274	3.5297	***
a3 - a4	-0.7941	-2.2870	0.6987	
a3 - a2	0.6659	0.0381	1.2937	***
a3 - a1	1.1345	0.2376	2.0313	***
a2 - a4	-1.4600	-2.9275	0.0075	
a2 - a3	-0.6659	-1.2937	-0.0381	***
a2 - a1	0.4686	-0.3854	1.3225	
a1 - a4	-1.9286	-3.5297	-0.3274	***
a1 - a3	-1.1345	-2.0313	-0.2376	***
a1 - a2	-0.4686	-1.3225	0.3854	

The GLM Procedure

Scheffe's Test for Rate

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Error Degrees of Freedom	47
Error Mean Square	0.525611
Critical Value of F	2.80236

Comparisons significant at the 0.05 level are indicated by *.**				
Improvement Comparison	**Difference Between Means**	**Simultaneous 95% Confidence Limits**		
a4 - a3	0.7941	-0.7773	2.3655	
a4 - a2	1.4600	-0.0847	3.0047	
a4 - a1	1.9286	0.2431	3.6140	***
a3 - a4	-0.7941	-2.3655	0.7773	
a3 - a2	0.6659	0.0051	1.3267	***
a3 - a1	1.1345	0.1904	2.0785	***
a2 - a4	-1.4600	-3.0047	0.0847	
a2 - a3	-0.6659	-1.3267	-0.0051	***
a2 - a1	0.4686	-0.4303	1.3675	
a1 - a4	-1.9286	-3.6140	-0.2431	***
a1 - a3	-1.1345	-2.0785	-0.1904	***
a1 - a2	-0.4686	-1.3675	0.4303	

The GLM Procedure

Ryan-Einot-Gabriel-Welsch Multiple Range Test for Rate

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	47
Error Mean Square	0.525611
Harmonic Mean of Cell Sizes	5.393157

Note: Cell sizes are not equal.

Number of Means	**2**	**3**	**4**
Critical Range	1.0198694	1.0684568	1.1758725

Means with the same letter are not significantly different.				
REGWQ Grouping		**Mean**	**N**	**Improvement**
	A	3.5000	2	a4
	A			
B	A	2.7059	17	a3
B				
B	C	2.0400	25	a2
	C			
	C	1.5714	7	a1

The GLM Procedure

Bartlett's Test for Homogeneity of Rate Variance			
Source	**DF**	**Chi-Square**	**Pr > ChiSq**
Improvement	3	0.1662	0.9829

The GLM Procedure

Level of Improvement	N	Rate	
		Mean	Std Dev
a1	7	1.57142857	0.78679579
a2	25	2.04000000	0.73484692
a3	17	2.70588235	0.68599434
a4	2	3.50000000	0.70710678

The GLM Procedure

Brown and Forsythe's Test for Homogeneity of Rate Variance ANOVA of Absolute Deviations from Group Medians					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Improvement	2	0.1730	0.0865	0.25	0.7818
Error	46	16.0719	0.3494		

The GLM Procedure

Level of Improvement	N	Rate	
		Mean	Std Dev
a1	7	1.57142857	0.78679579
a2	25	2.04000000	0.73484692
a3	17	2.70588235	0.68599434
a4	2	3.50000000	0.70710678

The GLM Procedure

Dependent Variable: Rate Course rate socres

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
1 vs 3	1	6.38130252	6.38130252	12.14	0.0011
2 vs 4	1	3.94740741	3.94740741	7.51	0.0086

Parameter	Estimate	Standard Error	t Value	Pr > |t|
1 vs 3	-1.13445378	0.32558485	-3.48	0.0011
2 vs 4	-1.46000000	0.53275671	-2.74	0.0086

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a1

Moments			
N	7	**Sum Weights**	7
Mean	1.57142857	**Sum Observations**	11
Std Deviation	0.78679579	**Variance**	0.61904762
Skewness	1.11454978	**Kurtosis**	0.27337278
Uncorrected SS	21	**Corrected SS**	3.71428571
Coeff Variation	50.0688232	**Std Error Mean**	0.29738086

Basic Statistical Measures			
Location		**Variability**	
Mean	1.571429	**Std Deviation**	0.78680
Median	1.000000	**Variance**	0.61905
Mode	1.000000	**Range**	2.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	5.284229	**Pr > |t|**	0.0019
Sign	**M**	3.5	**Pr >= |M|**	0.0156
Signed Rank	**S**	14	**Pr >= |S|**	0.0156

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	**W**	0.769278	**Pr < W**	0.0201
Kolmogorov-Smirnov	**D**	0.337593	**Pr > D**	0.0169
Cramer-von Mises	**W-Sq**	0.136369	**Pr > W-Sq**	0.0271
Anderson-Darling	**A-Sq**	0.782806	**Pr > A-Sq**	0.0223

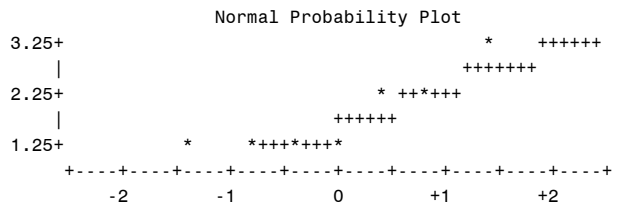
The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a1

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	3
99%	3
95%	3
90%	3
75% Q3	2
50% Median	1
25% Q1	1
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations					
Lowest			**Highest**		
Value	**Improvement**	**Obs**	**Value**	**Improvement**	**Obs**
1	a1	7	1	a1	5
1	a1	5	1	a1	7
1	a1	4	2	a1	2
1	a1	3	2	a1	6
2	a1	6	3	a1	1

```
Stem Leaf                 #             Boxplot
   3 0                    1                |
   2                                       |
   2 00                   2             +-----+
   1                                    |  +  |
   1 0000                 4             *-----*
     ----+----+----+----+
```



The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a2

Moments			
N	25	**Sum Weights**	25
Mean	2.04	**Sum Observations**	51
Std Deviation	0.73484692	**Variance**	0.54
Skewness	-0.0635491	**Kurtosis**	-1.0353129
Uncorrected SS	117	**Corrected SS**	12.96
Coeff Variation	36.021908	**Std Error Mean**	0.14696938

Basic Statistical Measures			
Location		**Variability**	
Mean	2.040000	**Std Deviation**	0.73485
Median	2.000000	**Variance**	0.54000
Mode	2.000000	**Range**	2.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	13.88044	**Pr > |t|**	<.0001
Sign	**M**	12.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	162.5	**Pr >= |S|**	<.0001

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	**W**	0.813187	**Pr < W**	0.0004
Kolmogorov-Smirnov	**D**	0.241705	**Pr > D**	<0.0100
Cramer-von Mises	**W-Sq**	0.329035	**Pr > W-Sq**	<0.0050
Anderson-Darling	**A-Sq**	1.954406	**Pr > A-Sq**	<0.0050

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a2

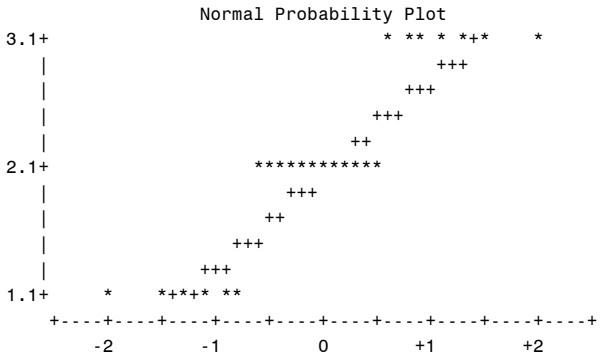
Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	2
25% Q1	2
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations					
Lowest			**Highest**		
Value	**Improvement**	**Obs**	**Value**	**Improvement**	**Obs**
1	a2	29	3	a2	19
1	a2	28	3	a2	20
1	a2	24	3	a2	22
1	a2	23	3	a2	27
1	a2	11	3	a2	32

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a2

```
Stem Leaf                     #             Boxplot
  30 0000000                  7             +-----+
  28                                        |     |
  26                                        |     |
  24                                        |     |
  22                                        |     |
  20 000000000000            12             *--+--*
  18                                           |
  16                                           |
  14                                           |
  12                                           |
  10 000000                   6               |
     ----+----+----+----+
 Multiply Stem.Leaf by 10**-1
```



The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a3

Moments			
N	17	**Sum Weights**	17
Mean	2.70588235	**Sum Observations**	46
Std Deviation	0.68599434	**Variance**	0.47058824
Skewness	-0.8609765	**Kurtosis**	1.42109375
Uncorrected SS	132	**Corrected SS**	7.52941176
Coeff Variation	25.3519648	**Std Error Mean**	0.16637807

Basic Statistical Measures			
Location		**Variability**	
Mean	2.705882	**Std Deviation**	0.68599
Median	3.000000	**Variance**	0.47059
Mode	3.000000	**Range**	3.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	16.26346	**Pr > |t|**	<.0001
Sign	**M**	8.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	76.5	**Pr >= |S|**	<.0001

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	**W**	0.779427	**Pr < W**	0.0011
Kolmogorov-Smirnov	**D**	0.371828	**Pr > D**	<0.0100
Cramer-von Mises	**W-Sq**	0.43146	**Pr > W-Sq**	<0.0050
Anderson-Darling	**A-Sq**	2.068229	**Pr > A-Sq**	<0.0050

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a3

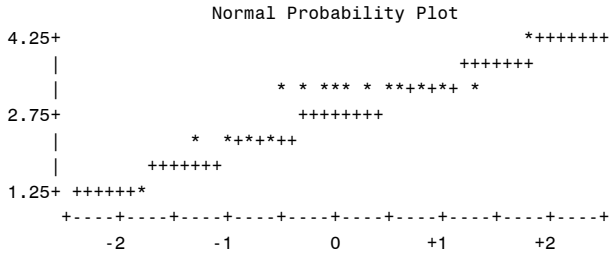
Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	4
99%	4
95%	4
90%	3
75% Q3	3
50% Median	3
25% Q1	2
10%	2
5%	1
1%	1
0% Min	1

Extreme Observations					
Lowest			**Highest**		
Value	**Improvement**	**Obs**	**Value**	**Improvement**	**Obs**
1	a3	49	3	a3	44
2	a3	46	3	a3	45
2	a3	36	3	a3	47
2	a3	35	3	a3	48
2	a3	34	4	a3	43

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a3

```
  Stem Leaf                     #             Boxplot
     4 0                        1                |
     3                                           |
     3 00000000000              11            +-----+
     2                                        |  +  |
     2 0000                     4             +-----+
     1                                           |
     1 0                        1                |
       ----+----+----+----+
```



The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a4

Moments			
N	2	**Sum Weights**	2
Mean	3.5	**Sum Observations**	7
Std Deviation	0.70710678	**Variance**	0.5
Skewness	.	**Kurtosis**	.
Uncorrected SS	25	**Corrected SS**	0.5
Coeff Variation	20.2030509	**Std Error Mean**	0.5

Basic Statistical Measures			
Location		**Variability**	
Mean	3.500000	**Std Deviation**	0.70711
Median	3.500000	**Variance**	0.50000
Mode	.	**Range**	1.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	7	**Pr > |t|**	0.0903
Sign	**M**	1	**Pr >= |M|**	0.5000
Signed Rank	**S**	1.5	**Pr >= |S|**	0.5000

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	**W**	1	**Pr < W**	1.0000
Kolmogorov-Smirnov	**D**	0.26025	**Pr > D**	>0.1500
Cramer-von Mises	**W-Sq**	0.041877	**Pr > W-Sq**	>0.2500
Anderson-Darling	**A-Sq**	0.250482	**Pr > A-Sq**	0.2332

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Improvementment=a4

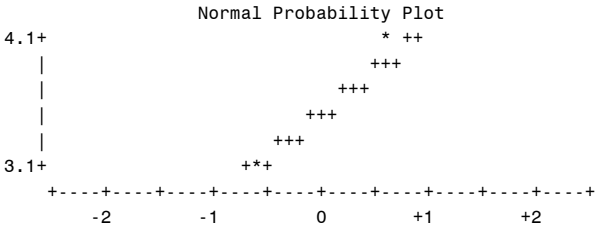
Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	4.0
99%	4.0
95%	4.0
90%	4.0
75% Q3	4.0
50% Median	3.5
25% Q1	3.0
10%	3.0
5%	3.0
1%	3.0
0% Min	3.0

Extreme Observations					
Lowest			**Highest**		
Value	**Improvement**	**Obs**	**Value**	**Improvement**	**Obs**
3	a4	50	3	a4	50
4	a4	51	4	a4	51

The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

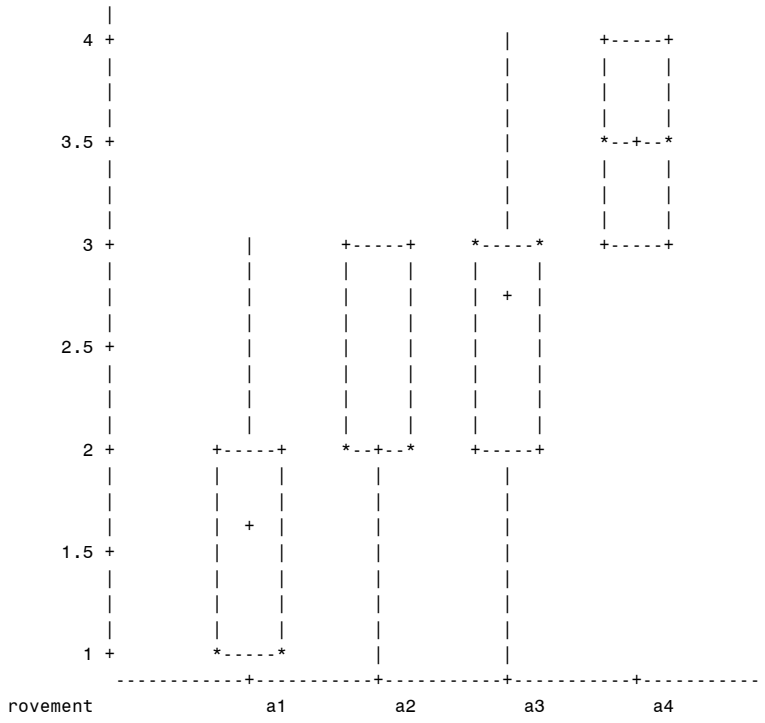
Improvementment=a4

```
 Stem Leaf                     #             Boxplot
   40 0                        1             +-----+
   38                                        |     |
   36                                        |     |
   34                                        *--+--*
   32                                        |     |
   30 0                        1             +-----+
      ----+----+----+----+
  Multiply Stem.Leaf by 10**-1
```



The UNIVARIATE Procedure
Variable: Rate (Course rate socres)

Schematic Plots



The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
Improvement	4	a1 a2 a3 a4

Number of Observations Read	51
Number of Observations Used	51

The GLM Procedure

Dependent Variable: Rate Course rate socres

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	10.98257703	3.66085901	6.96	0.0006
Error	47	24.70369748	0.52561058		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.307754	32.15173	0.724990	2.254902

Overall Noncentrality	
Min Var Unbiased Estimate	17.006
Low MSE Estimate	16.25
95% Confidence Limits	(4.1709,42.776)

Proportion of Variation Accounted for	
Eta-Square	0.31
Omega-Square	0.26
95% Confidence Limits	(0.08,0.46)

Source	DF	Type I SS	Mean Square	F Value	Pr > F	Noncentrality Parameter			
						Min Var Unbiased Estimate	Low MSE Estimate	95% Confidence Limits	
Improvement	3	10.98257703	3.66085901	6.96	0.0006	17	16.2	4.17	42.8

Source	Total Variation Accounted For				Partial Variation Accounted For			
	Semipartial Eta-Square	Semipartial Omega-Square	Conservative 95% Confidence Limits		Partial Eta-Square	Partial Omega-Square	95% Confidence Limits	
Improvement	0.3078	0.2597	0.0756	0.4561	0.3078	0.2597	0.0756	0.4561

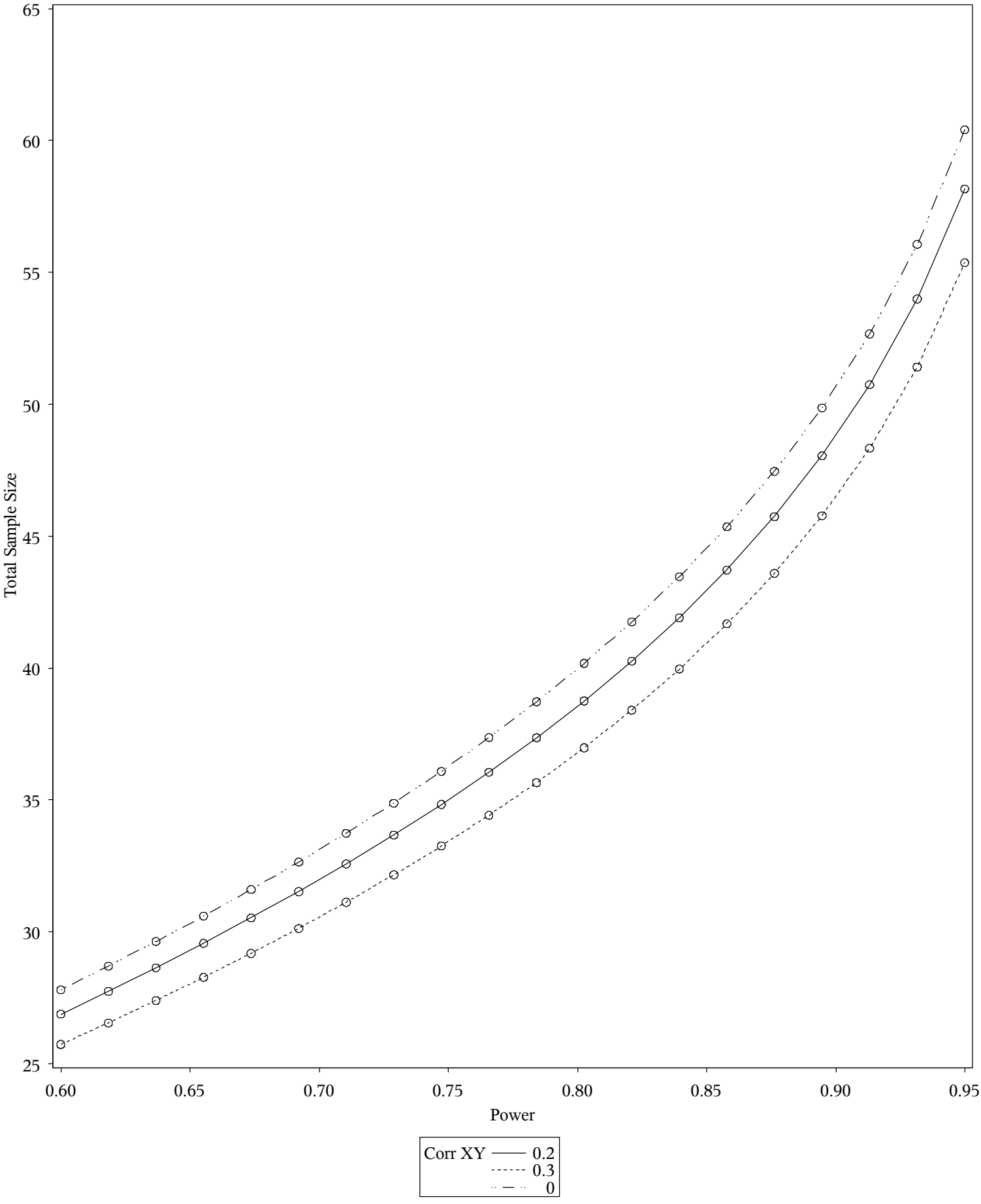
The GLM Procedure

Dependent Variable: Rate Course rate socres

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Noncentrality Parameter			
						Min Var Unbiased Estimate	Low MSE Estimate	95% Confidence Limits	
Improvement	3	10.98257703	3.66085901	6.96	0.0006	17	16.2	4.17	42.8

Source	Total Variation Accounted For				Partial Variation Accounted For			
	Semipartial Eta-Square	Semipartial Omega-Square	Conservative 95% Confidence Limits		Partial Eta-Square	Partial Omega-Square	95% Confidence Limits	
Improvement	0.3078	0.2597	0.0756	0.4561	0.3078	0.2597	0.0756	0.4561

SAS Program for CR-4 Design



The GLMPOWER Procedure

Fixed Scenario Elements	
Dependent Variable	Rate
Source	Improvement
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Test Degrees of Freedom	3
Error Degrees of Freedom	47

Computed Power
Power
0.903

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

Obs	per	impr	rt
1	1	2	2
2	3	1	3
3	3	3	3
4	2	4	3
5	5	1	2
6	2	2	3
7	5	4	4
8	2	1	1
9	3	1	1
10	5	1	1
11	4	2	1
12	5	2	1
13	2	2	2
14	1	2	2
15	1	2	2
16	4	2	2
17	1	2	2
18	1	2	2
19	5	2	3
20	1	2	3
21	5	2	3
22	4	3	2
23	2	3	2
24	1	3	2
25	3	3	3
26	1	3	3
27	5	3	3
28	1	3	3
29	1	3	3
30	4	3	3
31	1	3	4
32	5	2	2
33	2	2	3
34	2	3	3
35	5	1	2
36	5	2	1
37	4	2	1
38	3	2	2
39	2	2	2
40	3	2	3
41	1	3	3
42	3	2	1
43	5	2	1
44	3	2	2
45	4	2	2
46	2	2	3
47	2	3	2
48	1	3	3
49	1	3	3
50	4	3	1
51	4	1	1

SAS Program for RB-4 Design

Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The MEANS Procedure

Improvement=1

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
7	1.5714286	0.7867958	1.0000000	3.0000000

Improvement=2

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
25	2.0400000	0.7348469	1.0000000	3.0000000

Improvement=3

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
17	2.7058824	0.6859943	1.0000000	4.0000000

Improvement=4

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
2	3.5000000	0.7071068	3.0000000	4.0000000

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Improvement=1

Moments			
N	7	Sum Weights	7
Mean	1.57142857	Sum Observations	11
Std Deviation	0.78679579	Variance	0.61904762
Skewness	1.11454978	Kurtosis	0.27337278
Uncorrected SS	21	Corrected SS	3.71428571
Coeff Variation	50.0688232	Std Error Mean	0.29738086

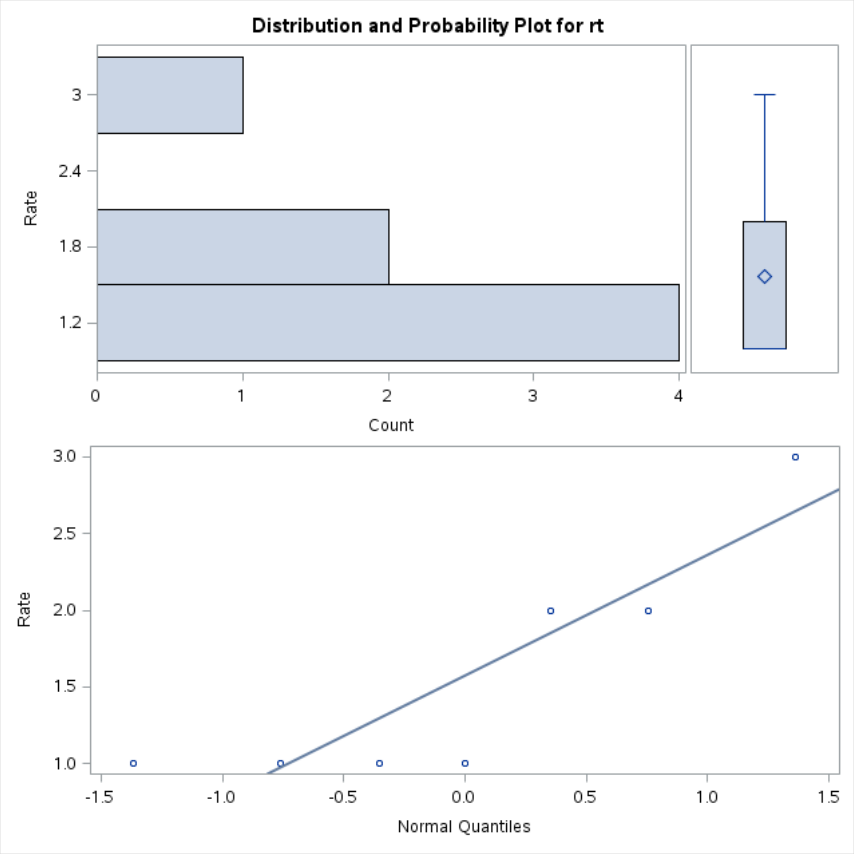
Basic Statistical Measures			
Location		Variability	
Mean	1.571429	Std Deviation	0.78680
Median	1.000000	Variance	0.61905
Mode	1.000000	Range	2.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	5.284229	Pr > |t|	0.0019
Sign	M	3.5	Pr >= |M|	0.0156
Signed Rank	S	14	Pr >= |S|	0.0156

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3

90%	3
75% Q3	2
50% Median	1
25% Q1	1
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	7	1	5
1	5	1	7
1	4	2	2
1	3	2	6
2	6	3	1



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Improvement=2

Moments			
N	25	**Sum Weights**	25
Mean	2.04	**Sum Observations**	51
Std Deviation	0.73484692	**Variance**	0.54
Skewness	-0.0635491	**Kurtosis**	-1.0353129
Uncorrected SS	117	**Corrected SS**	12.96
Coeff Variation	36.021908	**Std Error Mean**	0.14696938

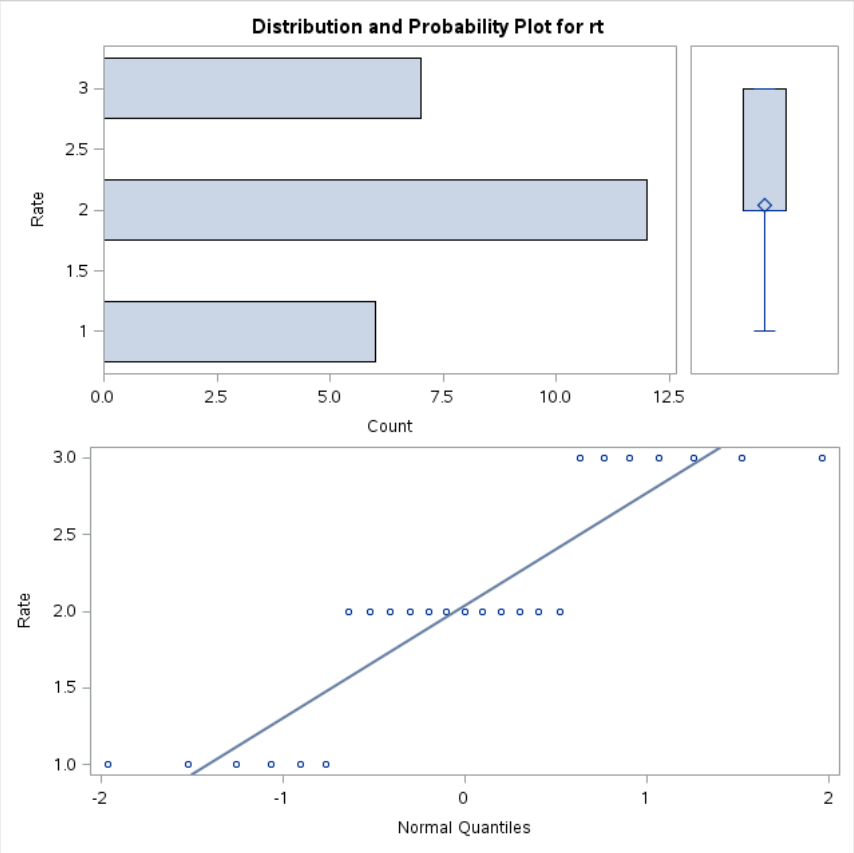
Basic Statistical Measures

Location		Variability	
Mean	2.040000	Std Deviation	0.73485
Median	2.000000	Variance	0.54000
Mode	2.000000	Range	2.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	13.88044	Pr > |t|	<.0001
Sign	M	12.5	Pr >= |M|	<.0001
Signed Rank	S	162.5	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	2
25% Q1	2
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
1	29	3	19
1	28	3	20
1	24	3	22
1	23	3	27
1	11	3	32



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Improvement=3

Moments			
N	17	Sum Weights	17
Mean	2.70588235	Sum Observations	46
Std Deviation	0.68599434	Variance	0.47058824
Skewness	-0.8609765	Kurtosis	1.42109375
Uncorrected SS	132	Corrected SS	7.52941176
Coeff Variation	25.3519648	Std Error Mean	0.16637807

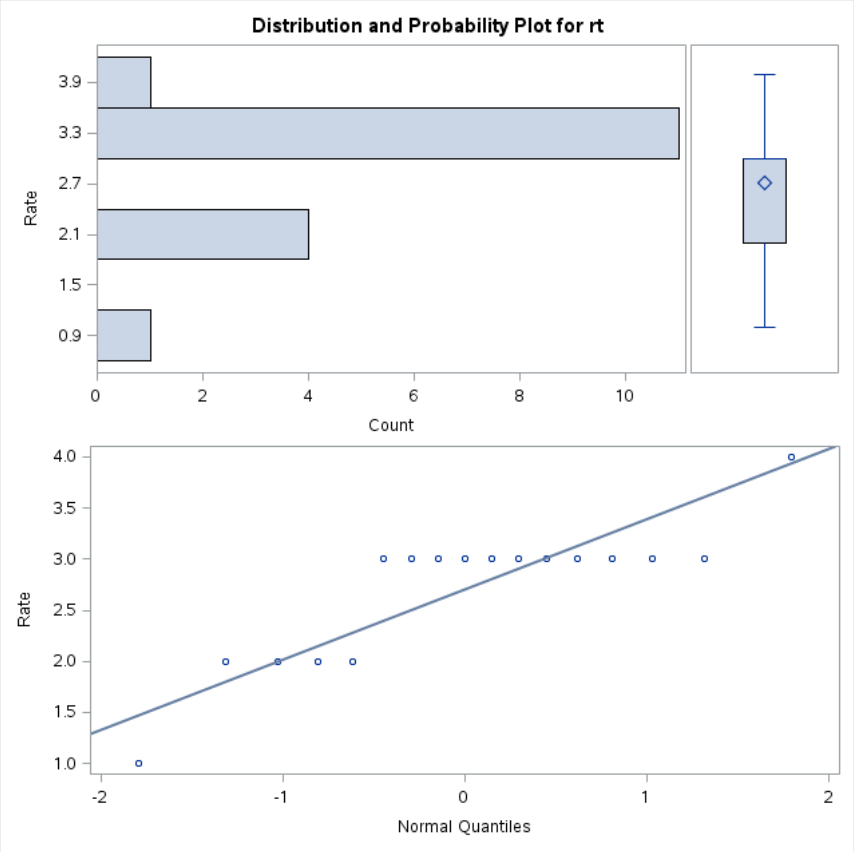
Basic Statistical Measures			
Location		Variability	
Mean	2.705882	Std Deviation	0.68599
Median	3.000000	Variance	0.47059
Mode	3.000000	Range	3.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	16.26346	Pr > |t|	<.0001
Sign	M	8.5	Pr >= |M|	<.0001
Signed Rank	S	76.5	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	4
99%	4
95%	4

90%	3
75% Q3	3
50% Median	3
25% Q1	2
10%	2
5%	1
1%	1
0% Min	1

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	49	3	44
2	46	3	45
2	36	3	47
2	35	3	48
2	34	4	43



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Improvement=4

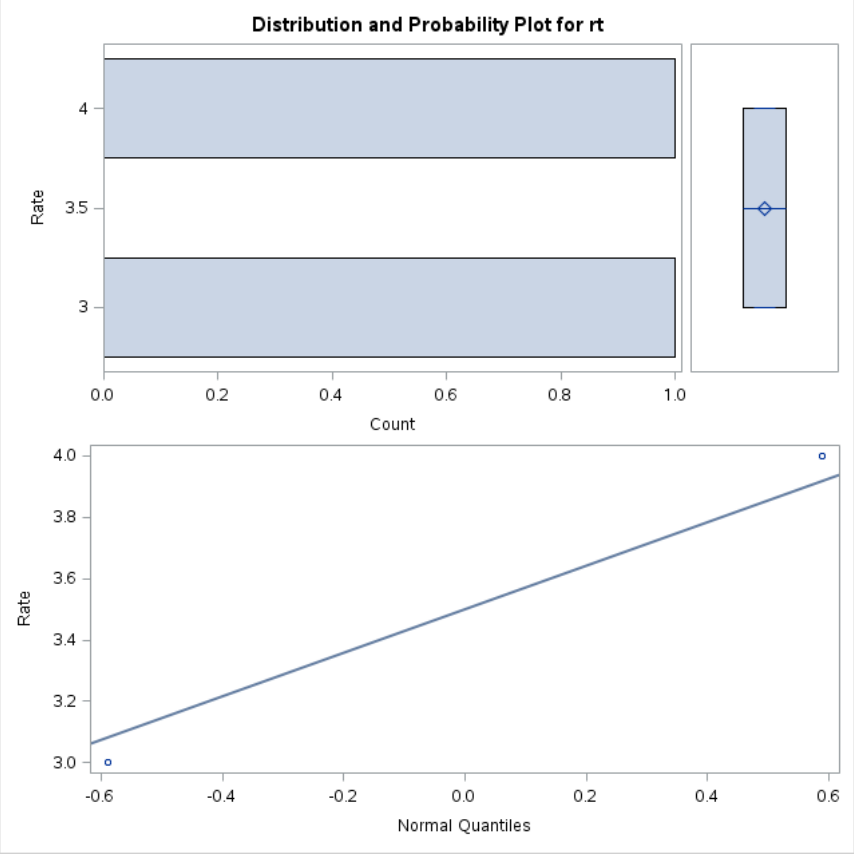
Moments			
N	2	**Sum Weights**	2
Mean	3.5	**Sum Observations**	7
Std Deviation	0.70710678	**Variance**	0.5
Skewness	.	**Kurtosis**	.
Uncorrected SS	25	**Corrected SS**	0.5
Coeff Variation	20.2030509	**Std Error Mean**	0.5

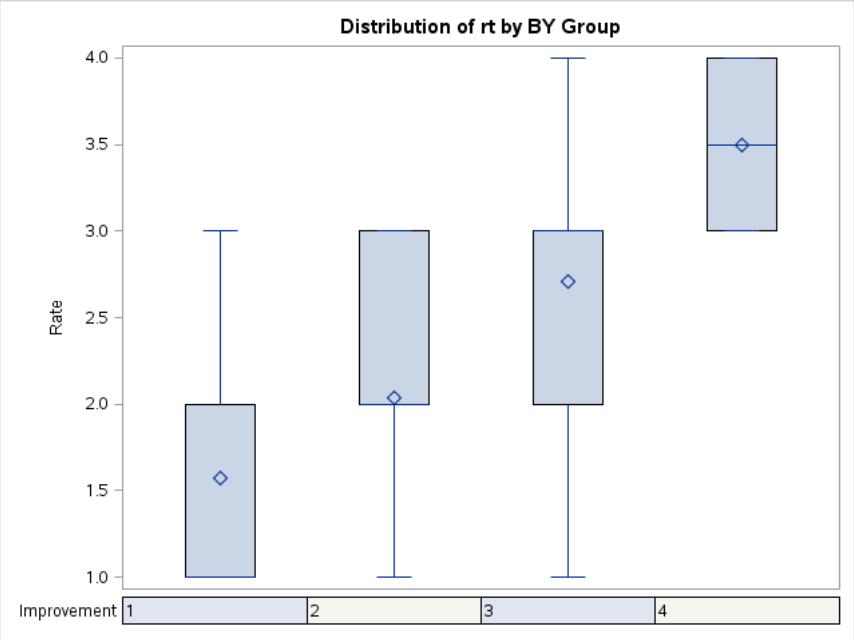
Basic Statistical Measures			
Location		**Variability**	
Mean	3.500000	**Std Deviation**	0.70711
Median	3.500000	**Variance**	0.50000
Mode	.	**Range**	1.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	7	**Pr > |t|**	0.0903
Sign	**M**	1	**Pr >= |M|**	0.5000
Signed Rank	**S**	1.5	**Pr >= |S|**	0.5000

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	4.0
99%	4.0
95%	4.0
90%	4.0
75% Q3	4.0
50% Median	3.5
25% Q1	3.0
10%	3.0
5%	3.0
1%	3.0
0% Min	3.0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
3	50	3	50
4	51	4	51





SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	Levels	Values
per	5	1 2 3 4 5
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.88980952	2.12711565	4.40	0.0009
Error	43	20.79646499	0.48363872		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.417242	30.84131	0.695441	2.254902

Overall Noncentrality	
Min Var Unbiased Estimate	22.355
Low MSE Estimate	21.265
90% Confidence Limits	(7.9001,48.602)

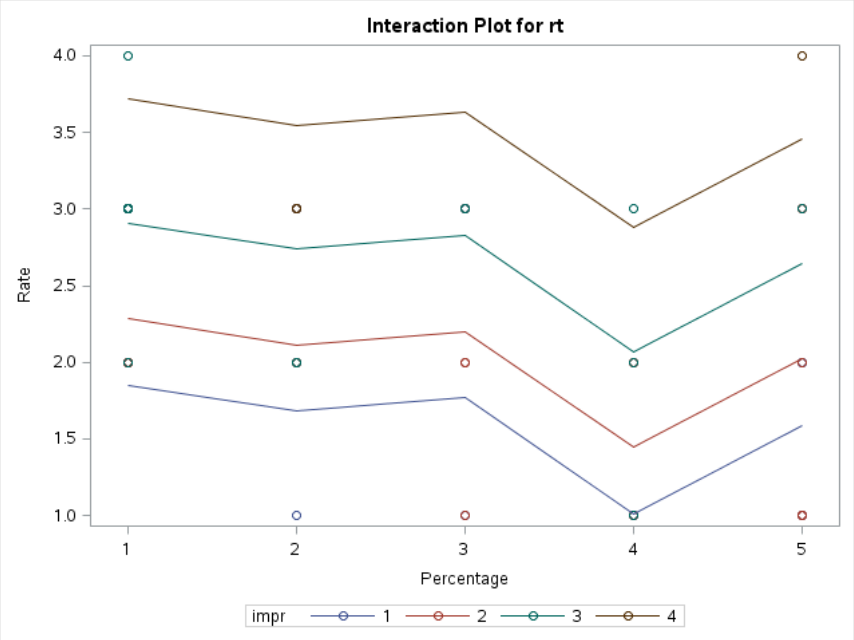
Proportion of Variation Accounted for	
Eta-Square	0.42
Omega-Square	0.32
90% Confidence Limits	(0.13,0.49)

						Noncentrality Parameter				Total Variation Accounted For				Partial Variation Acco		
Source	DF	Type I SS	Mean Square	F Value	Pr > F	Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	Cc
per	4	5.78789789	1.44697447	2.99	0.0290	7.41	7.05	0.648	23.4	0.1622	0.1065	0.0000	0.2638	0.2177	0.1351	0.01

impr	3	9.10191163	3.03397054	6.27	0.0013	14.94	14.22	4.657	35.3	0.2551	0.2115	0.0615	0.3778	0.3044	0.2368	0.08

						Noncentrality Parameter				Total Variation Accounted For				Partial Variation Acco		
Source	DF	Type II SS	Mean Square	F Value	Pr > F	Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	Co
per	4	3.90723249	0.97680812	2.02	0.1086	3.7	3.52	0.00	16.9	0.1095	0.0545	0.0000	0.1975	0.1582	0.0741	0.00
impr	3	9.10191163	3.03397054	6.27	0.0013	14.9	14.22	4.66	35.3	0.2551	0.2115	0.0615	0.3778	0.3044	0.2368	0.08

						Noncentrality Parameter				Total Variation Accounted For				Partial Variation Acco		
Source	DF	Type III SS	Mean Square	F Value	Pr > F	Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	Co
per	4	3.90723249	0.97680812	2.02	0.1086	3.7	3.52	0.00	16.9	0.1095	0.0545	0.0000	0.1975	0.1582	0.0741	0.00
impr	3	9.10191163	3.03397054	6.27	0.0013	14.9	14.22	4.66	35.3	0.2551	0.2115	0.0615	0.3778	0.3044	0.2368	0.08



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

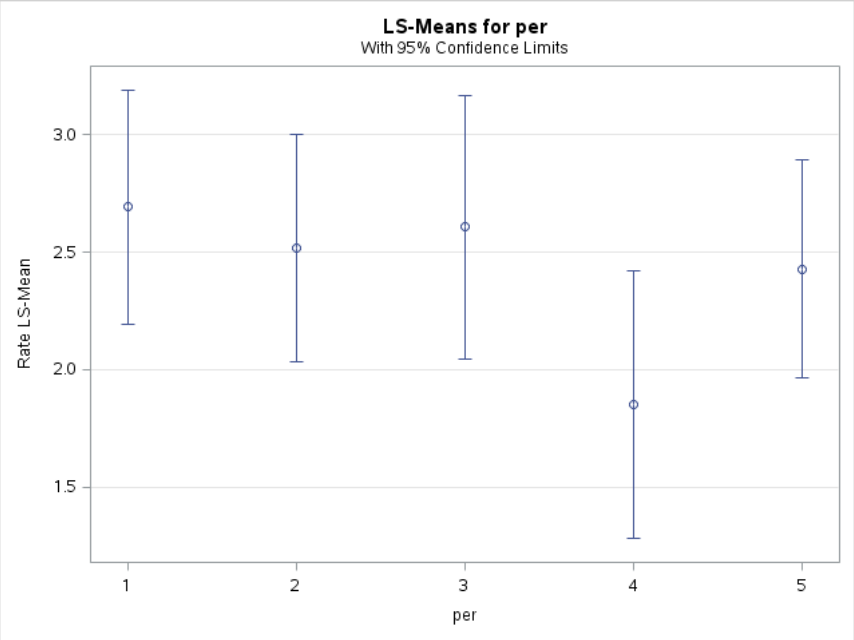
The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer

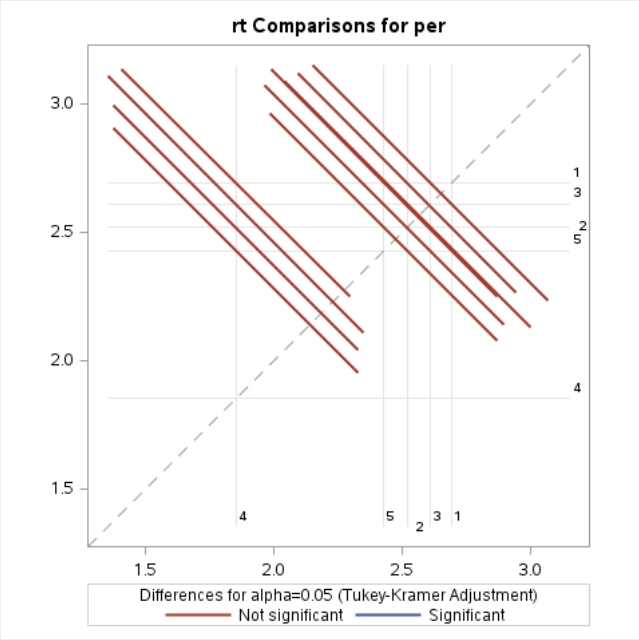
per	rt LSMEAN	LSMEAN Number
1	2.69227208	1
2	2.51882181	2
3	2.60817693	3
4	1.85108915	4
5	2.42797536	5

Least Squares Means for effect per
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4	5
1		0.9773	0.9989	0.0720	0.9119
2	0.9773		0.9989	0.2841	0.9983
3	0.9989	0.9989		0.2140	0.9815
4	0.0720	0.2841	0.2140		0.4287
5	0.9119	0.9983	0.9815	0.4287	





SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

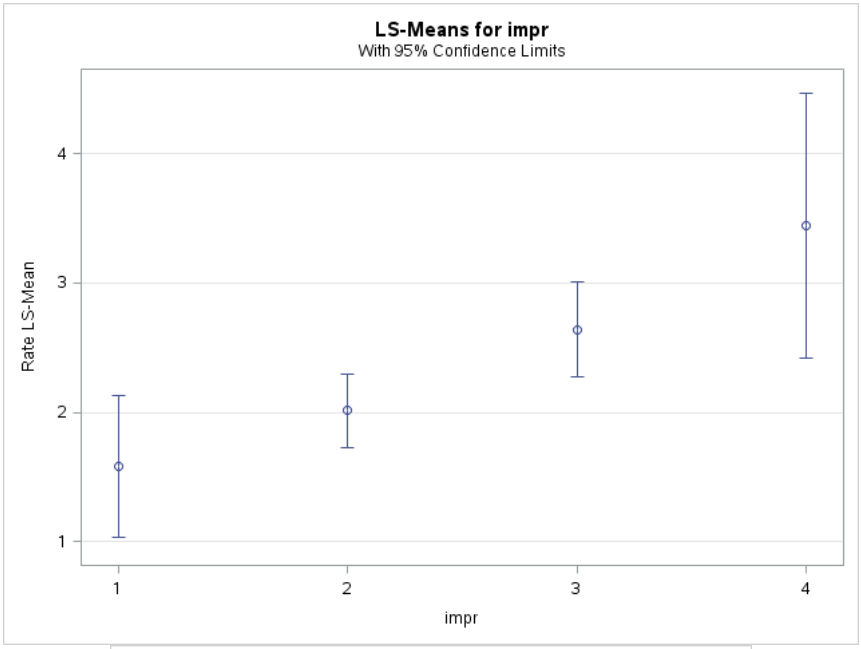
The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer

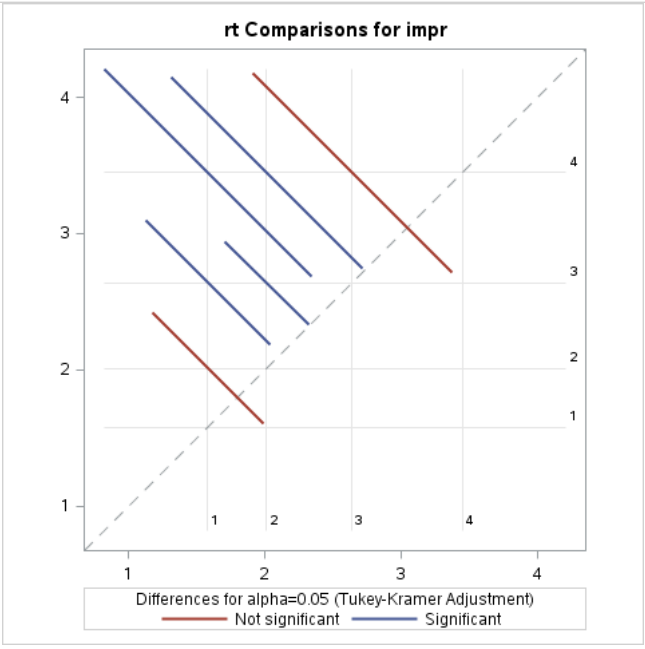
impr	rt LSMEAN	LSMEAN Number
1	1.58106836	1
2	2.01356075	2
3	2.63777067	3
4	3.44626848	4

Least Squares Means for effect impr
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4
1		0.5002	0.0175	0.0108
2	0.5002		0.0430	0.0435
3	0.0175	0.0430		0.4583
4	0.0108	0.0435	0.4583	





SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

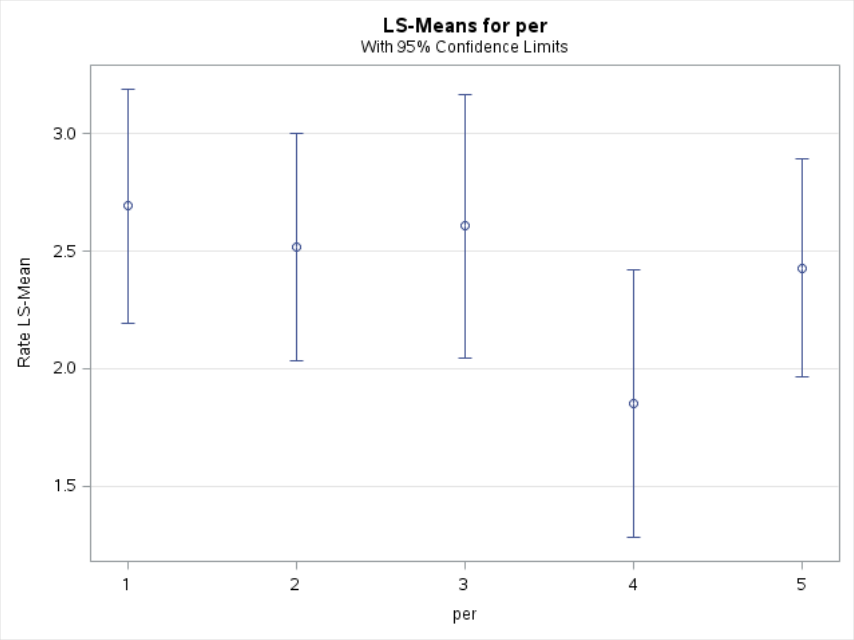
per	rt LSMEAN	LSMEAN Number
1	2.69227208	1
2	2.51882181	2
3	2.60817693	3
4	1.85108915	4
5	2.42797536	5

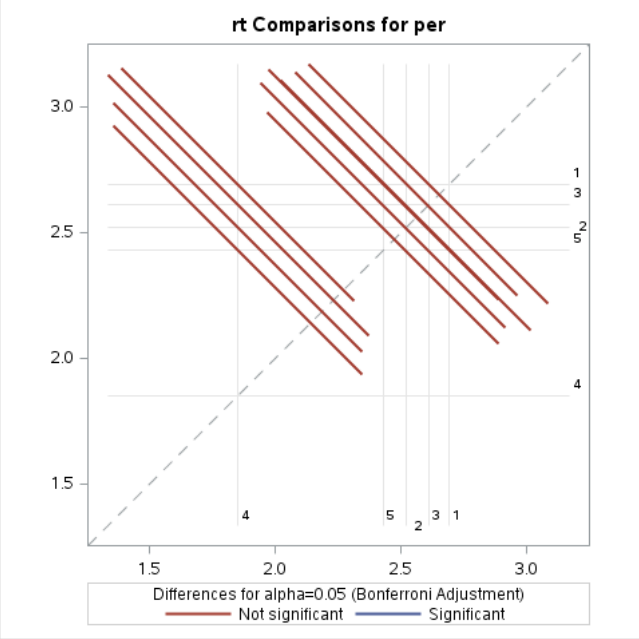
Least Squares Means for effect per
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4	5
1		1.0000	1.0000	0.1012	1.0000
2	1.0000		1.0000	0.5203	1.0000

3	1.0000	1.0000		0.3630	1.0000
4	0.1012	0.5203	0.3630		0.9134
5	1.0000	1.0000	1.0000	0.9134	





SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

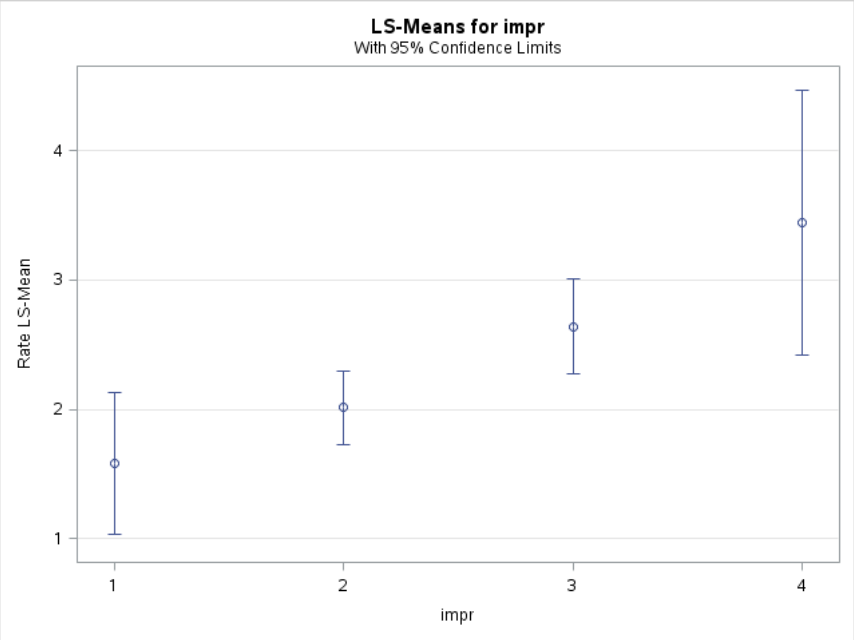
impr	rt LSMEAN	LSMEAN Number
1	1.58106836	1
2	2.01356075	2
3	2.63777067	3
4	3.44626848	4

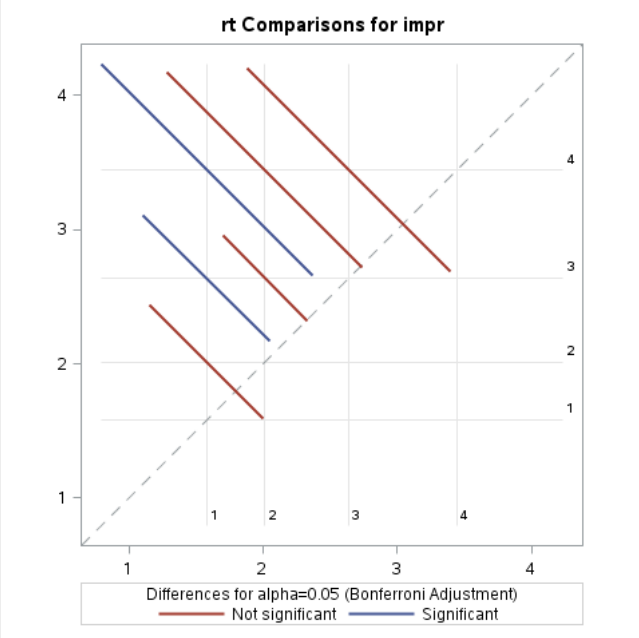
Least Squares Means for effect impr
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4

1		0.9945	0.0207	0.0125
2	0.9945		0.0540	0.0546
3	0.0207	0.0540		0.8774
4	0.0125	0.0546	0.8774	





SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
per	5	1 2 3 4 5
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

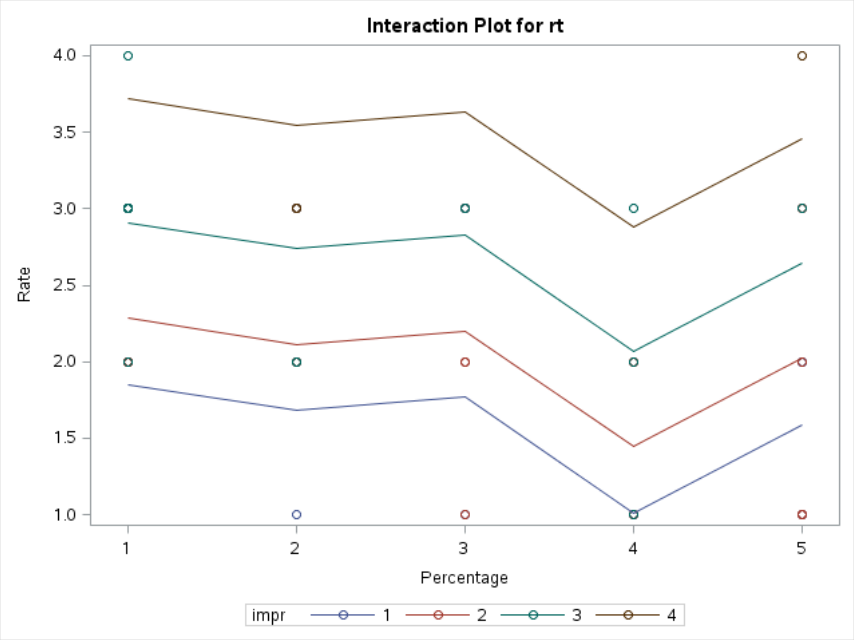
Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.88980952	2.12711565	4.40	0.0009
Error	43	20.79646499	0.48363872		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.417242	30.84131	0.695441	2.254902

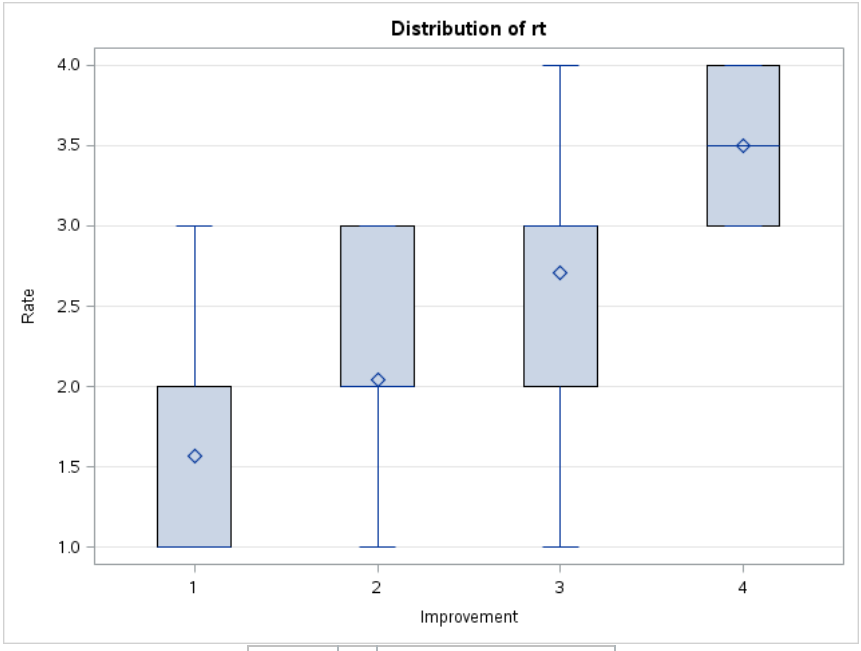
Source	DF	Type I SS	Mean Square	F Value	Pr > F
per	4	5.78789789	1.44697447	2.99	0.0290
impr	3	9.10191163	3.03397054	6.27	0.0013

Source	DF	Type III SS	Mean Square	F Value	Pr > F
per	4	3.90723249	0.97680812	2.02	0.1086
impr	3	9.10191163	3.03397054	6.27	0.0013



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

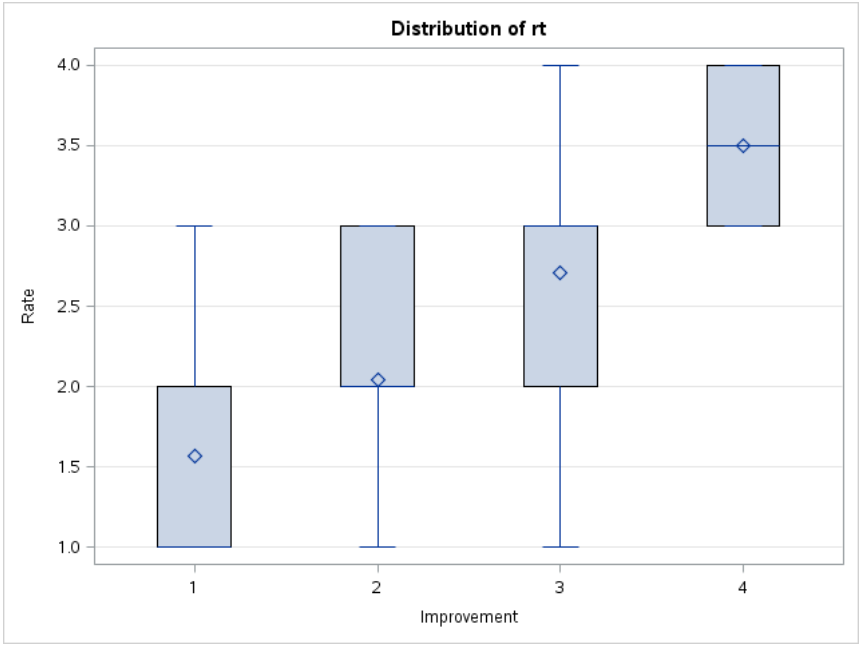
The GLM Procedure



Level of impr	N	rt	
		Mean	Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
t Tests (LSD) for rt

Note: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05

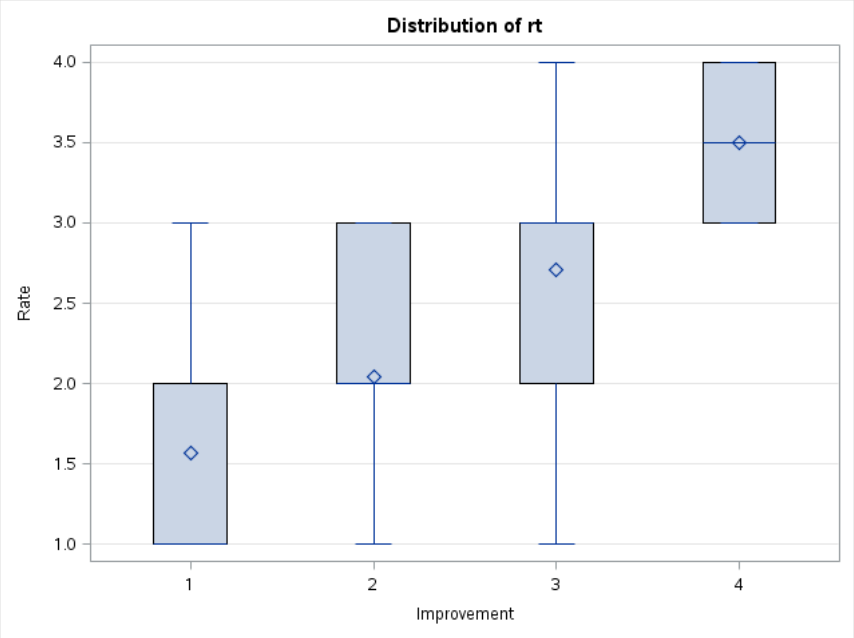
Error Degrees of Freedom	43
Error Mean Square	0.483639
Critical Value of t	2.01669

Comparisons significant at the 0.05 level are indicated by ***.

impr Comparison	Difference Between Means	95% Confidence Limits		
4 - 3	0.7941	-0.2543	1.8425	
4 - 2	1.4600	0.4294	2.4906	***
4 - 1	1.9286	0.8041	3.0531	***
3 - 4	-0.7941	-1.8425	0.2543	
3 - 2	0.6659	0.2250	1.1068	***
3 - 1	1.1345	0.5046	1.7643	***
2 - 4	-1.4600	-2.4906	-0.4294	***
2 - 3	-0.6659	-1.1068	-0.2250	***
2 - 1	0.4686	-0.1312	1.0683	
1 - 4	-1.9286	-3.0531	-0.8041	***
1 - 3	-1.1345	-1.7643	-0.5046	***
1 - 2	-0.4686	-1.0683	0.1312	

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Bonferroni (Dunn) t Tests for rt

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Error Degrees of Freedom	43
Error Mean Square	0.483639
Critical Value of t	2.76584

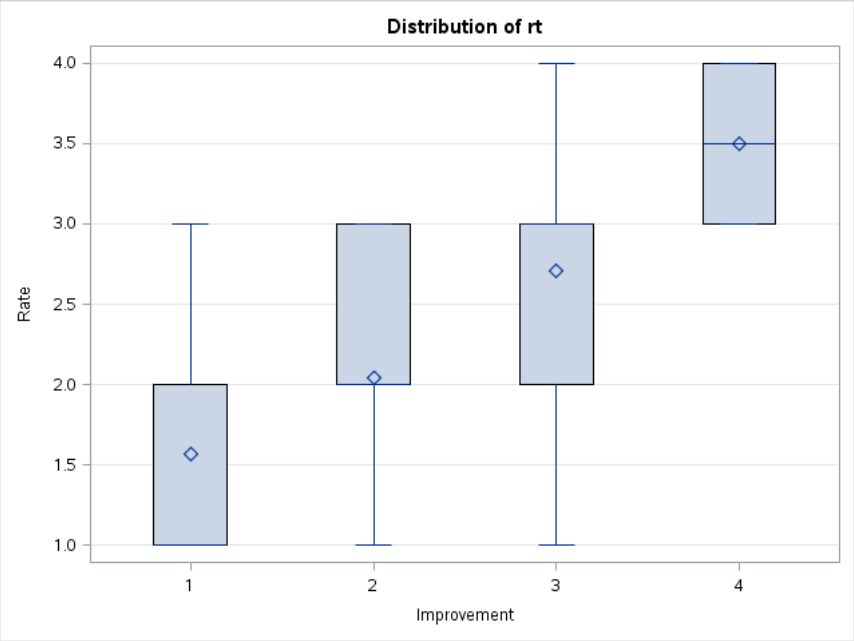
Comparisons significant at the 0.05 level are indicated by ***.

impr	Difference Between			

Comparison	Means	Simultaneous 95% Confidence Limits		
4 - 3	0.7941	-0.6438	2.2320	
4 - 2	1.4600	0.0465	2.8735	***
4 - 1	1.9286	0.3864	3.4708	***
3 - 4	-0.7941	-2.2320	0.6438	
3 - 2	0.6659	0.0612	1.2706	***
3 - 1	1.1345	0.2706	1.9983	***
2 - 4	-1.4600	-2.8735	-0.0465	***
2 - 3	-0.6659	-1.2706	-0.0612	***
2 - 1	0.4686	-0.3539	1.2911	
1 - 4	-1.9286	-3.4708	-0.3864	***
1 - 3	-1.1345	-1.9983	-0.2706	***
1 - 2	-0.4686	-1.2911	0.3539	

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for rt

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	43
Error Mean Square	0.483639
Harmonic Mean of Cell Sizes	5.393157

Note: Cell sizes are not equal.

Number of Means	2	3	4
Critical Range	0.9813257	1.0280129	1.1317725

Means with the same letter are not significantly different.

REGWQ Grouping	Mean	N	impr
A	3.5000	2	4

	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
1&2 vs 3&4	1	7.99112306	7.99112306	16.52	0.0002
1 vs 3&4	1	7.08704033	7.08704033	14.65	0.0004
1 vs 2	1	0.96142397	0.96142397	1.99	0.1658
3 vs 4	1	1.05896691	1.05896691	2.19	0.1462

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The FREQ Procedure

Frequency
Percent
Row Pct
Col Pct

Table of per by impr					
	impr(Improvement)				
per(Percentage)	1	2	3	4	Total
3	4 3.48 22.22 36.36	8 6.96 44.44 15.69	6 5.22 33.33 13.04	0 0.00 0.00 0.00	18 15.65
5	5 4.35 21.74 45.45	11 9.57 47.83 21.57	3 2.61 13.04 6.52	4 3.48 17.39 57.14	23 20.00
2	1 0.87 4.17 9.09	13 11.30 54.17 25.49	7 6.09 29.17 15.22	3 2.61 12.50 42.86	24 20.87
4	1 0.87 7.69 9.09	6 5.22 46.15 11.76	6 5.22 46.15 13.04	0 0.00 0.00 0.00	13 11.30
1	0 0.00 0.00 0.00	13 11.30 35.14 25.49	24 20.87 64.86 52.17	0 0.00 0.00 0.00	37 32.17
Total	11 9.57	51 44.35	46 40.00	7 6.09	115 100.00

Statistics for Table of per by impr

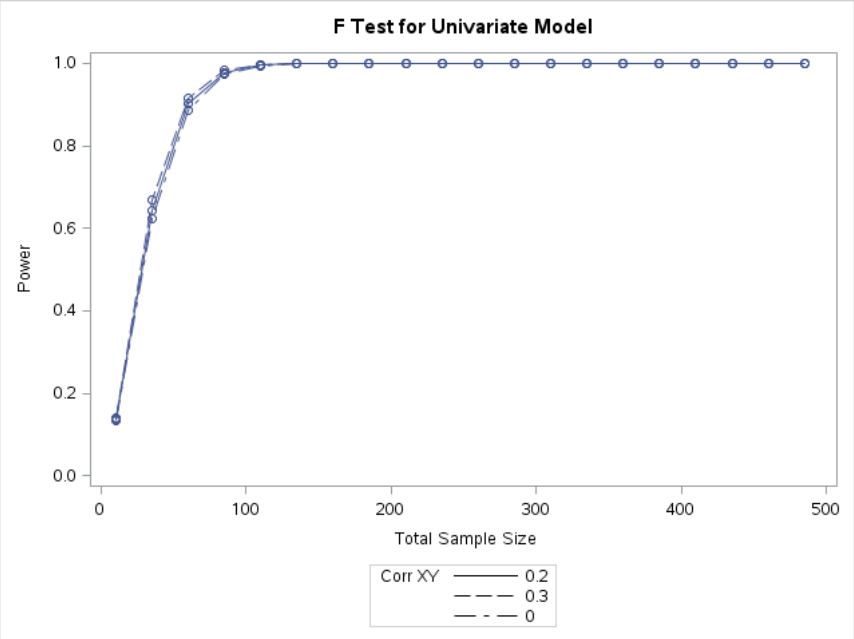
Statistic	Value	ASE
Gamma	0.3168	0.1018
Kendall's Tau-b	0.2297	0.0751
Stuart's Tau-c	0.2141	0.0698
Somers' D C|R	0.2071	0.0678
Somers' D R|C	0.2547	0.0834
Pearson Correlation	0.2458	0.0849
Spearman Correlation	0.2681	0.0873
Lambda Asymmetric C|R	0.1719	0.0865
Lambda Asymmetric R|C	0.1154	0.0713
Lambda Symmetric	0.1408	0.0657
Uncertainty Coefficient C|R	0.1491	0.0322

Uncertainty Coefficient R|C	0.1079	0.0263
Uncertainty Coefficient Symmetric	0.1252	0.0289

Sample Size = 115

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLMPOWER Procedure



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLMPOWER Procedure

Fixed Scenario Elements	
Dependent Variable	rt
Source	impr
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Test Degrees of Freedom	3
Error Degrees of Freedom	47

Computed Power
Power
0.903

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
per	5	1 2 3 4 5
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

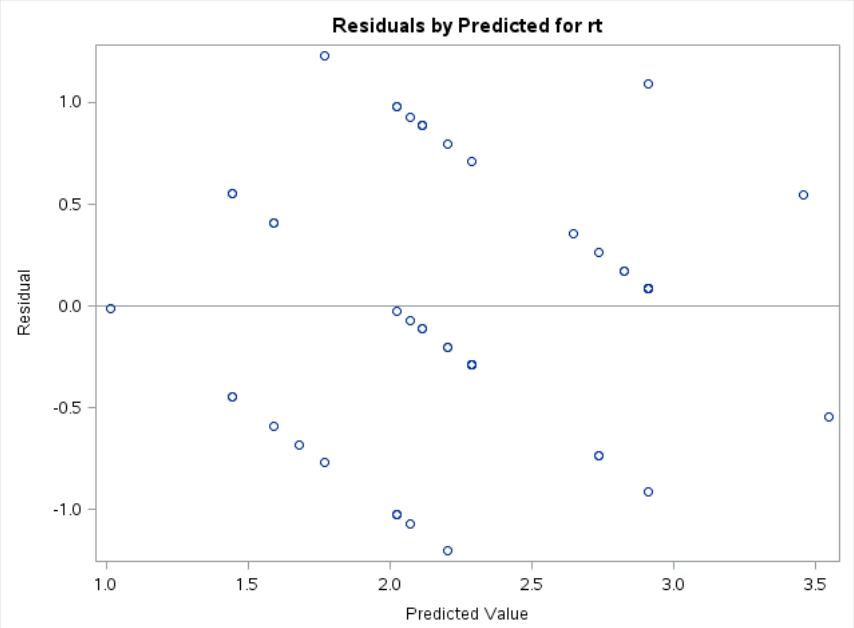
Dependent Variable: rt Rate

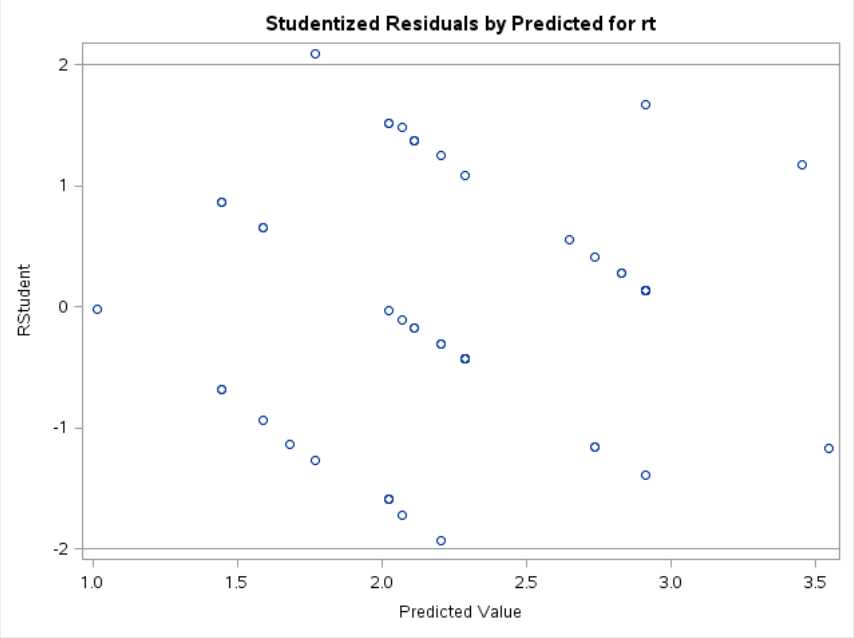
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.88980952	2.12711565	4.40	0.0009
Error	43	20.79646499	0.48363872		
Corrected Total	50	35.68627451			

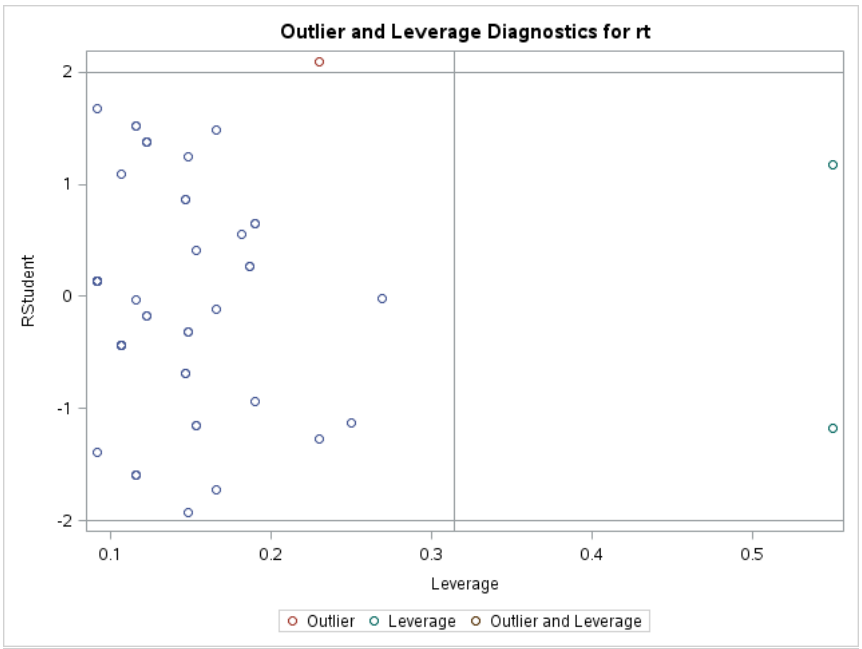
R-Square	Coeff Var	Root MSE	rt Mean
0.417242	30.84131	0.695441	2.254902

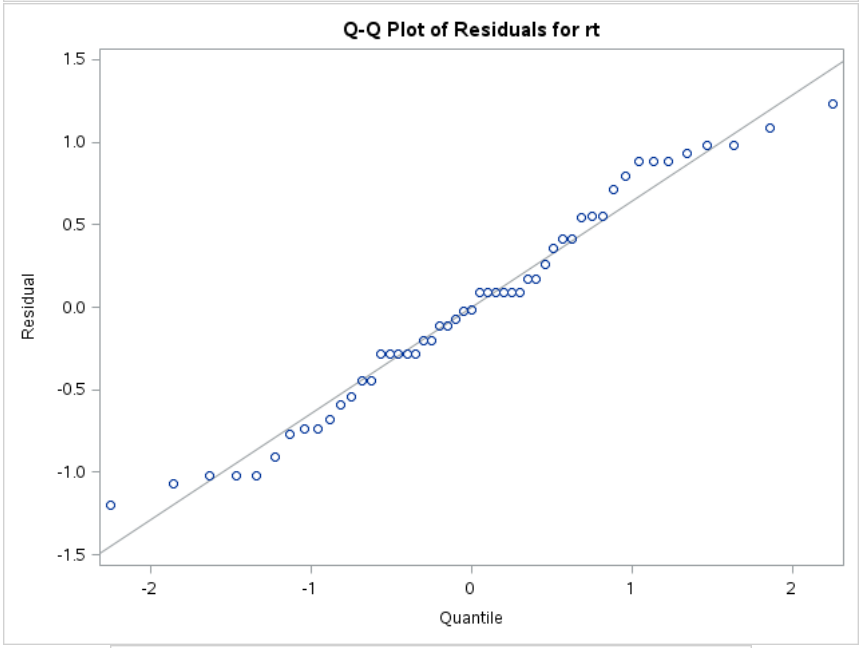
Source	DF	Type I SS	Mean Square	F Value	Pr > F
per	4	5.78789789	1.44697447	2.99	0.0290
impr	3	9.10191163	3.03397054	6.27	0.0013

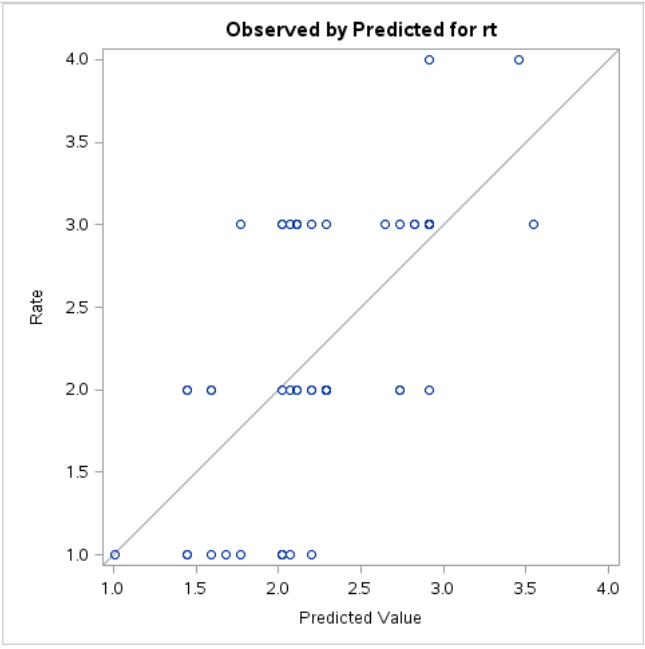
Source	DF	Type III SS	Mean Square	F Value	Pr > F
per	4	3.90723249	0.97680812	2.02	0.1086
impr	3	9.10191163	3.03397054	6.27	0.0013

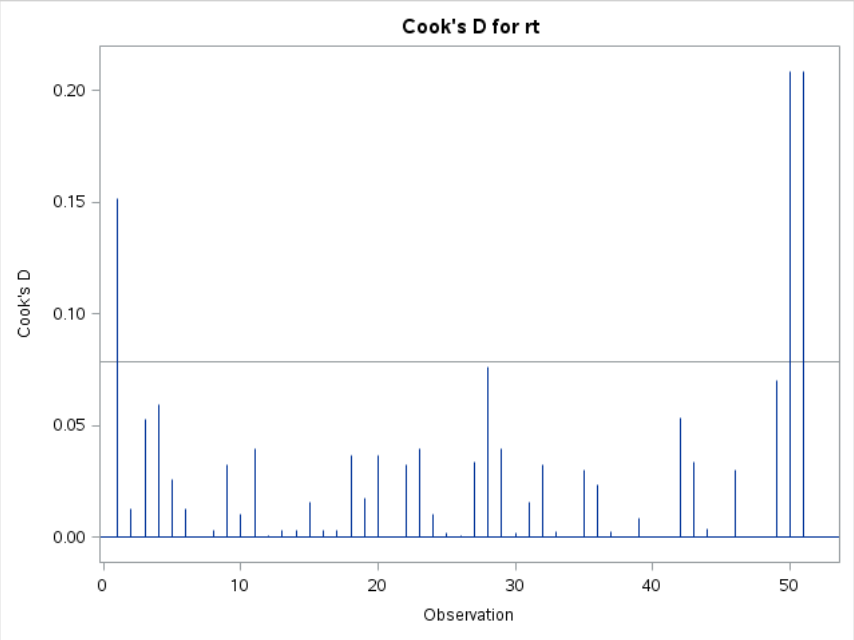


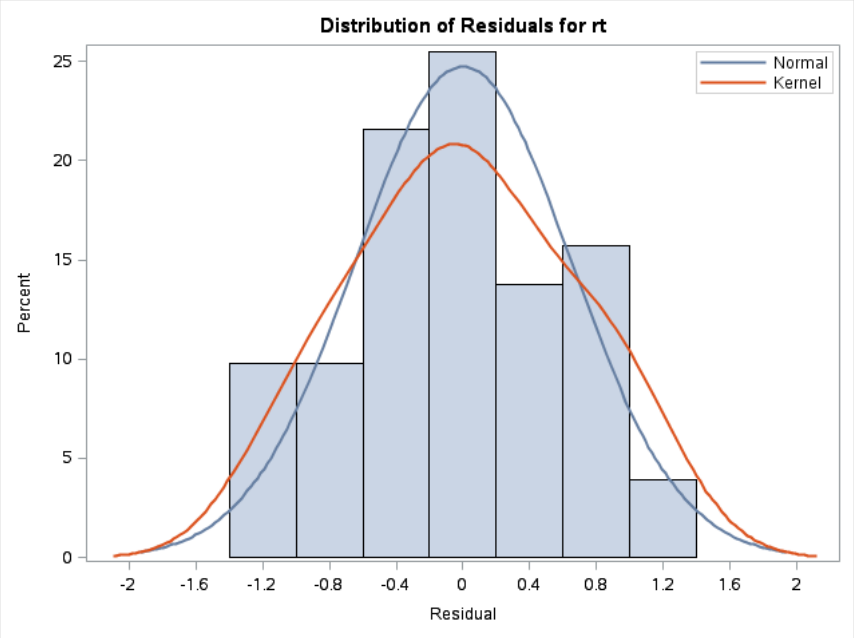


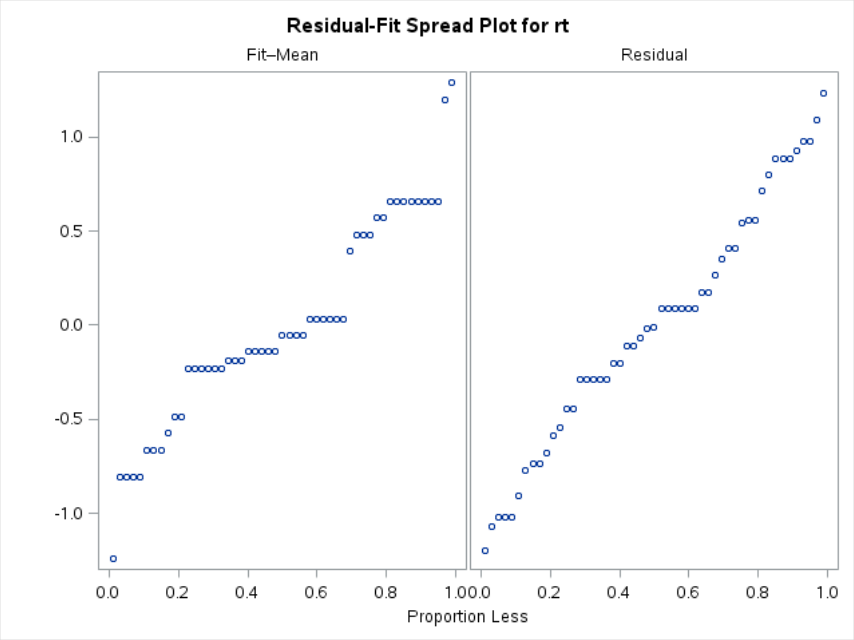

Outlier and Leverage Diagnostics for rt
RStudent
Leverage
Outlier
Leverage
Outlier and Leverage

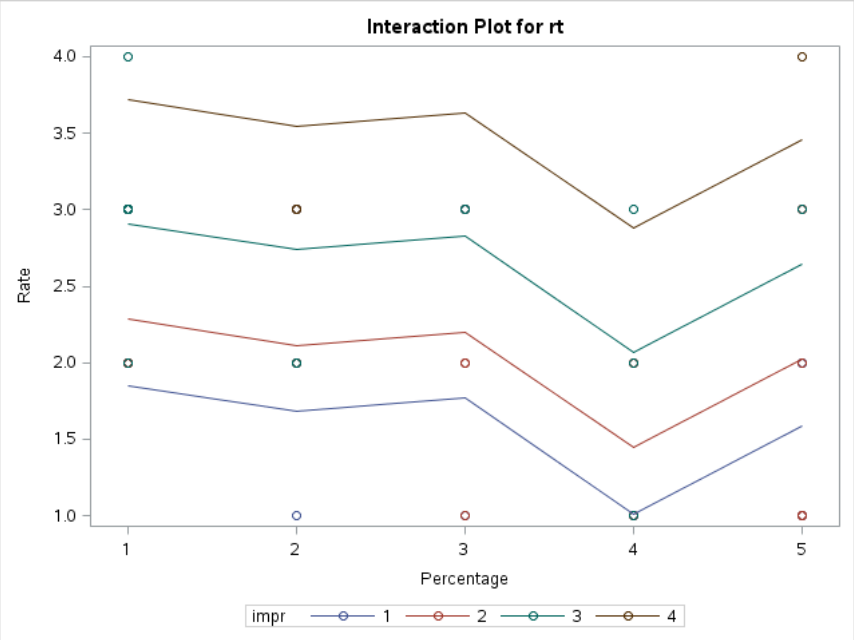

Q-Q Plot of Residuals for rt
Residual
Quantile


Observed by Predicted for rt
Rate
Predicted Value


Cook's D for rt
Cook's D
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
50
Observation

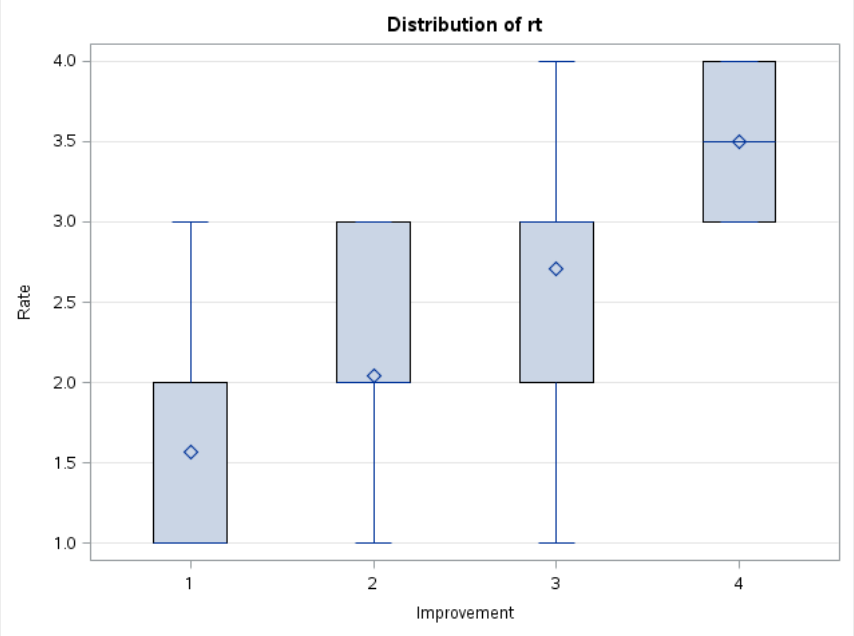

Distribution of Residuals for rt
Normal
Kernel
Percent
25
20
15
10
5
0
-2
-1.6
-1.2
-0.8
-0.4
0
0.4
0.8
1.2
1.6
2
Residual


Residual-Fit Spread Plot for rt
Fit–Mean
Residual
1.0
0.5
0.0
-0.5
-1.0
0.0
0.2
0.4
0.6
0.8
1.0
Proportion Less



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for rt

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	43
Error Mean Square	0.483639
Harmonic Mean of Cell Sizes	5.393157

Note: Cell sizes are not equal.

Number of Means	**2**	**3**	**4**

Critical Range	0.9813257	1.0280129	1.1317725

Means with the same letter are not significantly different.

REGWQ Grouping		Mean	N	impr
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
per	5	3 5 2 4 1
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

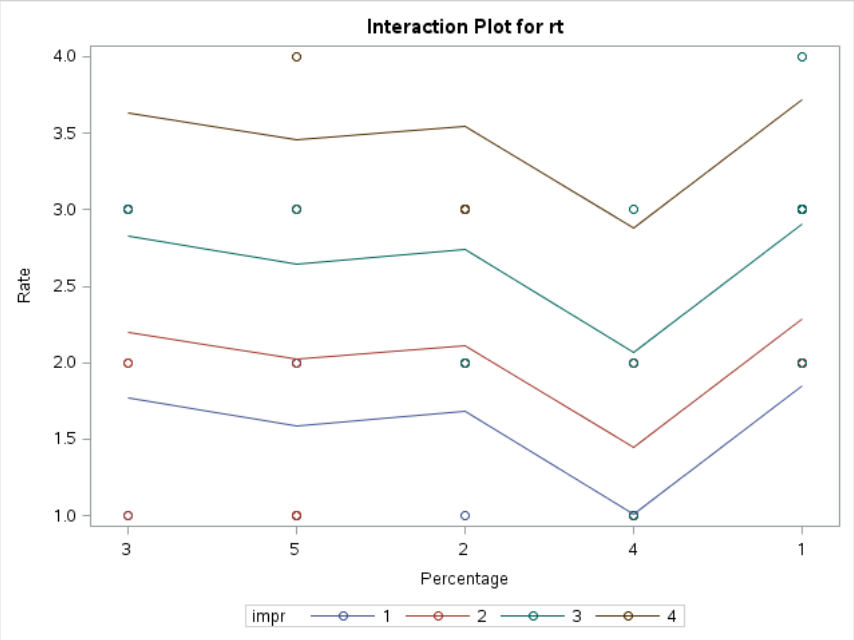
Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.88980952	2.12711565	4.40	0.0009
Error	43	20.79646499	0.48363872		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.417242	30.84131	0.695441	2.254902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
per	4	5.78789789	1.44697447	2.99	0.0290
impr	3	9.10191163	3.03397054	6.27	0.0013

Source	DF	Type III SS	Mean Square	F Value	Pr > F
per	4	3.90723249	0.97680812	2.02	0.1086
impr	3	9.10191163	3.03397054	6.27	0.0013



SAS Program for RB-4 Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

Obs	per	impr	rt	Yhat
1	3	1	3	1.76958
2	5	1	2	1.58938
3	2	1	1	1.68022
4	3	1	1	1.76958
5	5	1	1	1.58938
6	5	1	2	1.58938
7	4	1	1	1.01249
8	1	2	2	2.28617
9	2	2	3	2.11272
10	4	2	1	1.44498
11	5	2	1	2.02187
12	2	2	2	2.11272
13	1	2	2	2.28617
14	1	2	2	2.28617
15	4	2	2	1.44498
16	1	2	2	2.28617
17	1	2	2	2.28617
18	5	2	3	2.02187
19	1	2	3	2.28617
20	5	2	3	2.02187
21	5	2	2	2.02187
22	2	2	3	2.11272
23	5	2	1	2.02187
24	4	2	1	1.44498
25	3	2	2	2.20207
26	2	2	2	2.11272
27	3	2	3	2.20207
28	3	2	1	2.20207
29	5	2	1	2.02187
30	3	2	2	2.20207
31	4	2	2	1.44498
32	2	2	3	2.11272
33	3	3	3	2.82628
34	4	3	2	2.06919

35	2	3	2	2.73693
36	1	3	2	2.91038
37	3	3	3	2.82628
38	1	3	3	2.91038
39	5	3	3	2.64608
40	1	3	3	2.91038
41	1	3	3	2.91038
42	4	3	3	2.06919
43	1	3	4	2.91038
44	2	3	3	2.73693
45	1	3	3	2.91038
46	2	3	2	2.73693
47	1	3	3	2.91038
48	1	3	3	2.91038
49	4	3	1	2.06919
50	2	4	3	3.54542
51	5	4	4	3.45458

Tukey's Test for Non-Additivity

The GLM Procedure

Class Level Information		
Class	Levels	Values
per	5	3 5 2 4 1
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

Tukey's Test for Non-Additivity

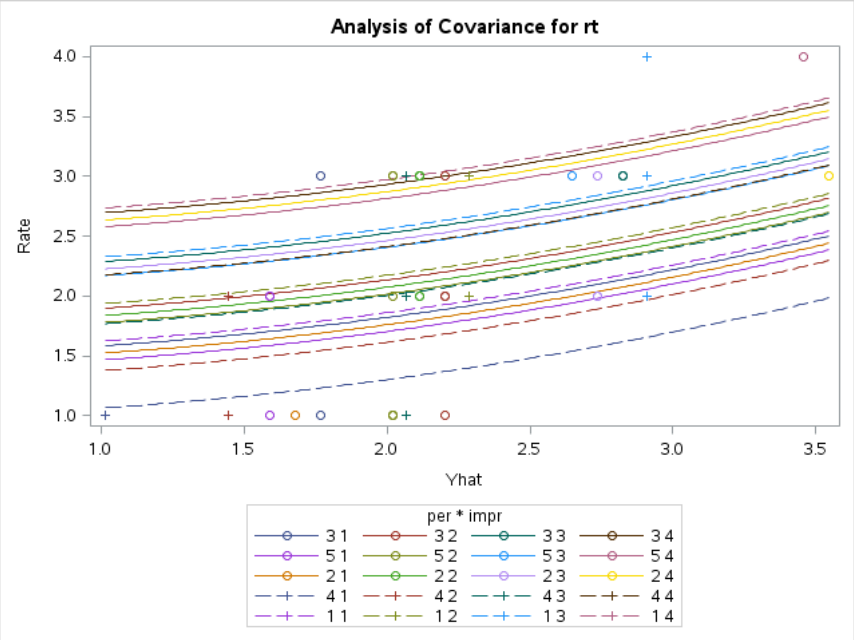
The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	14.90254966	1.86281871	3.76	0.0021
Error	42	20.78372485	0.49485059		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.417599	31.19675	0.703456	2.254902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
per	4	5.78789789	1.44697447	2.92	0.0320
impr	3	9.10191163	3.03397054	6.13	0.0015
Yhat*Yhat	1	0.01274014	0.01274014	0.03	0.8733


Analysis of Covariance for rt
Rate
4.0
3.5
3.0
2.5
2.0
1.5
1.0
1.0
1.5
2.0
2.5
3.0
3.5
Yhat
per * impr
3 1
3 2
3 3
3 4
5 1
5 2
5 3
5 4
2 1
2 2
2 3
2 4
4 1
4 2
4 3
4 4
1 1
1 2
1 3
1 4

SAS Program for CRF-33 Design

Obs	Difficulty	Improvement	Rate
1	3	2	2
2	1	1	3
3	1	3	3
4	1	4	3
5	2	1	2
6	2	2	3
7	2	4	4
8	3	1	1
9	3	1	1
10	3	1	1
11	3	2	1
12	3	2	1
13	3	2	2
14	3	2	2
15	3	2	2
16	3	2	2
17	3	2	2
18	3	2	2
19	3	2	3
20	3	2	3
21	3	2	3
22	3	3	2
23	3	3	2
24	3	3	2
25	3	3	3
26	3	3	3
27	3	3	3
28	3	3	3
29	3	3	3
30	3	3	3
31	3	3	4
32	4	2	2
33	4	2	3
34	4	3	3
35	2	1	2
36	2	2	1
37	2	2	1
38	2	2	2
39	2	2	2
40	2	2	3
41	2	3	3
42	3	2	1
43	3	2	1
44	3	2	2
45	3	2	2
46	3	2	3
47	3	3	2
48	3	3	3
49	3	3	3
50	4	3	1
51	2	1	1

SAS Program for CRF-33 Design

The GLM Procedure

Class Level Information		
Class	Levels	Values
Difficulty	4	1 2 3 4
Improvement	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for CRF-33 Design

The GLM Procedure

Dependent Variable: Rate Rate of the course

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	16.21191554	1.47381050	2.95	0.0062
Error	39	19.47435897	0.49934254		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.454290	31.33802	0.706642	2.254902

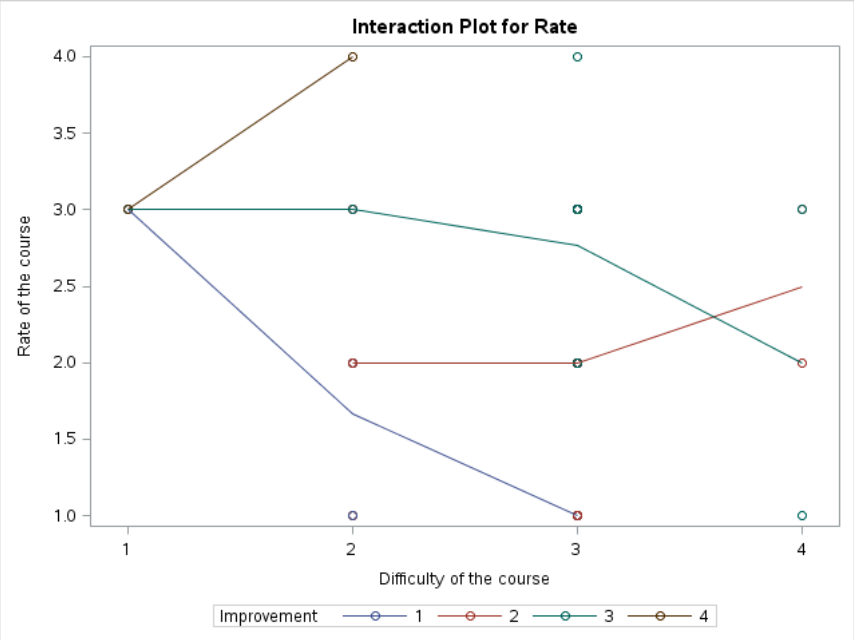
Overall Noncentrality	
Min Var Unbiased Estimate	19.802
Low MSE Estimate	18.731
90% Confidence Limits	(5.2329,46.998)

Proportion of Variation Accounted for	
Eta-Square	0.45
Omega-Square	0.30
90% Confidence Limits	(0.09,0.48)

Source	DF	Type I SS	Mean Square	F Value	Pr > F	Noncentrality Parameter				Total Variation Accounted For				Partial
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square
Difficulty	3	1.78475936	0.59491979	1.19	0.3256	0.391	0.37	0.00	9.9	0.0500	0.0079	0.0000	0.1280	0.0840
Improvement	3	10.13062423	3.37687474	6.76	0.0009	16.248	15.37	5.32	37.7	0.2839	0.2386	0.0834	0.4058	0.3422
Difficult*Improvemen	5	4.29653195	0.85930639	1.72	0.1527	3.163	2.99	0.00	16.6	0.1204	0.0497	0.0000	0.1927	0.1807

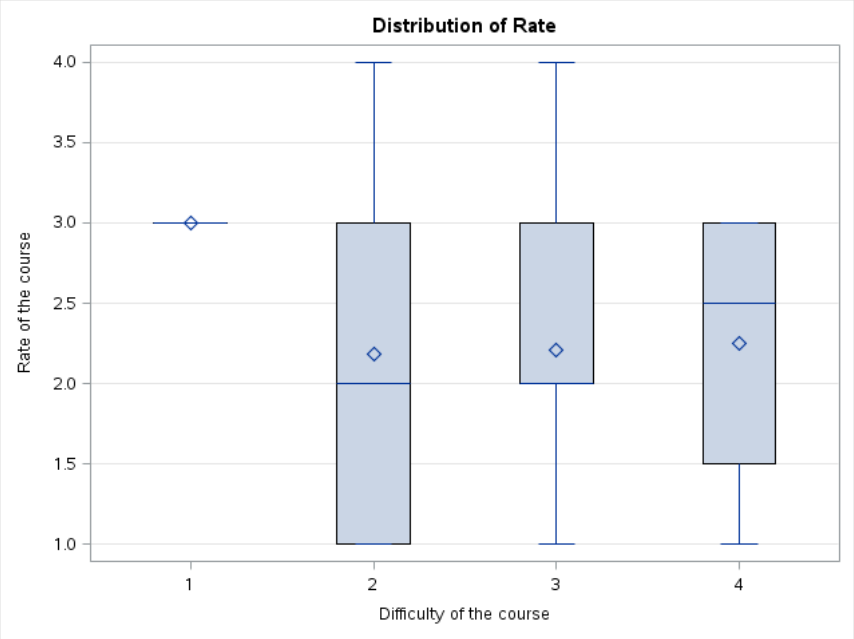
Source	DF	Type II SS	Mean Square	F Value	Pr > F	Noncentrality Parameter				Total Variation Accounted For				Partial
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square
Difficulty	3	0.93280656	0.31093552	0.62	0.6046	-1.23	-1.16	0.00	6.03	0.0261	-0.0156	0.0000	0.0776	0.0457
Improvement	3	10.13062423	3.37687474	6.76	0.0009	16.25	15.37	5.32	37.70	0.2839	0.2386	0.0834	0.4058	0.3422
Difficult*Improvemen	5	4.29653195	0.85930639	1.72	0.1527	3.16	2.99	0.00	16.62	0.1204	0.0497	0.0000	0.1927	0.1807

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Noncentrality Parameter				Total Variation Accounted For				Partial V
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits		Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square
Difficulty	3	2.01015770	0.67005257	1.34	0.2748	0.819	0.775	0	10.8	0.0563	0.0142	0.0000	0.1390	0.0936
Improvement	3	3.64781389	1.21593796	2.44	0.0793	3.931	3.718	0	16.9	0.1022	0.0594	0.0000	0.2069	0.1578
Difficult*Improvemen	5	4.29653195	0.85930639	1.72	0.1527	3.163	2.992	0	16.6	0.1204	0.0497	0.0000	0.1927	0.1807



SAS Program for CRF-33 Design

The GLM Procedure



SAS Program for CRF-33 Design

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for Rate

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	39
Error Mean Square	0.499343
Harmonic Mean of Cell Sizes	5.677419

Note: Cell sizes are not equal.

Number of Means	**2**	**3**	**4**
Critical Range	0.9754354	1.0218067	1.1254312

Means with the same letter are not significantly different.			
REGWQ Grouping	Mean	N	Difficulty
A	3.0000	3	1
A			
A	2.2500	4	4
A			
A	2.2121	33	3
A			
A	2.1818	11	2

SAS Program for CRF-33 Design

The GLM Procedure
Tukey's Studentized Range (HSD) Test for Rate

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

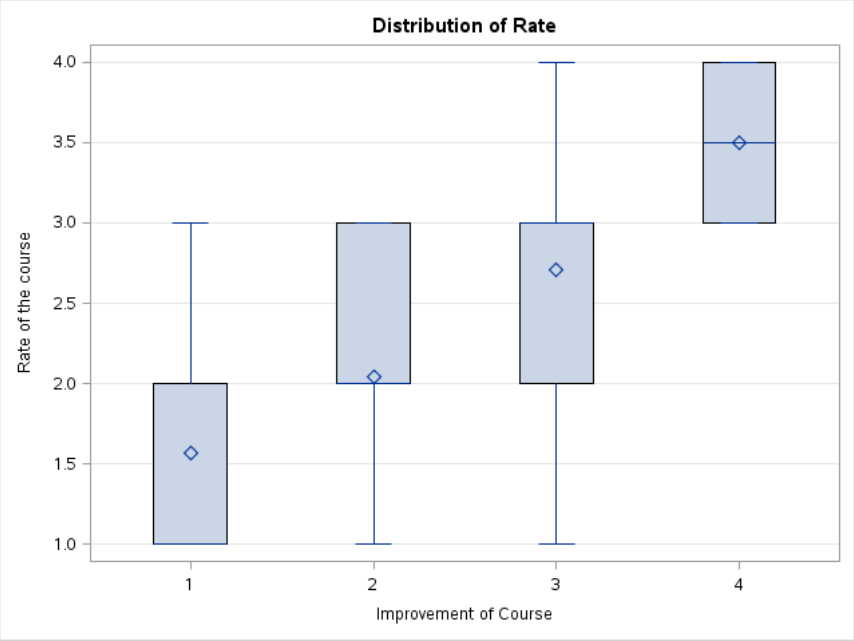
Alpha	0.05
Error Degrees of Freedom	39
Error Mean Square	0.499343
Critical Value of Studentized Range	3.79485
Minimum Significant Difference	1.1254
Harmonic Mean of Cell Sizes	5.677419

Note: Cell sizes are not equal.

Means with the same letter are not significantly different.			
Tukey Grouping	Mean	N	Difficulty
A	3.0000	3	1
A			
A	2.2500	4	4
A			
A	2.2121	33	3
A			
A	2.1818	11	2

SAS Program for CRF-33 Design

The GLM Procedure



SAS Program for CRF-33 Design

The GLM Procedure
Ryan-Einot-Gabriel-Welsch Multiple Range Test for Rate

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	39
Error Mean Square	0.499343
Harmonic Mean of Cell Sizes	5.393157

Note: Cell sizes are not equal.

Number of Means	**2**	**3**	**4**
Critical Range	1.0008119	1.0483897	1.15471

Means with the same letter are not significantly different.

REGWQ Grouping		Mean	N	Improvement
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

SAS Program for CRF-33 Design

The GLM Procedure
Tukey's Studentized Range (HSD) Test for Rate

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Error Degrees of Freedom	39
Error Mean Square	0.499343
Critical Value of Studentized Range	3.79485
Minimum Significant Difference	1.1547
Harmonic Mean of Cell Sizes	5.393157

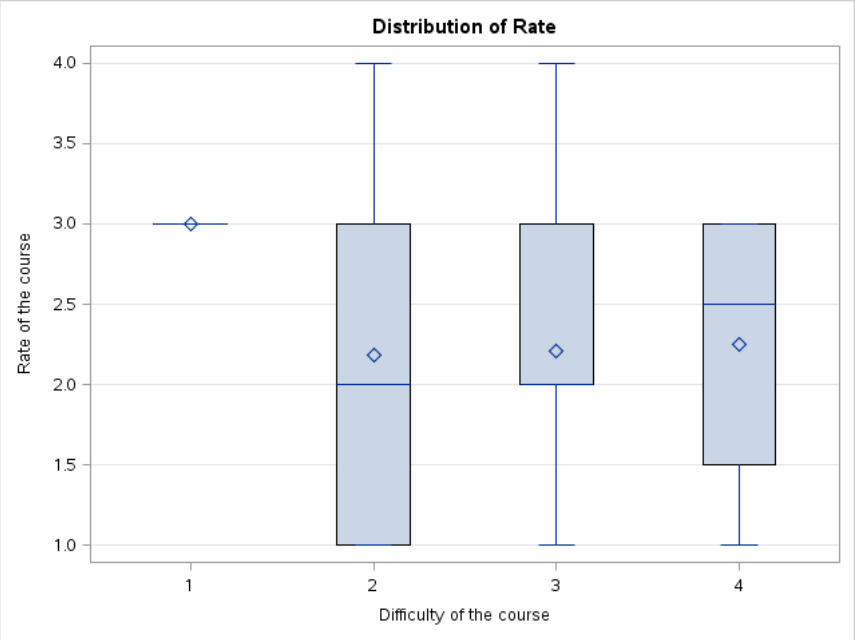
Note: Cell sizes are not equal.

Means with the same letter are not significantly different.

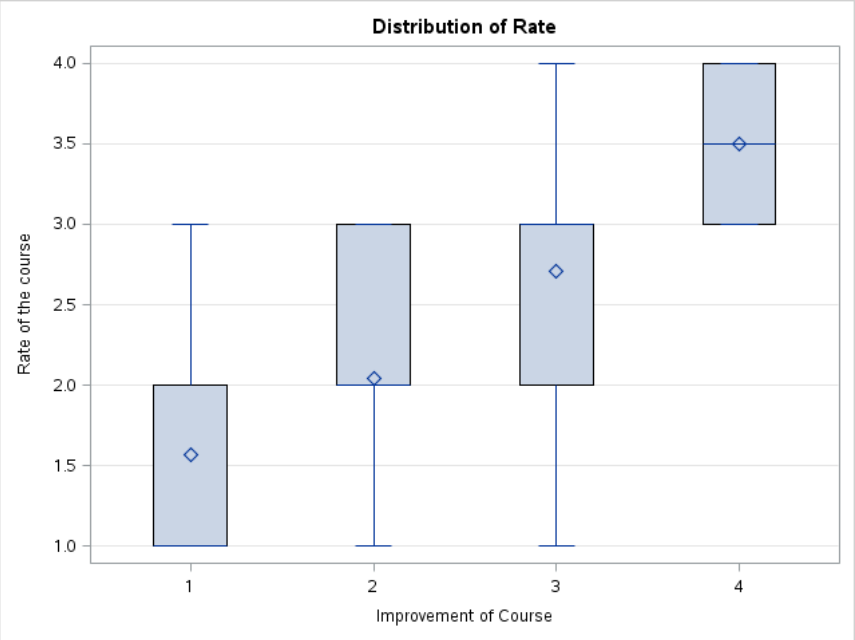
Tukey Grouping		Mean	N	Improvement
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B		2.0400	25	2
B				
B		1.5714	7	1

SAS Program for CRF-33 Design

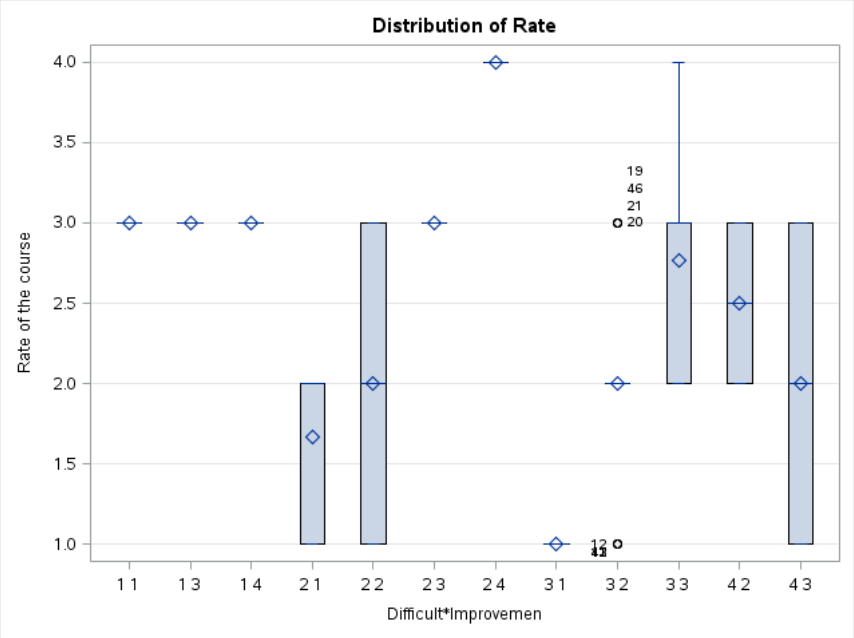
The GLM Procedure



Level of Difficulty	N	Rate	
		Mean	Std Dev
1	3	3.00000000	0.00000000
2	11	2.18181818	0.98164982
3	33	2.21212121	0.81996859
4	4	2.25000000	0.95742711



Level of Improvement	N	Rate	
		Mean	Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

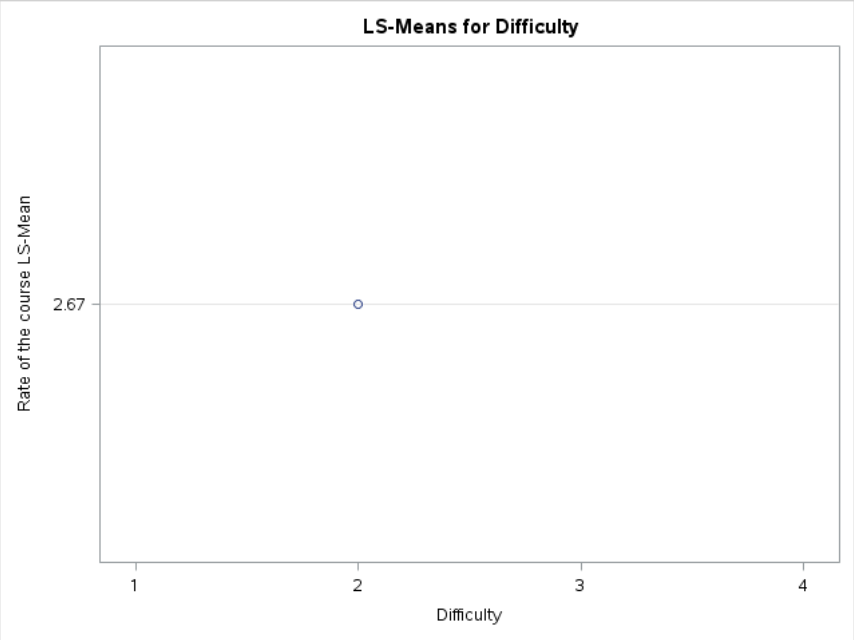


Level of Difficulty	Level of Improvement	N	Rate	
			Mean	Std Dev
1	1	1	3.00000000	.
1	3	1	3.00000000	.
1	4	1	3.00000000	.
2	1	3	1.66666667	0.57735027
2	2	6	2.00000000	0.89442719
2	3	1	3.00000000	.
2	4	1	4.00000000	.
3	1	3	1.00000000	0.00000000
3	2	17	2.00000000	0.70710678
3	3	13	2.76923077	0.59914469
4	2	2	2.50000000	0.70710678
4	3	2	2.00000000	1.41421356

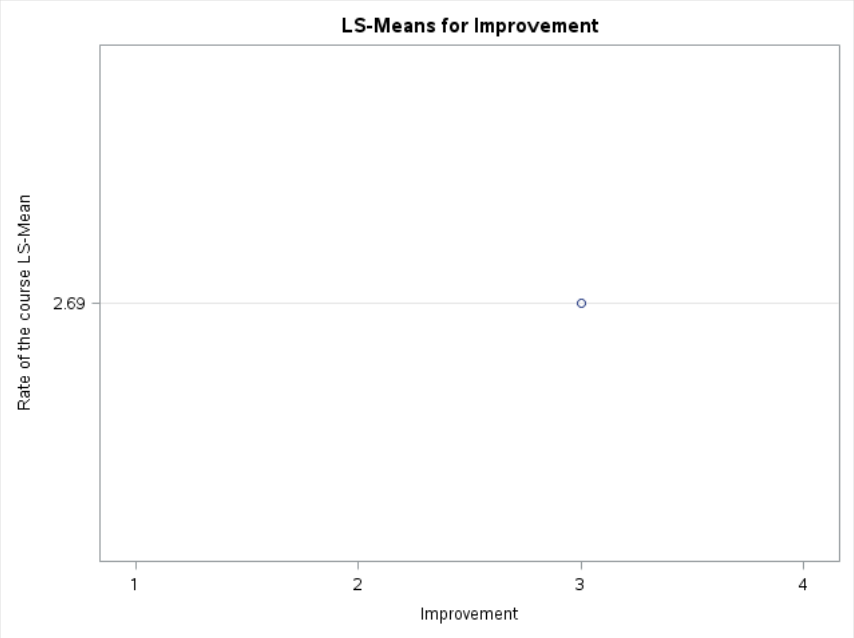
SAS Program for CRF-33 Design

The GLM Procedure
Least Squares Means

Difficulty	Rate LSMEAN
1	Non-est
2	2.66666667
3	Non-est
4	Non-est



Improvement	Rate LSMEAN
1	Non-est
2	Non-est
3	2.69230769
4	Non-est



SAS Program for CRF-33 Design

The GLM Procedure

Class Level Information		
Class	Levels	Values
Difficulty	4	1 2 3 4
Improvement	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for CRF-33 Design

The GLM Procedure

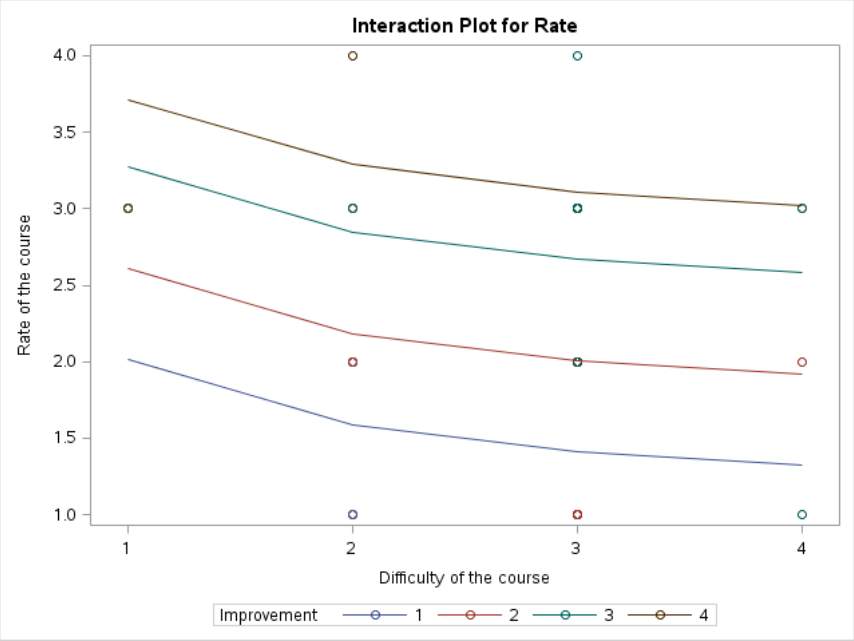
Dependent Variable: Rate Rate of the course

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	11.91538359	1.98589726	3.68	0.0048
Error	44	23.77089092	0.54024752		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.333893	32.59633	0.735015	2.254902

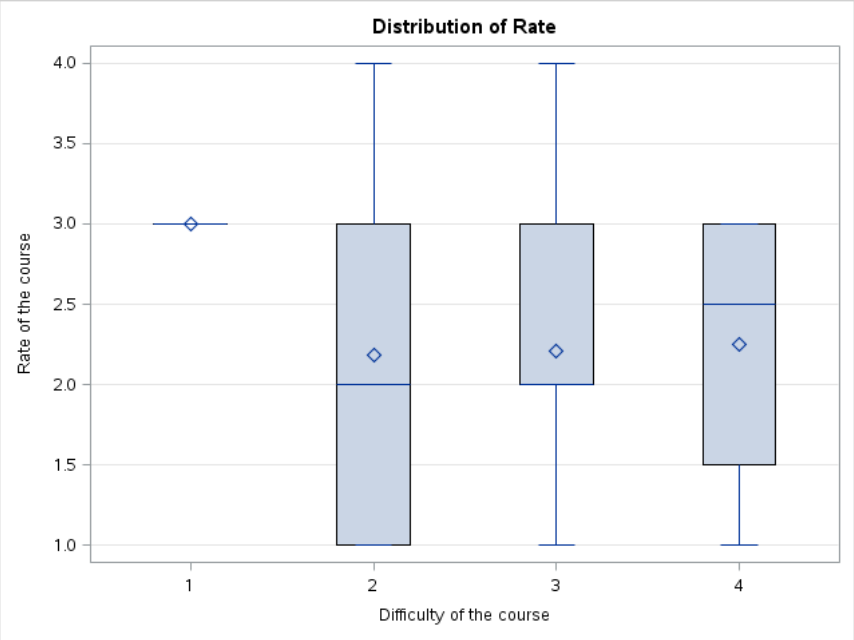
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Difficulty	3	1.78475936	0.59491979	1.10	0.3588
Improvement	3	10.13062423	3.37687474	6.25	0.0013

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Difficulty	3	0.93280656	0.31093552	0.58	0.6341
Improvement	3	10.13062423	3.37687474	6.25	0.0013

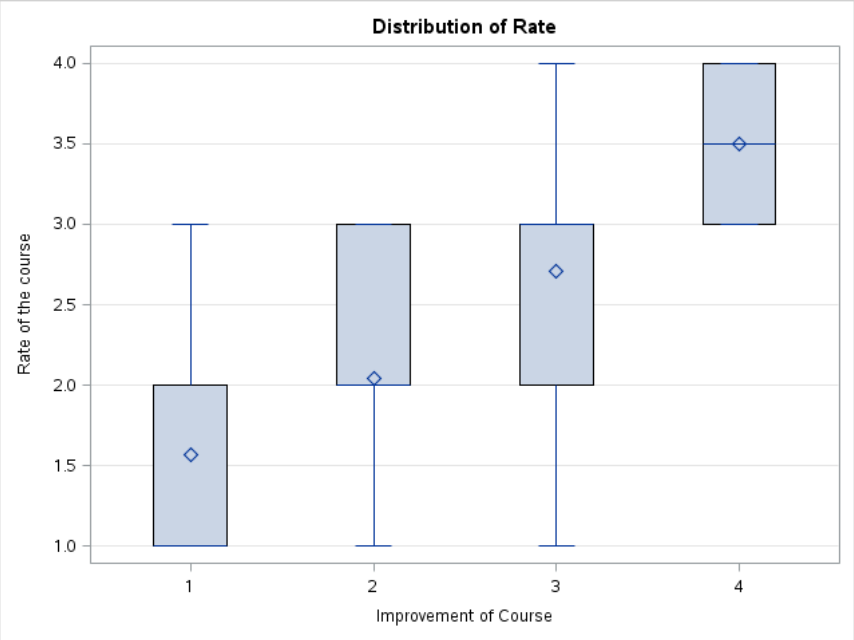


SAS Program for CRF-33 Design

The GLM Procedure



Level of Difficulty	N	Rate	
		Mean	Std Dev
1	3	3.00000000	0.00000000
2	11	2.18181818	0.98164982
3	33	2.21212121	0.81996859
4	4	2.25000000	0.95742711



Level of Improvement	N	Rate	
		Mean	Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

SAS Program for CRF-33 Design

The GLM Procedure

Dependent Variable: Rate Rate of the course

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Improvement 1 2 vs 3 & 4	1	6.83614125	6.83614125	12.65	0.0009

Improvement 1 vs 2	1	1.76557211	1.76557211	3.27	0.0775
Improvement 3 vs 4	1	0.27457579	0.27457579	0.51	0.4797
Difficulty 1 & 2 vs 3 & 4	1	0.83743126	0.83743126	1.55	0.2197
Difficulty1 vs 2	1	0.37680415	0.37680415	0.70	0.4081
Difficulty3 vs 4	1	0.02675821	0.02675821	0.05	0.8249

Parameter	Estimate	Standard Error	t Value	Pr > |t|
1 * 2 vs 3 & 4	-2.36590837	0.66510283	-3.56	0.0009
1 vs 2	-0.59575384	0.32954939	-1.81	0.0775
3 vs 4	-0.43793900	0.61429771	-0.71	0.4797
1 * 2 vs 3 & 4	0.87108578	0.69965305	1.25	0.2197
1 vs 2	0.42515974	0.50908545	0.84	0.4081
3 vs 4	0.08692845	0.39059777	0.22	0.8249

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=1 Improvement of Course=1

Moments			
N	1	**Sum Weights**	1
Mean	3	**Sum Observations**	3
Std Deviation	.	**Variance**	.
Skewness	.	**Kurtosis**	.
Uncorrected SS	9	**Corrected SS**	0
Coeff Variation	.	**Std Error Mean**	.

Basic Statistical Measures			
Location		**Variability**	
Mean	3.000000	**Std Deviation**	.
Median	3.000000	**Variance**	.
Mode	3.000000	**Range**	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	.	**Pr > |t|**	.
Sign	**M**	0.5	**Pr >= |M|**	1.0000
Signed Rank	**S**	0.5	**Pr >= |S|**	1.0000

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	3
25% Q1	3
10%	3
5%	3
1%	3
0% Min	3

Extreme Observations							
Lowest				**Highest**			
Value	**Difficulty**	**Improvement**	**Obs**	**Value**	**Difficulty**	**Improvement**	**Obs**
3	1	1	1	3	1	1	1

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=1 Improvement of Course=3

Moments			
N	1	Sum Weights	1
Mean	3	Sum Observations	3
Std Deviation	.	Variance	.
Skewness	.	Kurtosis	.
Uncorrected SS	9	Corrected SS	0
Coeff Variation	.	Std Error Mean	.

Basic Statistical Measures			
Location		Variability	
Mean	3.000000	Std Deviation	.
Median	3.000000	Variance	.
Mode	3.000000	Range	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	.	Pr > |t|	.
Sign	M	0.5	Pr >= |M|	1.0000
Signed Rank	S	0.5	Pr >= |S|	1.0000

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	3
25% Q1	3
10%	3
5%	3
1%	3
0% Min	3

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
3	1	3	2	3	1	3	2

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=1 Improvement of Course=4

Moments			
N	1	Sum Weights	1
Mean	3	Sum Observations	3
Std Deviation	.	Variance	.
Skewness	.	Kurtosis	.
Uncorrected SS	9	Corrected SS	0
Coeff Variation	.	Std Error Mean	.

Basic Statistical Measures			

Location		Variability	
Mean	3.000000	Std Deviation	.
Median	3.000000	Variance	.
Mode	3.000000	Range	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	.	Pr > |t|	.
Sign	M	0.5	Pr >= |M|	1.0000
Signed Rank	S	0.5	Pr >= |S|	1.0000

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	3
25% Q1	3
10%	3
5%	3
1%	3
0% Min	3

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
3	1	4	3	3	1	4	3

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=2 Improvement of Course=1

Moments			
N	3	Sum Weights	3
Mean	1.66666667	Sum Observations	5
Std Deviation	0.57735027	Variance	0.33333333
Skewness	-1.7320508	Kurtosis	.
Uncorrected SS	9	Corrected SS	0.66666667
Coeff Variation	34.6410162	Std Error Mean	0.33333333

Basic Statistical Measures			
Location		Variability	
Mean	1.666667	Std Deviation	0.57735
Median	2.000000	Variance	0.33333
Mode	2.000000	Range	1.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	5	Pr > |t|	0.0377
Sign	M	1.5	Pr >= |M|	0.2500
Signed Rank	S	3	Pr >= |S|	0.2500

Quantiles (Definition 5)	
Level	Quantile
100% Max	2

99%	2
95%	2
90%	2
75% Q3	2
50% Median	2
25% Q1	1
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
1	2	1	6	1	2	1	6
2	2	1	5	2	2	1	4
2	2	1	4	2	2	1	5

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=2 Improvement of Course=2

Moments			
N	6	Sum Weights	6
Mean	2	Sum Observations	12
Std Deviation	0.89442719	Variance	0.8
Skewness	0	Kurtosis	-1.875
Uncorrected SS	28	Corrected SS	4
Coeff Variation	44.7213595	Std Error Mean	0.36514837

Basic Statistical Measures			
Location		Variability	
Mean	2.000000	Std Deviation	0.89443
Median	2.000000	Variance	0.80000
Mode	1.000000	Range	2.00000
		Interquartile Range	2.00000

Note: The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	5.477226	Pr > |t|	0.0028
Sign	M	3	Pr >= |M|	0.0313
Signed Rank	S	10.5	Pr >= |S|	0.0313

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	2
25% Q1	1
10%	1
5%	1

1%	1
0% Min	1

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
1	2	2	9	1	2	2	9
1	2	2	8	2	2	2	10
2	2	2	11	2	2	2	11
2	2	2	10	3	2	2	7
3	2	2	12	3	2	2	12

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=2 Improvement of Course=3

Moments			
N	1	Sum Weights	1
Mean	3	Sum Observations	3
Std Deviation	.	Variance	.
Skewness	.	Kurtosis	.
Uncorrected SS	9	Corrected SS	0
Coeff Variation	.	Std Error Mean	.

Basic Statistical Measures			
Location		Variability	
Mean	3.000000	Std Deviation	.
Median	3.000000	Variance	.
Mode	3.000000	Range	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	.	Pr > |t|	.
Sign	M	0.5	Pr >= |M|	1.0000
Signed Rank	S	0.5	Pr >= |S|	1.0000

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	3
25% Q1	3
10%	3
5%	3
1%	3
0% Min	3

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
3	2	3	13	3	2	3	13

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=2 Improvement of Course=4

Moments			
N	1	Sum Weights	1
Mean	4	Sum Observations	4
Std Deviation	.	Variance	.
Skewness	.	Kurtosis	.
Uncorrected SS	16	Corrected SS	0
Coeff Variation	.	Std Error Mean	.

Basic Statistical Measures			
Location		Variability	
Mean	4.000000	Std Deviation	.
Median	4.000000	Variance	.
Mode	4.000000	Range	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	.	Pr > |t|	.
Sign	M	0.5	Pr >= |M|	1.0000
Signed Rank	S	0.5	Pr >= |S|	1.0000

Quantiles (Definition 5)	
Level	Quantile
100% Max	4
99%	4
95%	4
90%	4
75% Q3	4
50% Median	4
25% Q1	4
10%	4
5%	4
1%	4
0% Min	4

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
4	2	4	14	4	2	4	14

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=3 Improvement of Course=1

Moments			
N	3	Sum Weights	3
Mean	1	Sum Observations	3
Std Deviation	0	Variance	0
Skewness	.	Kurtosis	.
Uncorrected SS	3	Corrected SS	0
Coeff Variation	0	Std Error Mean	0

Basic Statistical Measures			
Location		Variability	
Mean	1.000000	Std Deviation	0
Median	1.000000	Variance	0

Mode	1.000000	**Range**	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	.	**Pr > |t|**	.
Sign	**M**	1.5	**Pr >= |M|**	0.2500
Signed Rank	**S**	3	**Pr >= |S|**	0.2500

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	1
99%	1
95%	1
90%	1
75% Q3	1
50% Median	1
25% Q1	1
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations							
Lowest				**Highest**			
Value	**Difficulty**	**Improvement**	**Obs**	**Value**	**Difficulty**	**Improvement**	**Obs**
1	3	1	17	1	3	1	15
1	3	1	16	1	3	1	16
1	3	1	15	1	3	1	17

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=3 Improvement of Course=2

Moments			
N	17	**Sum Weights**	17
Mean	2	**Sum Observations**	34
Std Deviation	0.70710678	**Variance**	0.5
Skewness	0	**Kurtosis**	-0.7428571
Uncorrected SS	76	**Corrected SS**	8
Coeff Variation	35.3553391	**Std Error Mean**	0.17149859

Basic Statistical Measures			
Location		**Variability**	
Mean	2.000000	**Std Deviation**	0.70711
Median	2.000000	**Variance**	0.50000
Mode	2.000000	**Range**	2.00000
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	11.6619	**Pr > |t|**	<.0001
Sign	**M**	8.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	76.5	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	3
99%	3

95%	3
90%	3
75% Q3	2
50% Median	2
25% Q1	2
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
1	3	2	31	2	3	2	33
1	3	2	30	3	3	2	27
1	3	2	20	3	3	2	28
1	3	2	19	3	3	2	29
2	3	2	33	3	3	2	34

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=3 Improvement of Course=3

Moments			
N	13	**Sum Weights**	13
Mean	2.76923077	**Sum Observations**	36
Std Deviation	0.59914469	**Variance**	0.35897436
Skewness	0.06502776	**Kurtosis**	0.05064935
Uncorrected SS	104	**Corrected SS**	4.30769231
Coeff Variation	21.6357805	**Std Error Mean**	0.16617284

Basic Statistical Measures			
Location		Variability	
Mean	2.769231	**Std Deviation**	0.59914
Median	3.000000	**Variance**	0.35897
Mode	3.000000	**Range**	2.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	16.66476	**Pr > |t|**	<.0001
Sign	**M**	6.5	**Pr >= |M|**	0.0002
Signed Rank	**S**	45.5	**Pr >= |S|**	0.0002

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	4
99%	4
95%	4
90%	3
75% Q3	3
50% Median	3
25% Q1	2
10%	2
5%	2
1%	2
0% Min	2

Extreme Observations

Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
2	3	3	45	3	3	3	42
2	3	3	37	3	3	3	43
2	3	3	36	3	3	3	46
2	3	3	35	3	3	3	47
3	3	3	47	4	3	3	44

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=4 Improvement of Course=2

Moments			
N	2	Sum Weights	2
Mean	2.5	Sum Observations	5
Std Deviation	0.70710678	Variance	0.5
Skewness	.	Kurtosis	.
Uncorrected SS	13	Corrected SS	0.5
Coeff Variation	28.2842712	Std Error Mean	0.5

Basic Statistical Measures			
Location		Variability	
Mean	2.500000	Std Deviation	0.70711
Median	2.500000	Variance	0.50000
Mode	.	Range	1.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	5	Pr > |t|	0.1257
Sign	M	1	Pr >= |M|	0.5000
Signed Rank	S	1.5	Pr >= |S|	0.5000

Quantiles (Definition 5)	
Level	Quantile
100% Max	3.0
99%	3.0
95%	3.0
90%	3.0
75% Q3	3.0
50% Median	2.5
25% Q1	2.0
10%	2.0
5%	2.0
1%	2.0
0% Min	2.0

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
2	4	2	48	2	4	2	48
3	4	2	49	3	4	2	49

SAS Program for CRF-33 Design

The UNIVARIATE Procedure
Variable: Rate (Rate of the course)

Difficulty of the course=4 Improvement of Course=3

Moments			
N	2	Sum Weights	2
Mean	2	Sum Observations	4
Std Deviation	1.41421356	Variance	2
Skewness	.	Kurtosis	.
Uncorrected SS	10	Corrected SS	2
Coeff Variation	70.7106781	Std Error Mean	1

Basic Statistical Measures			
Location		Variability	
Mean	2.000000	Std Deviation	1.41421
Median	2.000000	Variance	2.00000
Mode	.	Range	2.00000
		Interquartile Range	2.00000

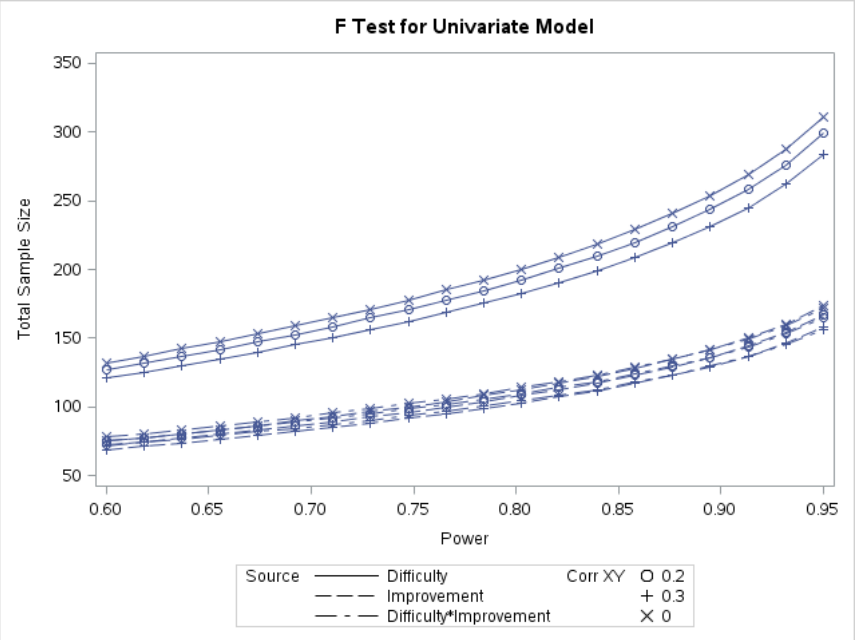
Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	2	Pr > |t|	0.2952
Sign	M	1	Pr >= |M|	0.5000
Signed Rank	S	1.5	Pr >= |S|	0.5000

Quantiles (Definition 5)	
Level	Quantile
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	2
25% Q1	1
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations							
Lowest				Highest			
Value	Difficulty	Improvement	Obs	Value	Difficulty	Improvement	Obs
1	4	3	51	1	4	3	51
3	4	3	50	3	4	3	50

SAS Program for CRF-33 Design

The GLMPOWER Procedure



SAS Program for CRF-33 Design

The GLMPOWER Procedure

Fixed Scenario Elements	
Dependent Variable	Rate
Source	Improvement
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Test Degrees of Freedom	3
Error Degrees of Freedom	47

Computed Power
Power
0.903

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

Obs	wo	st	impr	rt
1	1	1	2	2
2	2	0	1	3
3	3	0	3	3
4	2	0	4	3
5	1	1	1	2
6	2	1	2	3
7	2	0	4	4
8	2	0	1	1
9	3	2	1	1
10	2	1	1	1
11	1	1	2	1
12	2	2	2	1
13	4	0	2	2
14	1	1	2	2
15	3	1	2	2
16	4	1	2	2
17	4	1	2	2
18	4	1	2	2
19	3	0	2	3
20	1	0	2	3
21	3	0	2	3
22	1	0	3	2
23	3	1	3	2
24	3	1	3	2
25	2	0	3	3
26	2	1	3	3
27	3	1	3	3
28	3	0	3	3
29	3	1	3	3
30	1	1	3	3
31	3	0	3	4
32	1	1	2	2
33	3	1	2	3

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

Obs	wo	st	impr	rt
34	3	0	3	3
35	1	1	1	2
36	2	2	2	1
37	2	2	2	1
38	4	1	2	2
39	1	1	2	2
40	3	1	2	3
41	1	1	3	3
42	3	1	2	1
43	4	0	2	1
44	2	0	2	2
45	3	0	2	2
46	2	0	2	3
47	1	1	3	2
48	1	0	3	3
49	1	0	3	3
50	2	0	3	1
51	4	1	1	1

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The MEANS Procedure

Stimulation=0 Improvement=1

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
2	2.0000000	1.4142136	1.0000000	3.0000000

Stimulation=0 Improvement=2

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
8	2.3750000	0.7440238	1.0000000	3.0000000

Stimulation=0 Improvement=3

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
9	2.7777778	0.8333333	1.0000000	4.0000000

Stimulation=0 Improvement=4

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
2	3.5000000	0.7071068	3.0000000	4.0000000

Stimulation=1 Improvement=1

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
4	1.5000000	0.5773503	1.0000000	2.0000000

Stimulation=1 Improvement=2

Analysis Variable : rt Rate				
N	Mean	Std Dev	Minimum	Maximum
14	2.0714286	0.6157279	1.0000000	3.0000000

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The MEANS Procedure

Stimulation=1 Improvement=3

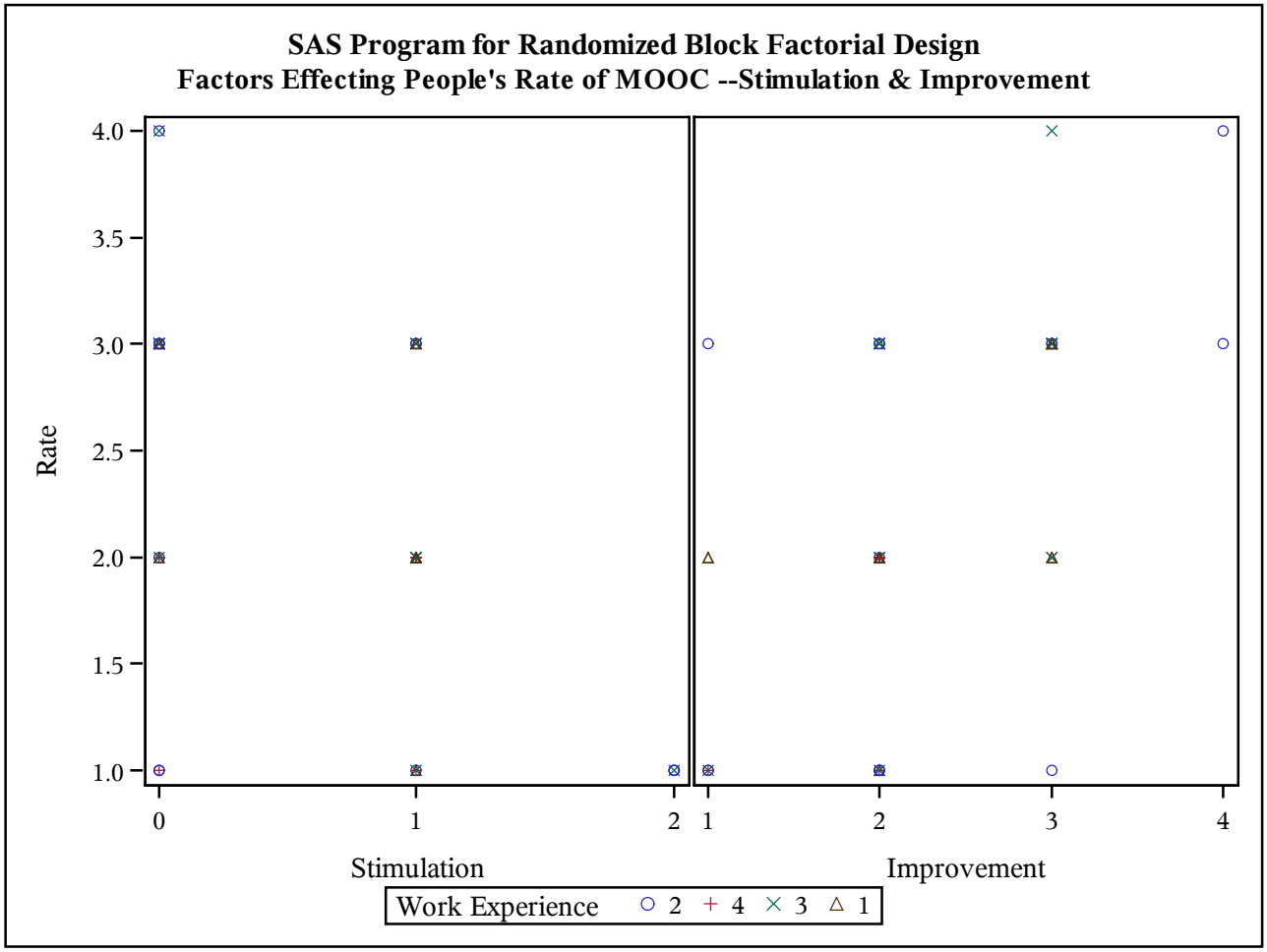
Analysis Variable : rt Rate				
N	**Mean**	**Std Dev**	**Minimum**	**Maximum**
8	2.6250000	0.5175492	2.0000000	3.0000000

Stimulation=2 Improvement=1

Analysis Variable : rt Rate				
N	**Mean**	**Std Dev**	**Minimum**	**Maximum**
1	1.0000000	.	1.0000000	1.0000000

Stimulation=2 Improvement=2

Analysis Variable : rt Rate				
N	**Mean**	**Std Dev**	**Minimum**	**Maximum**
3	1.0000000	0	1.0000000	1.0000000


SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement
Rate
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0
1
2
1
2
3
4
Stimulation
Improvement
Work Experience
2
4
3
1

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=1

Moments			
N	2	Sum Weights	2
Mean	2	Sum Observations	4
Std Deviation	1.41421356	Variance	2
Skewness	.	Kurtosis	.
Uncorrected SS	10	Corrected SS	2
Coeff Variation	70.7106781	Std Error Mean	1

Basic Statistical Measures			
Location		Variability	
Mean	2.000000	Std Deviation	1.41421
Median	2.000000	Variance	2.00000
Mode	.	Range	2.00000
		Interquartile Range	2.00000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	2	Pr > |t|	0.2952
Sign	M	1	Pr >= |M|	0.5000
Signed Rank	S	1.5	Pr >= |S|	0.5000

Quantiles (Definition 5)	
Quantile	Estimate
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	2
25% Q1	1

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

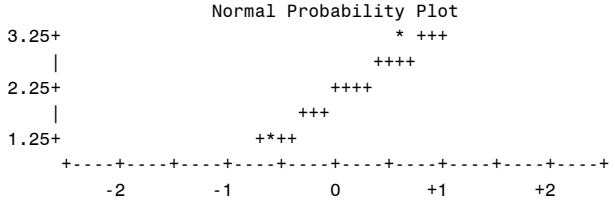
The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=1

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	2	1	2
3	1	3	1

```
Stem Leaf                     #             Boxplot
   3 0                        1             +-----+
   2                                        |     |
   2                                        *--+--*
   1                                        |     |
   1 0                        1             +-----+
     ----+----+----+----+
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=2

Moments			
N	8	**Sum Weights**	8
Mean	2.375	**Sum Observations**	19
Std Deviation	0.74402381	**Variance**	0.55357143
Skewness	-0.8237683	**Kurtosis**	-0.1515088
Uncorrected SS	49	**Corrected SS**	3.875
Coeff Variation	31.3273183	**Std Error Mean**	0.26305214

Basic Statistical Measures			
Location		**Variability**	
Mean	2.375000	**Std Deviation**	0.74402
Median	2.500000	**Variance**	0.55357
Mode	3.000000	**Range**	2.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	9.028628	**Pr > |t|**	<.0001
Sign	**M**	4	**Pr >= |M|**	0.0078
Signed Rank	**S**	18	**Pr >= |S|**	0.0078

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	3.0
99%	3.0
95%	3.0
90%	3.0
75% Q3	3.0
50% Median	2.5
25% Q1	2.0

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=2

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1.0
5%	1.0
1%	1.0
0% Min	1.0

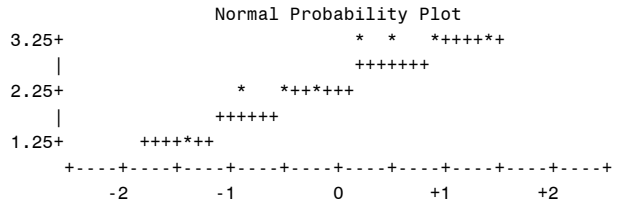
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	7	2	9
2	9	3	4
2	8	3	5
2	3	3	6
3	10	3	10

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=2

```
  Stem Leaf                     #             Boxplot
     3 0000                     4             +-----+
     2                                        *-----*
     2 000                      3             +--+--+
     1                                           |
     1 0                        1                |
       ----+----+----+----+
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=3

Moments			
N	9	**Sum Weights**	9
Mean	2.77777778	**Sum Observations**	25
Std Deviation	0.83333333	**Variance**	0.69444444
Skewness	-1.1657143	**Kurtosis**	2.42742857
Uncorrected SS	75	**Corrected SS**	5.55555556
Coeff Variation	30	**Std Error Mean**	0.27777778

Basic Statistical Measures			
Location		**Variability**	
Mean	2.777778	**Std Deviation**	0.83333
Median	3.000000	**Variance**	0.69444
Mode	3.000000	**Range**	3.00000
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	10	**Pr > |t|**	<.0001
Sign	**M**	4.5	**Pr >= |M|**	0.0039
Signed Rank	**S**	22.5	**Pr >= |S|**	0.0039

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	4
99%	4
95%	4
90%	4
75% Q3	3
50% Median	3
25% Q1	3

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=3

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1
5%	1
1%	1
0% Min	1

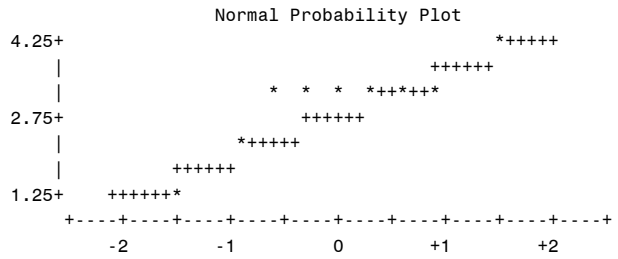
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	19	3	14
2	12	3	16
3	18	3	17
3	17	3	18
3	16	4	15

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=3

```
  Stem Leaf                     #             Boxplot
     4 0                        1                *
     3
     3 000000                   6             +-----+
     2                                           +
     2 0                        1                *
     1
     1 0                        1                *
       ----+----+----+----+
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=4

Moments			
N	2	**Sum Weights**	2
Mean	3.5	**Sum Observations**	7
Std Deviation	0.70710678	**Variance**	0.5
Skewness	.	**Kurtosis**	.
Uncorrected SS	25	**Corrected SS**	0.5
Coeff Variation	20.2030509	**Std Error Mean**	0.5

Basic Statistical Measures			
Location		**Variability**	
Mean	3.500000	**Std Deviation**	0.70711
Median	3.500000	**Variance**	0.50000
Mode	.	**Range**	1.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	7	**Pr > |t|**	0.0903
Sign	**M**	1	**Pr >= |M|**	0.5000
Signed Rank	**S**	1.5	**Pr >= |S|**	0.5000

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	4.0
99%	4.0
95%	4.0
90%	4.0
75% Q3	4.0
50% Median	3.5
25% Q1	3.0

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=4

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	3.0
5%	3.0
1%	3.0
0% Min	3.0

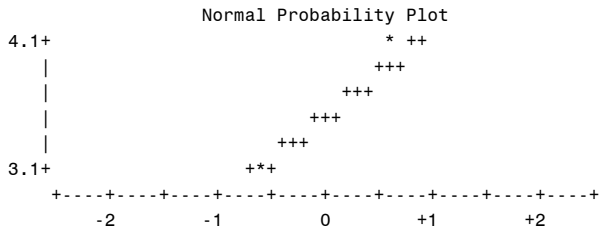
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
3	20	3	20
4	21	4	21

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=0 Improvement=4

```
 Stem Leaf                     #             Boxplot
   40 0                        1             +-----+
   38                                        |     |
   36                                        |     |
   34                                        *--+--*
   32                                        |     |
   30 0                        1             +-----+
      ----+----+----+----+
  Multiply Stem.Leaf by 10**-1
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=1

Moments			
N	4	**Sum Weights**	4
Mean	1.5	**Sum Observations**	6
Std Deviation	0.57735027	**Variance**	0.33333333
Skewness	0	**Kurtosis**	-6
Uncorrected SS	10	**Corrected SS**	1
Coeff Variation	38.4900179	**Std Error Mean**	0.28867513

Basic Statistical Measures			
Location		**Variability**	
Mean	1.500000	**Std Deviation**	0.57735
Median	1.500000	**Variance**	0.33333
Mode	1.000000	**Range**	1.00000
		Interquartile Range	1.00000

Note: The mode displayed is the smallest of 2 modes with a count of 2.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	5.196152	**Pr > |t|**	0.0138
Sign	**M**	2	**Pr >= |M|**	0.1250
Signed Rank	**S**	5	**Pr >= |S|**	0.1250

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	2.0
99%	2.0
95%	2.0
90%	2.0
75% Q3	2.0
50% Median	1.5
25% Q1	1.0

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=1

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1.0
5%	1.0
1%	1.0
0% Min	1.0

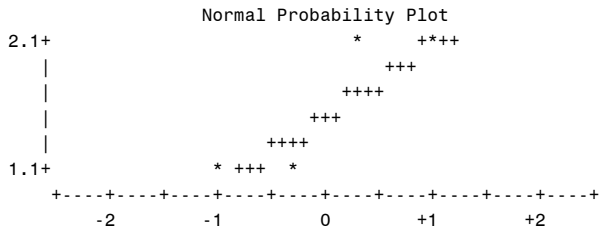
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	25	1	23
1	23	1	25
2	24	2	22
2	22	2	24

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=1

```
 Stem Leaf                     #             Boxplot
   20 00                       2             +-----+
   18                                        |     |
   16                                        |     |
   14                                        *--+--*
   12                                        |     |
   10 00                       2             +-----+
      ----+----+----+----+
  Multiply Stem.Leaf by 10**-1
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=2

Moments			
N	14	**Sum Weights**	14
Mean	2.07142857	**Sum Observations**	29
Std Deviation	0.61572793	**Variance**	0.37912088
Skewness	-0.0235376	**Kurtosis**	0.3023429
Uncorrected SS	65	**Corrected SS**	4.92857143
Coeff Variation	29.7247964	**Std Error Mean**	0.16456021

Basic Statistical Measures			
Location		**Variability**	
Mean	2.071429	**Std Deviation**	0.61573
Median	2.000000	**Variance**	0.37912
Mode	2.000000	**Range**	2.00000
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	12.58766	**Pr > |t|**	<.0001
Sign	**M**	7	**Pr >= |M|**	0.0001
Signed Rank	**S**	52.5	**Pr >= |S|**	0.0001

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	3
99%	3
95%	3
90%	3
75% Q3	2
50% Median	2
25% Q1	2

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=2

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1
5%	1
1%	1
0% Min	1

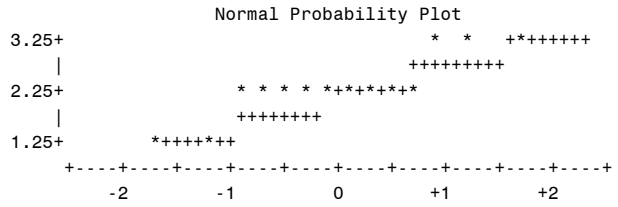
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	39	2	36
1	28	2	37
2	37	3	27
2	36	3	35
2	34	3	38

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=2

```
  Stem Leaf                     #             Boxplot
     3 000                      3                *
     2
     2 000000000                9             +--+--+
     1
     1 00                       2                *
       ----+----+----+----+
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=3

Moments			
N	8	**Sum Weights**	8
Mean	2.625	**Sum Observations**	21
Std Deviation	0.51754917	**Variance**	0.26785714
Skewness	-0.6440612	**Kurtosis**	-2.24
Uncorrected SS	57	**Corrected SS**	1.875
Coeff Variation	19.7161588	**Std Error Mean**	0.18298126

Basic Statistical Measures			
Location		**Variability**	
Mean	2.625000	**Std Deviation**	0.51755
Median	3.000000	**Variance**	0.26786
Mode	3.000000	**Range**	1.00000
		Interquartile Range	1.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	14.34573	**Pr > |t|**	<.0001
Sign	**M**	4	**Pr >= |M|**	0.0078
Signed Rank	**S**	18	**Pr >= |S|**	0.0078

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	3
99%	3
95%	3
90%	3
75% Q3	3
50% Median	3
25% Q1	2

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=3

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	2
5%	2
1%	2
0% Min	2

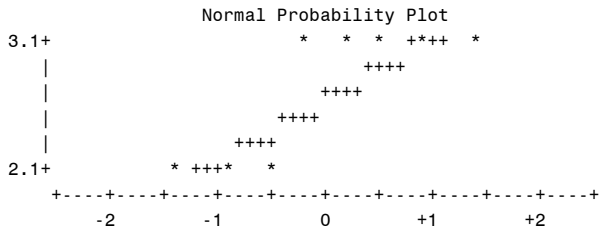
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
2	47	3	42
2	41	3	43
2	40	3	44
3	46	3	45
3	45	3	46

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=1 Improvement=3

```
 Stem Leaf                     #             Boxplot
   30 OOOOO                    5             +-----+
   28                                        |     |
   26                                        |  +  |
   24                                        |     |
   22                                        |     |
   20 OOO                      3             +-----+
      ----+----+----+----+
  Multiply Stem.Leaf by 10**-1
```



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=2 Improvement=1

Moments			
N	1	**Sum Weights**	1
Mean	1	**Sum Observations**	1
Std Deviation	.	**Variance**	.
Skewness	.	**Kurtosis**	.
Uncorrected SS	1	**Corrected SS**	0
Coeff Variation	.	**Std Error Mean**	.

Basic Statistical Measures			
Location		**Variability**	
Mean	1.000000	**Std Deviation**	.
Median	1.000000	**Variance**	.
Mode	1.000000	**Range**	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	.	**Pr > |t|**	.
Sign	**M**	0.5	**Pr >= |M|**	1.0000
Signed Rank	**S**	0.5	**Pr >= |S|**	1.0000

Quantiles (Definition 5)	
Quantile	**Estimate**
100% Max	1
99%	1
95%	1
90%	1
75% Q3	1
50% Median	1
25% Q1	1

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=2 Improvement=1

Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	48	1	48

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=2 Improvement=2

Moments			
N	3	Sum Weights	3
Mean	1	Sum Observations	3
Std Deviation	0	Variance	0
Skewness	.	Kurtosis	.
Uncorrected SS	3	Corrected SS	0
Coeff Variation	0	Std Error Mean	0

Basic Statistical Measures			
Location		Variability	
Mean	1.000000	Std Deviation	0
Median	1.000000	Variance	0
Mode	1.000000	Range	0
		Interquartile Range	0

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	.	Pr > |t|	.
Sign	M	1.5	Pr >= |M|	0.2500
Signed Rank	S	3	Pr >= |S|	0.2500

Quantiles (Definition 5)	
Quantile	Estimate
100% Max	1
99%	1
95%	1
90%	1
75% Q3	1
50% Median	1
25% Q1	1

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Stimulation=2 Improvement=2

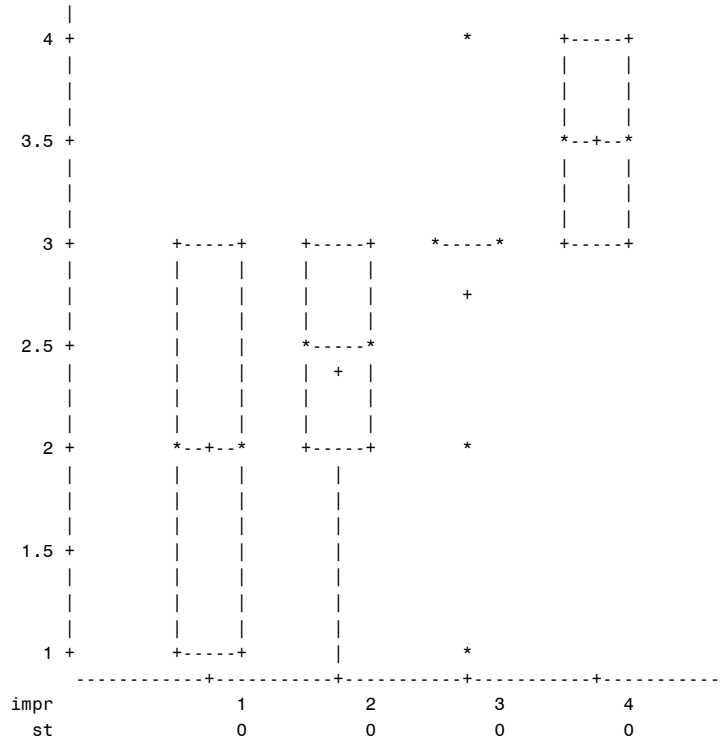
Quantiles (Definition 5)	
Quantile	**Estimate**
10%	1
5%	1
1%	1
0% Min	1

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	51	1	49
1	50	1	50
1	49	1	51

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

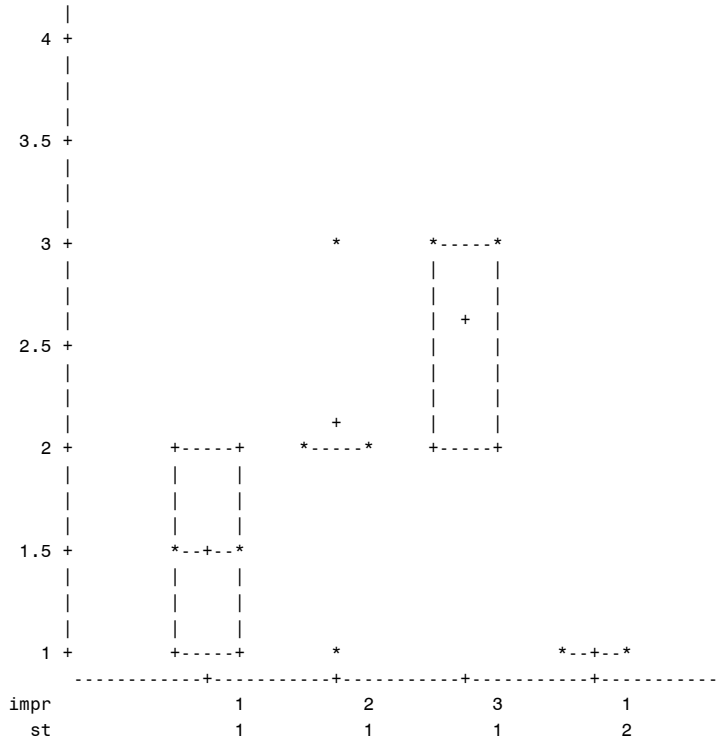
Schematic Plots



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

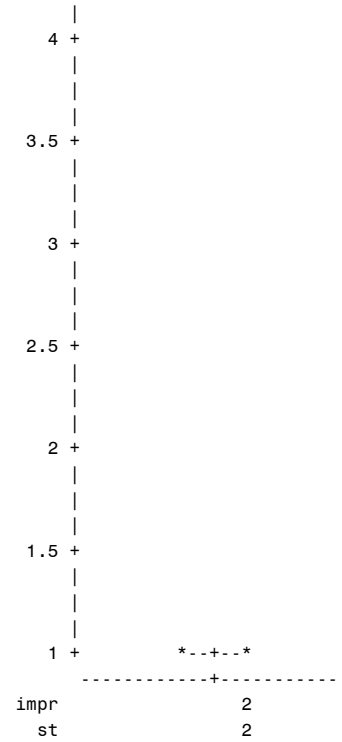
Schematic Plots



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The UNIVARIATE Procedure
Variable: rt (Rate)

Schematic Plots



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
wo	4	1 2 3 4
st	3	0 1 2
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	17.73800970	1.61254634	3.50	0.0018
Error	39	17.94826481	0.46021192		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.497054	30.08509	0.678389	2.254902

Overall Noncentrality	
Min Var Unbiased Estimate	25.567
Low MSE Estimate	24.185
90% Confidence Limits	(8.6569,55.995)

Proportion of Variation Accounted for	
Eta-Square	0.50
Omega-Square	0.35
90% Confidence Limits	(0.15,0.52)

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Type I SS	Mean Square	F Value	Pr > F	Noncentrality Parameter			
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits	
wo	3	3.74877451	1.24959150	2.72	0.0578	4.73	4.47	0.000	18.3
st	2	9.19235317	4.59617659	9.99	0.0003	16.95	16.03	5.962	38.4
impr	3	4.70257920	1.56752640	3.41	0.0269	6.69	6.33	0.622	21.8
st*impr	3	0.09430282	0.03143427	0.07	0.9765	-2.81	-2.65	0.000	0.0

Source	Total Variation Accounted For				Partial Variation Accounted For			
	Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	90% Confidence Limits	
wo	0.1050	0.0655	0.0000	0.2107	0.1728	0.0916	0.0000	0.2645
st	0.2576	0.2288	0.0797	0.3926	0.3387	0.2606	0.1047	0.4293
impr	0.1318	0.0919	0.0000	0.2444	0.2076	0.1240	0.0121	0.2997
st*impr	0.0026	-0.0356	0.0000	0.0000	0.0052	-0.0580	0.0000	0.0000

Source	DF	Type II SS	Mean Square	F Value	Pr > F	Noncentrality Parameter			
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits	
wo	3	1.78586217	0.59528739	1.29	0.2902	0.682	0.645	0.000	10.5
st	2	4.84895932	2.42447966	5.27	0.0094	7.996	7.564	1.459	23.6
impr	3	4.70257920	1.56752640	3.41	0.0269	6.694	6.332	0.622	21.8
st*impr	3	0.09430282	0.03143427	0.07	0.9765	-2.806	-2.654	0.000	0.0

Source	Total Variation Accounted For				Partial Variation Accounted For			
	Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	90% Confidence Limits	
wo	0.0500	0.0112	0.0000	0.1281	0.0905	0.0170	0.0000	0.1711
st	0.1359	0.1087	0.0074	0.2658	0.2127	0.1434	0.0278	0.3161
impr	0.1318	0.0919	0.0000	0.2444	0.2076	0.1240	0.0121	0.2997
st*impr	0.0026	-0.0356	0.0000	0.0000	0.0052	-0.0580	0.0000	0.0000

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Noncentrality Parameter			
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits	
wo	3	1.78586217	0.59528739	1.29	0.2902	0.682	0.645	0.000	10.5
st	2	3.59309661	1.79654831	3.90	0.0285	5.407	5.115	0.433	19.0
impr	3	4.26894773	1.42298258	3.09	0.0380	5.800	5.487	0.266	20.3
st*impr	3	0.09430282	0.03143427	0.07	0.9765	-2.806	-2.654	0.000	0.0

Source	Total Variation Accounted For				Partial Variation Accounted For			
	Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits		Partial Eta-Square	Partial Omega-Square	90% Confidence Limits	
wo	0.0500	0.0112	0.0000	0.1281	0.0905	0.0170	0.0000	0.1711
st	0.1007	0.0739	0.0000	0.2233	0.1668	0.1022	0.0084	0.2716
impr	0.1196	0.0799	0.0000	0.2294	0.1921	0.1096	0.0052	0.2843
st*impr	0.0026	-0.0356	0.0000	0.0000	0.0052	-0.0580	0.0000	0.0000

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey

wo	rt LSMEAN	LSMEAN Number
1	Non-est	1
2	Non-est	2
3	Non-est	3
4	Non-est	4

Least Squares Means for effect wo
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4
1		0.9959	0.8282	0.5690
2	0.9959		0.7897	0.7850
3	0.8282	0.7897		0.2270
4	0.5690	0.7850	0.2270	

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer

st	impr	rt LSMEAN	LSMEAN Number
0	1	2.00280645	1
0	2	2.34721419	2
0	3	2.62532913	3
0	4	3.50280645	4
1	1	1.55557162	5
1	2	2.06584245	6
1	3	2.45314447	7
2	1	0.70792712	8
2	2	1.00280645	9

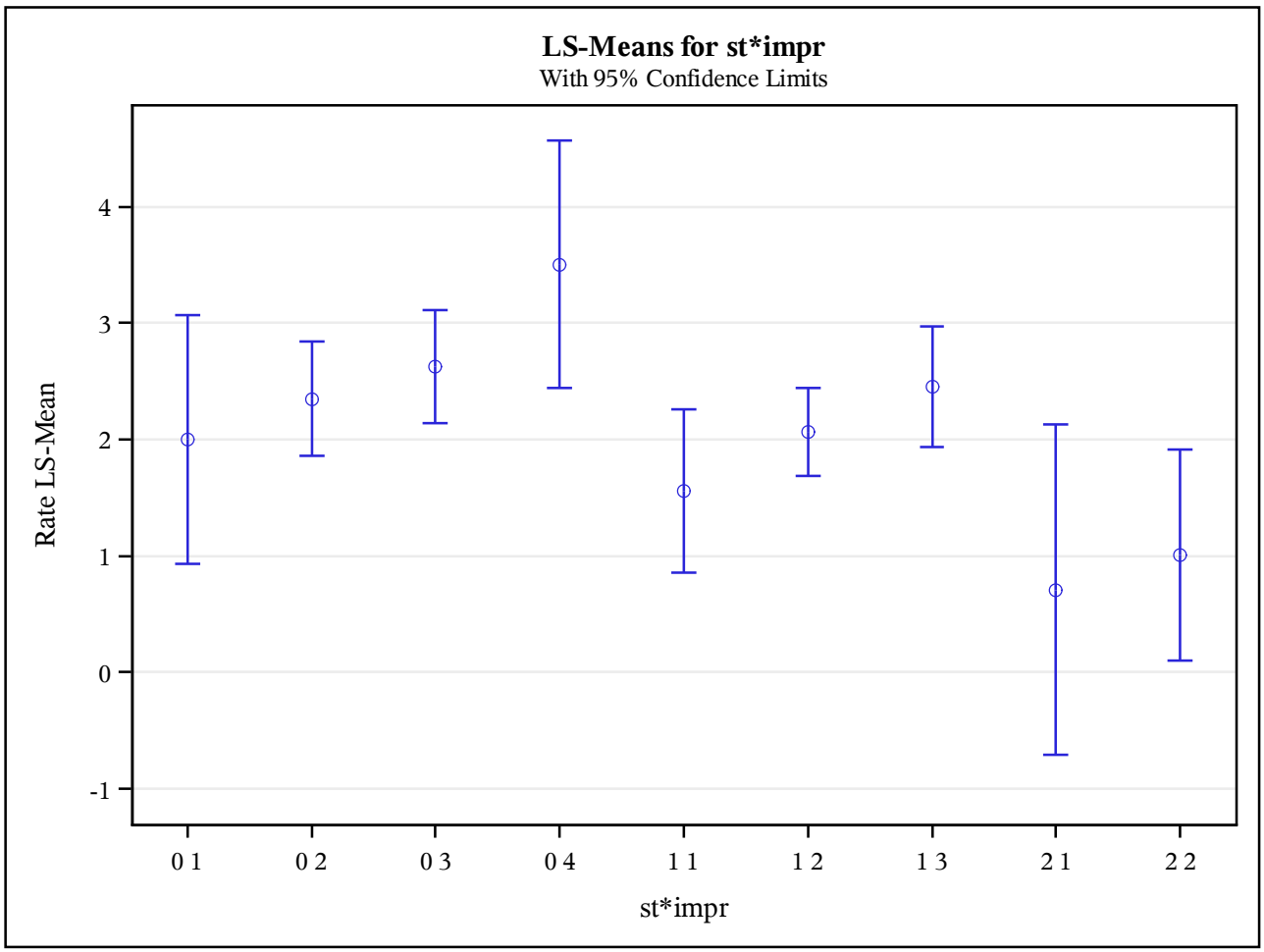
Least Squares Means for effect st*impr
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4	5	6	7	8	9
1		0.9995	0.9740	0.4188	0.9984	1.0000	0.9974	0.8684	0.7910
2	0.9995		0.9955	0.5561	0.6468	0.9908	1.0000	0.4078	0.2028
3	0.9740	0.9955		0.8390	0.2499	0.6586	0.9998	0.2046	0.0601
4	0.4188	0.5561	0.8390		0.0789	0.2717	0.7026	0.0697	0.0068
5	0.9984	0.6468	0.2499	0.0789		0.9246	0.5057	0.9752	0.9860
6	1.0000	0.9908	0.6586	0.2717	0.9246		0.9436	0.6307	0.4938
7	0.9974	1.0000	0.9998	0.7026	0.5057	0.9436		0.3161	0.1610
8	0.8684	0.4078	0.2046	0.0697	0.9752	0.6307	0.3161		1.0000
9	0.7910	0.2028	0.0601	0.0068	0.9860	0.4938	0.1610	1.0000	

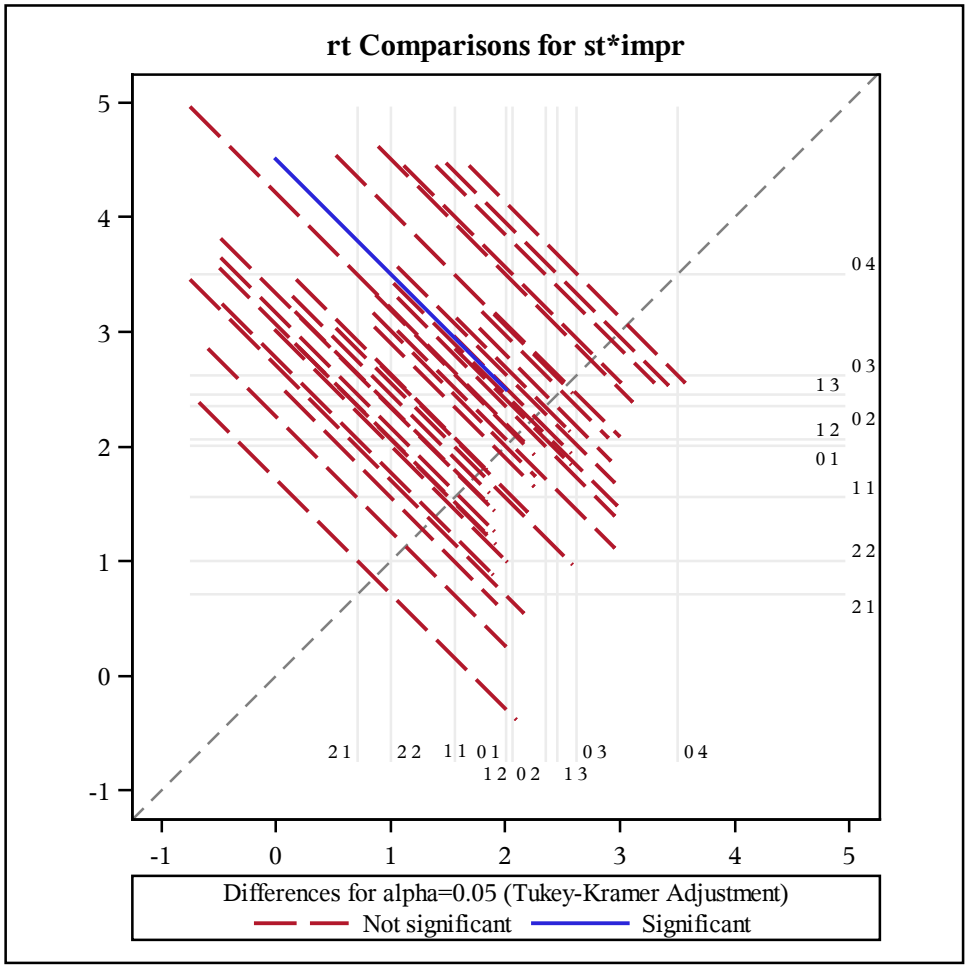
SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

wo	rt LSMEAN	LSMEAN Number
1	Non-est	1
2	Non-est	2
3	Non-est	3
4	Non-est	4

Least Squares Means for effect wo
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4
1		1.0000	1.0000	1.0000
2	1.0000		1.0000	1.0000
3	1.0000	1.0000		0.3550
4	1.0000	1.0000	0.3550	

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

st	impr	rt LSMEAN	LSMEAN Number
0	1	2.00280645	1
0	2	2.34721419	2
0	3	2.62532913	3
0	4	3.50280645	4
1	1	1.55557162	5
1	2	2.06584245	6
1	3	2.45314447	7
2	1	0.70792712	8
2	2	1.00280645	9

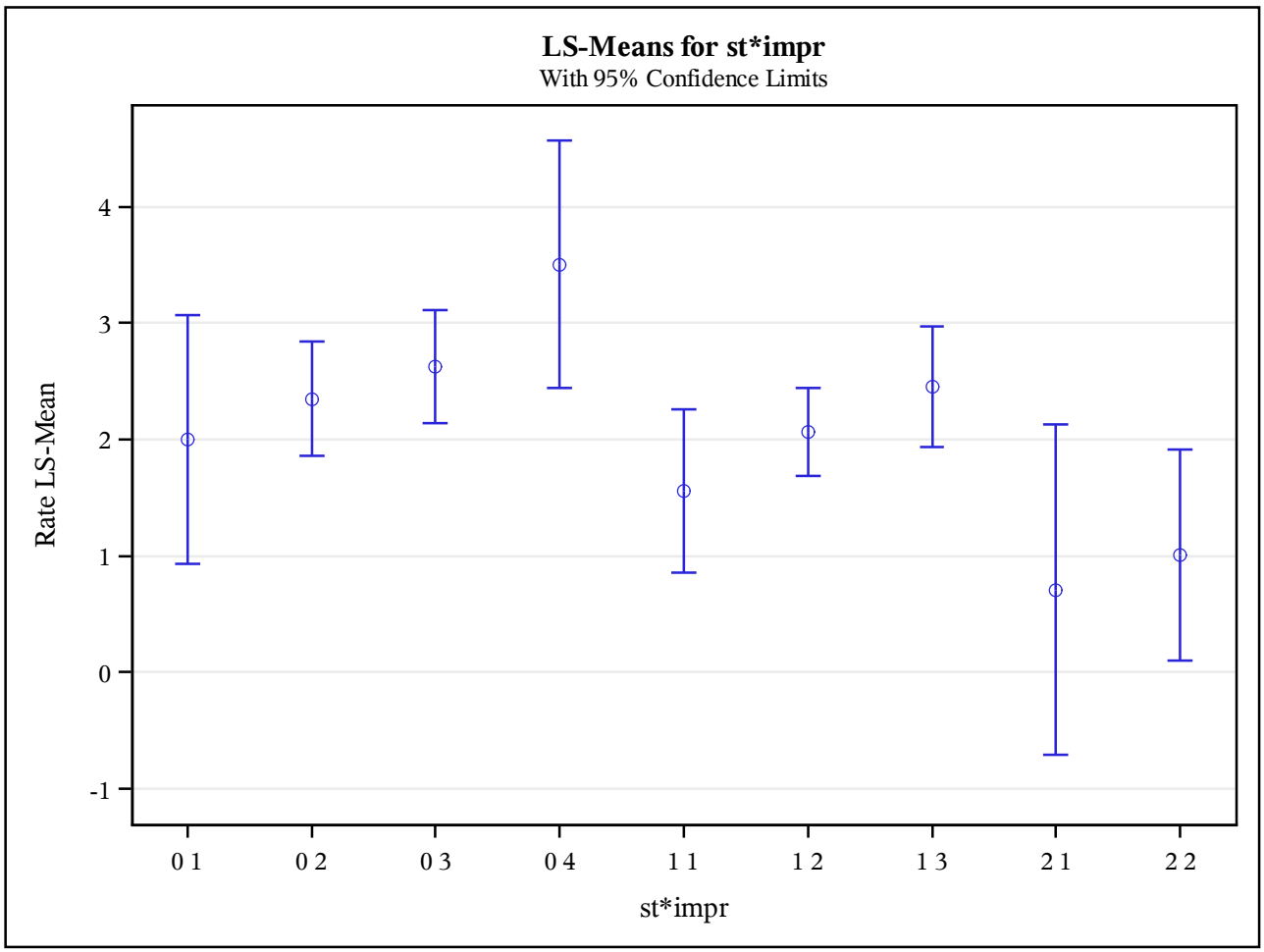
Least Squares Means for effect st*impr
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4	5	6	7	8	9
1		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.4250
3	1.0000	1.0000		1.0000	0.5611	1.0000	1.0000	0.4301	0.0968
4	1.0000	1.0000	1.0000		0.1330	0.6293	1.0000	0.1151	0.0088
5	1.0000	1.0000	0.5611	0.1330		1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	0.6293	1.0000		1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		0.7785	0.3162
8	1.0000	1.0000	0.4301	0.1151	1.0000	1.0000	0.7785		1.0000
9	1.0000	0.4250	0.0968	0.0088	1.0000	1.0000	0.3162	1.0000	

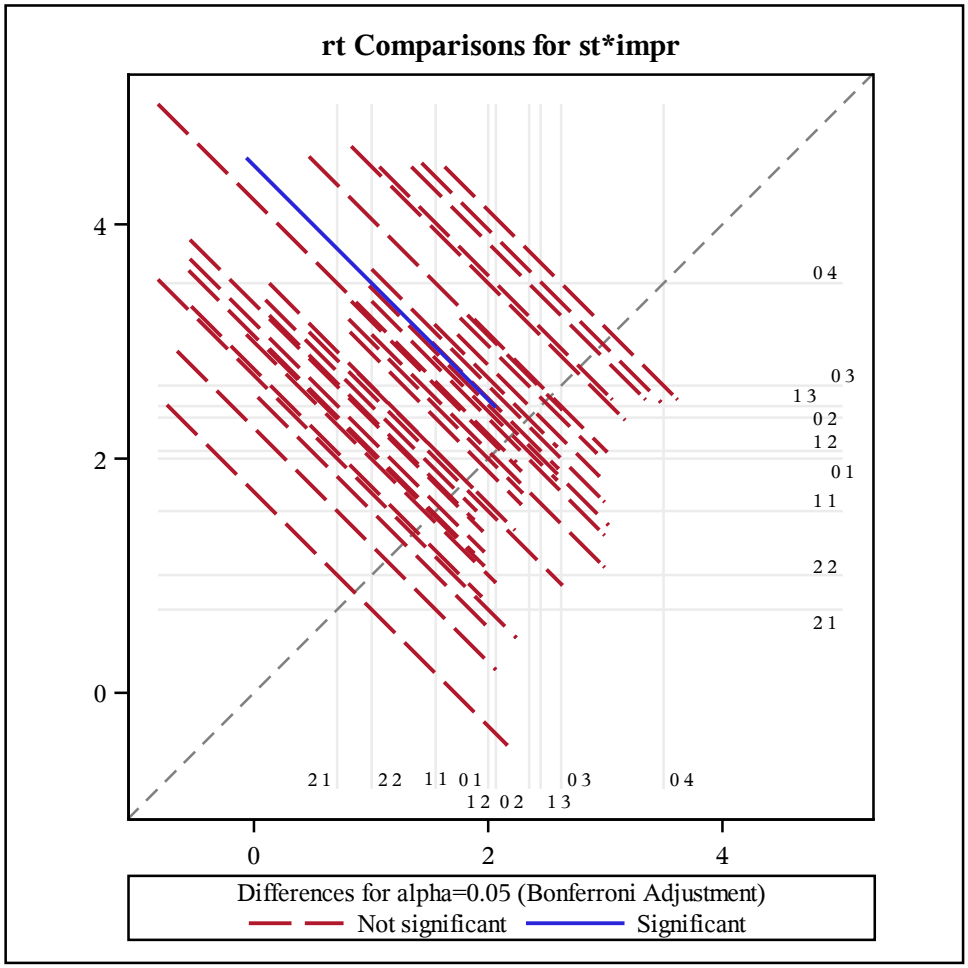
SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Scheffe

wo	rt LSMEAN	LSMEAN Number
1	Non-est	1
2	Non-est	2
3	Non-est	3
4	Non-est	4

Least Squares Means for effect wo
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4
1		0.9969	0.8657	0.6430
2	0.9969		0.8342	0.8302
3	0.8657	0.8342		0.3016
4	0.6430	0.8302	0.3016	

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Scheffe

st	impr	rt LSMEAN	LSMEAN Number
0	1	2.00280645	1
0	2	2.34721419	2
0	3	2.62532913	3
0	4	3.50280645	4
1	1	1.55557162	5
1	2	2.06584245	6
1	3	2.45314447	7
2	1	0.70792712	8
2	2	1.00280645	9

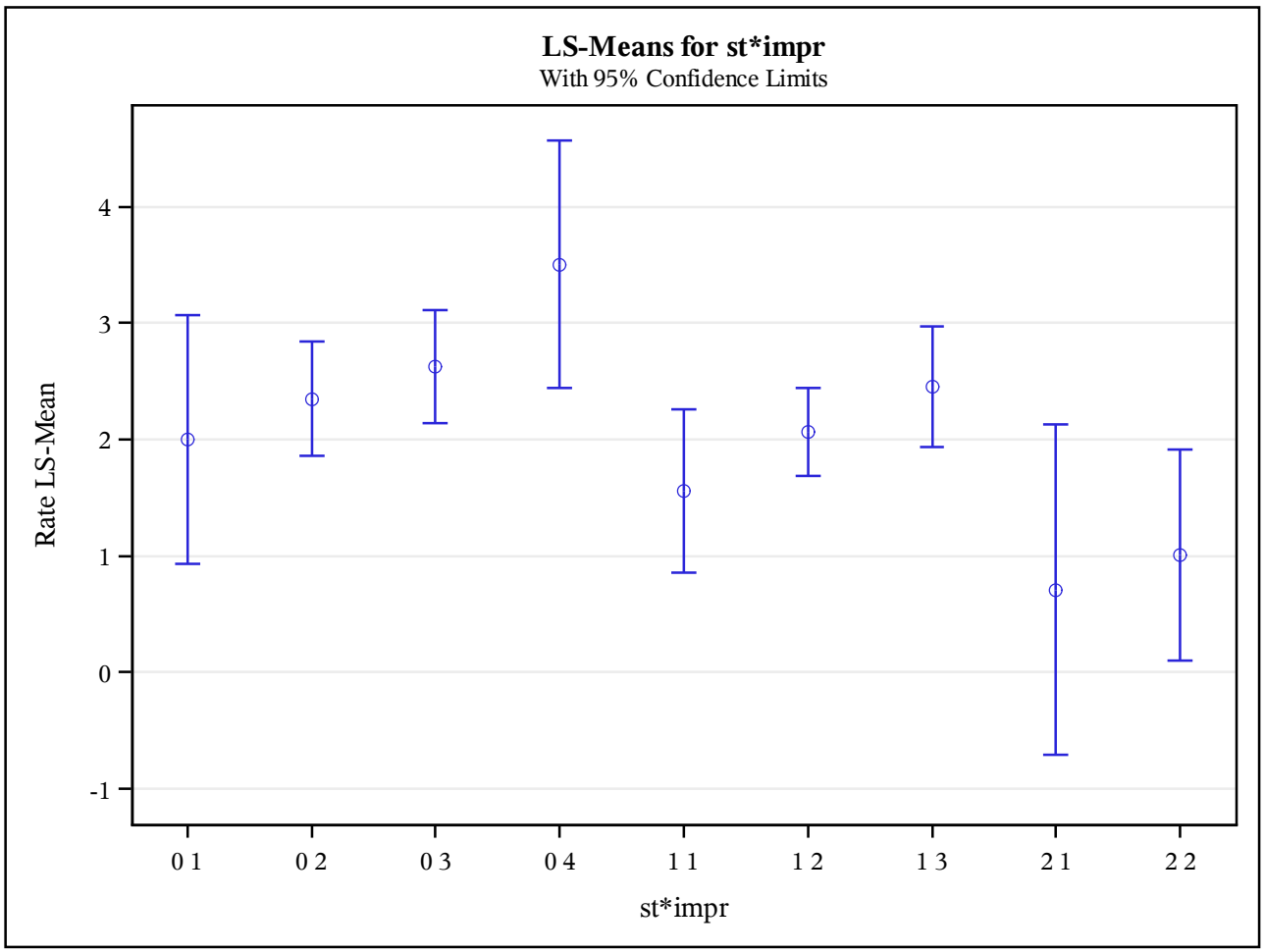
Least Squares Means for effect st*impr
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: rt

i/j	1	2	3	4	5	6	7	8	9
1		1.0000	0.9963	0.7629	0.9998	1.0000	0.9997	0.9736	0.9510
2	1.0000		0.9995	0.8506	0.8957	0.9989	1.0000	0.7546	0.5477
3	0.9963	0.9995		0.9656	0.6065	0.9009	1.0000	0.5502	0.2798
4	0.7629	0.8506	0.9656		0.3285	0.6310	0.9193	0.3056	0.0671
5	0.9998	0.8957	0.6065	0.3285		0.9869	0.8215	0.9965	0.9982
6	1.0000	0.9989	0.9009	0.6310	0.9869		0.9908	0.8883	0.8141
7	0.9997	1.0000	1.0000	0.9193	0.8215	0.9908		0.6762	0.4869
8	0.9736	0.7546	0.5502	0.3056	0.9965	0.8883	0.6762		1.0000
9	0.9510	0.5477	0.2798	0.0671	0.9982	0.8141	0.4869	1.0000	

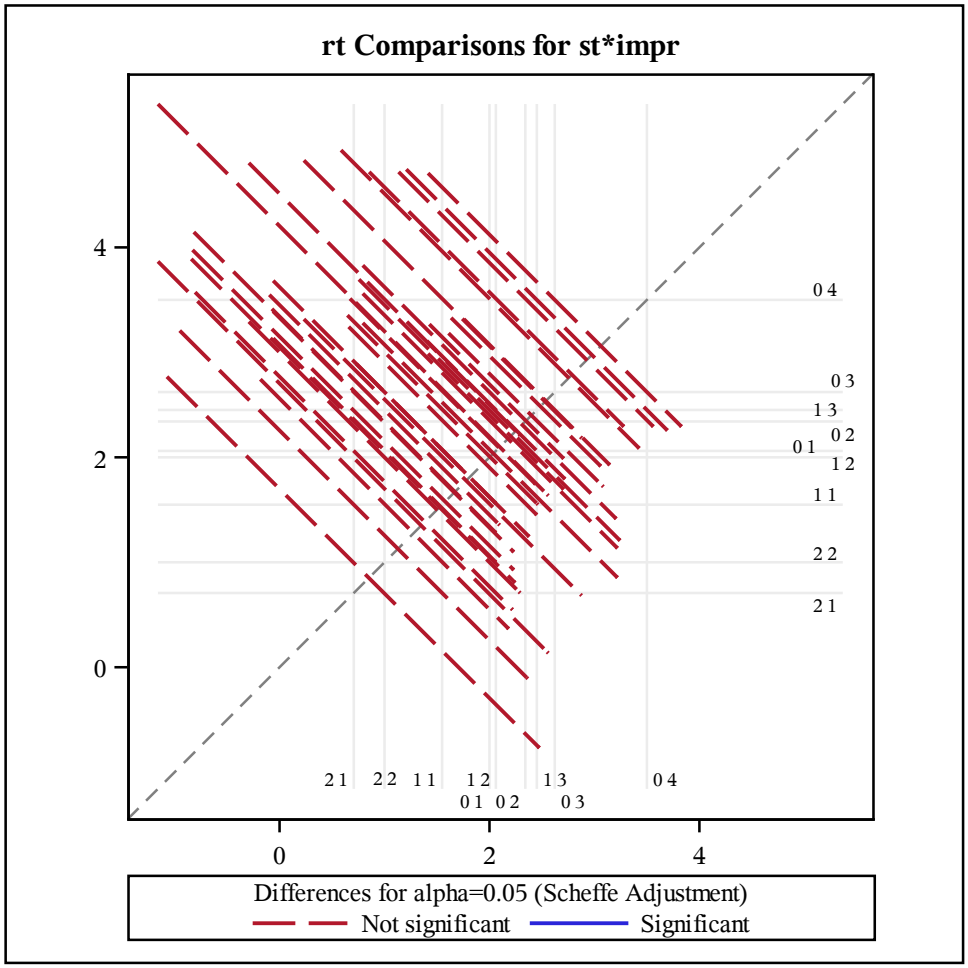
SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Scheffe



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Scheffe



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
wo	4	1 2 3 4
st	3	0 1 2

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	12.94112768	2.58822554	5.12	0.0008
Error	45	22.74514683	0.50544771		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.362636	31.52902	0.710948	2.254902

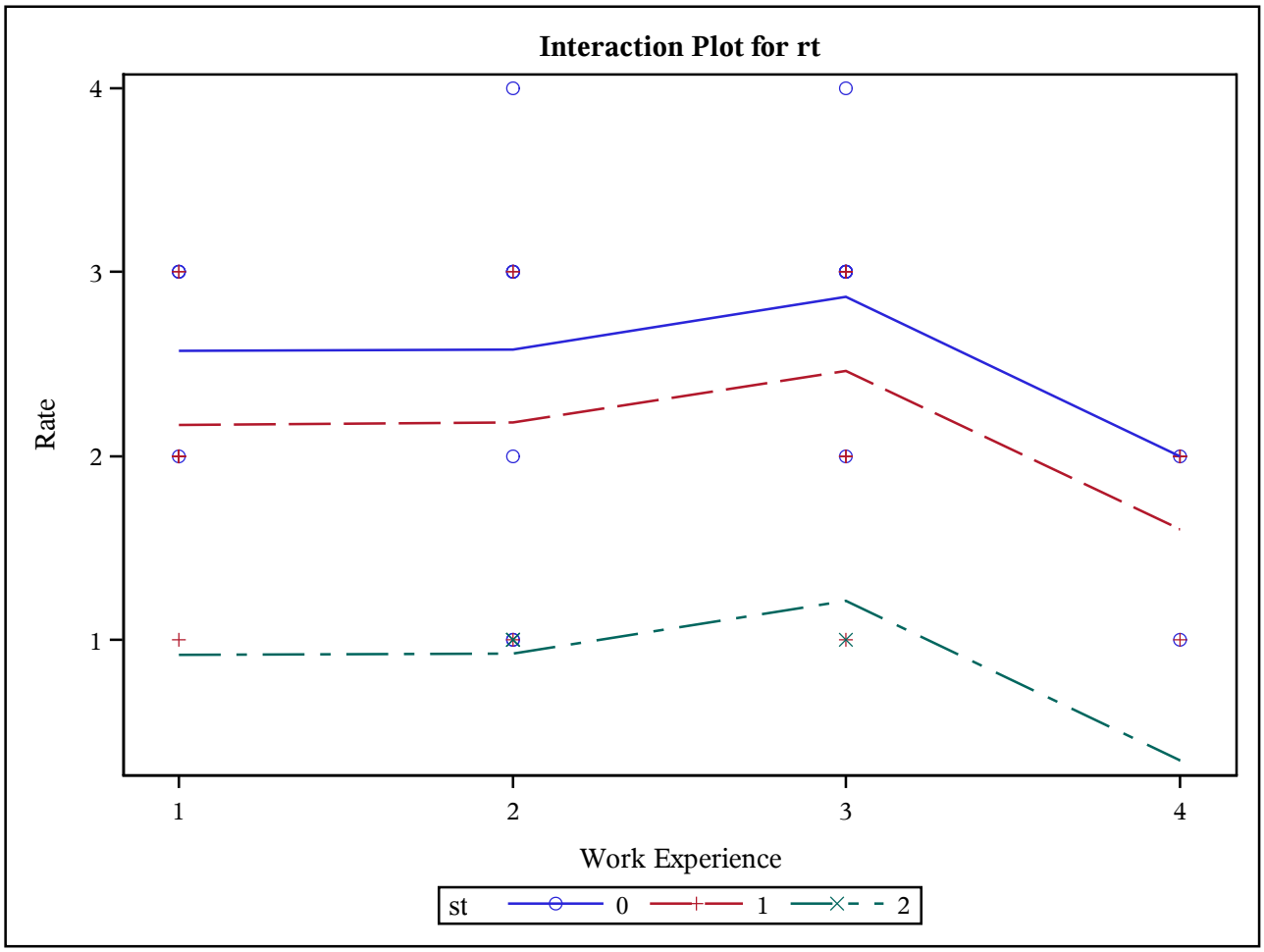
Source	DF	Type I SS	Mean Square	F Value	Pr > F
wo	3	3.74877451	1.24959150	2.47	0.0738
st	2	9.19235317	4.59617659	9.09	0.0005

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wo	3	3.59184951	1.19728317	2.37	0.0832
st	2	9.19235317	4.59617659	9.09	0.0005

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

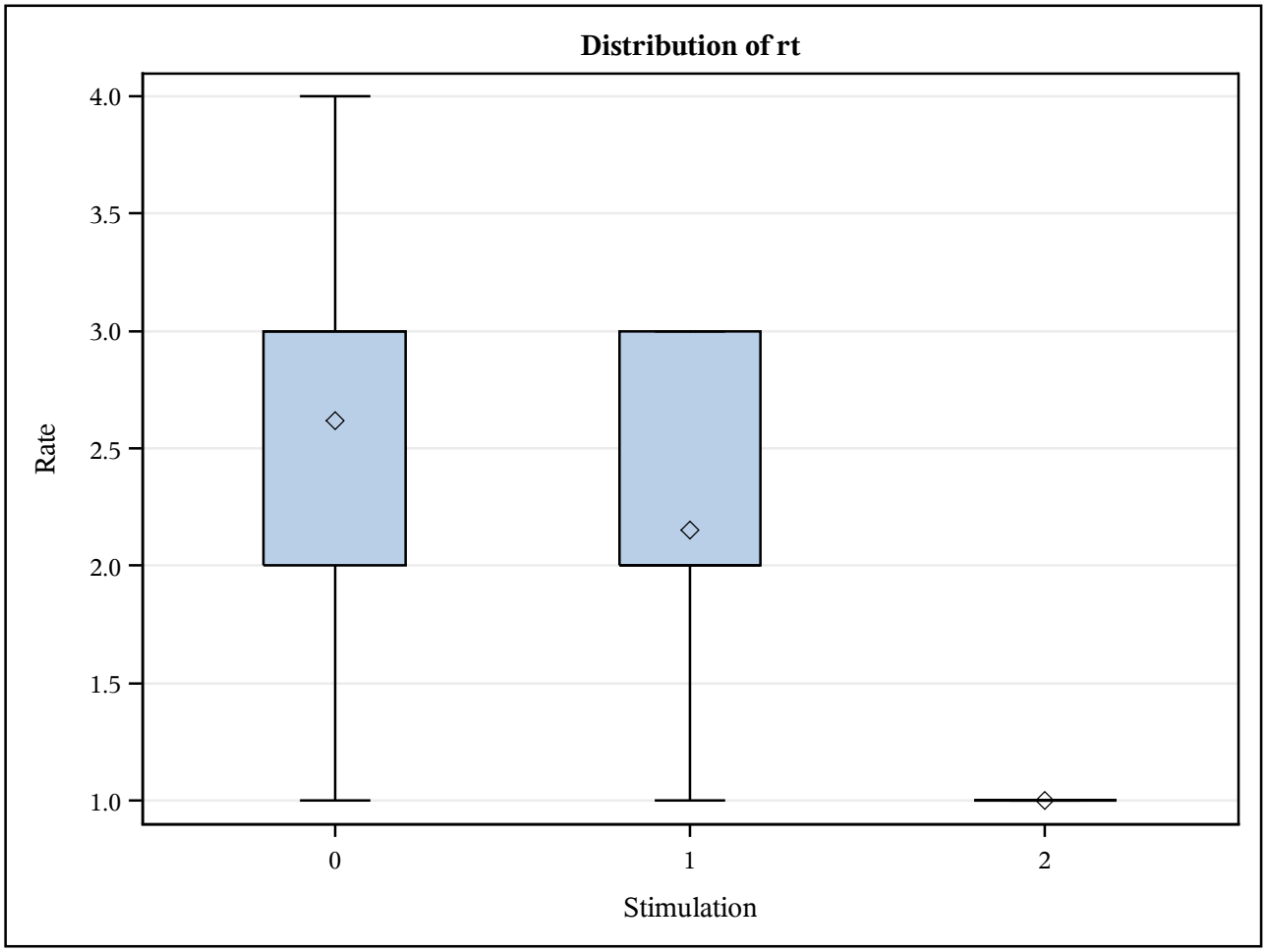
The GLM Procedure

Dependent Variable: rt Rate



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

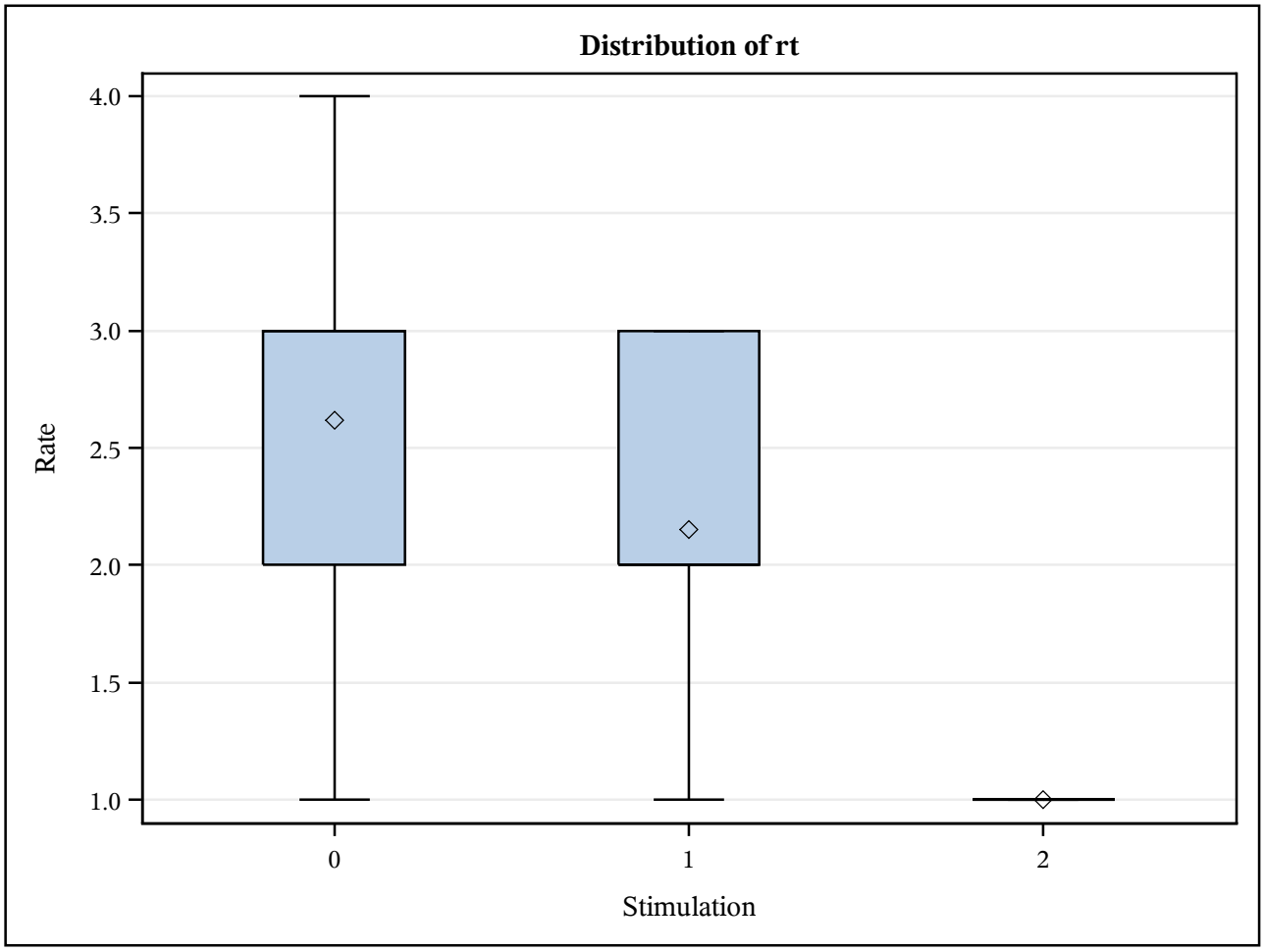
The GLM Procedure



Level of st	N	rt	
		Mean	Std Dev
0	21	2.61904762	0.86464967
1	26	2.15384615	0.67482191
2	4	1.00000000	0.00000000

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

t Tests (LSD) for rt

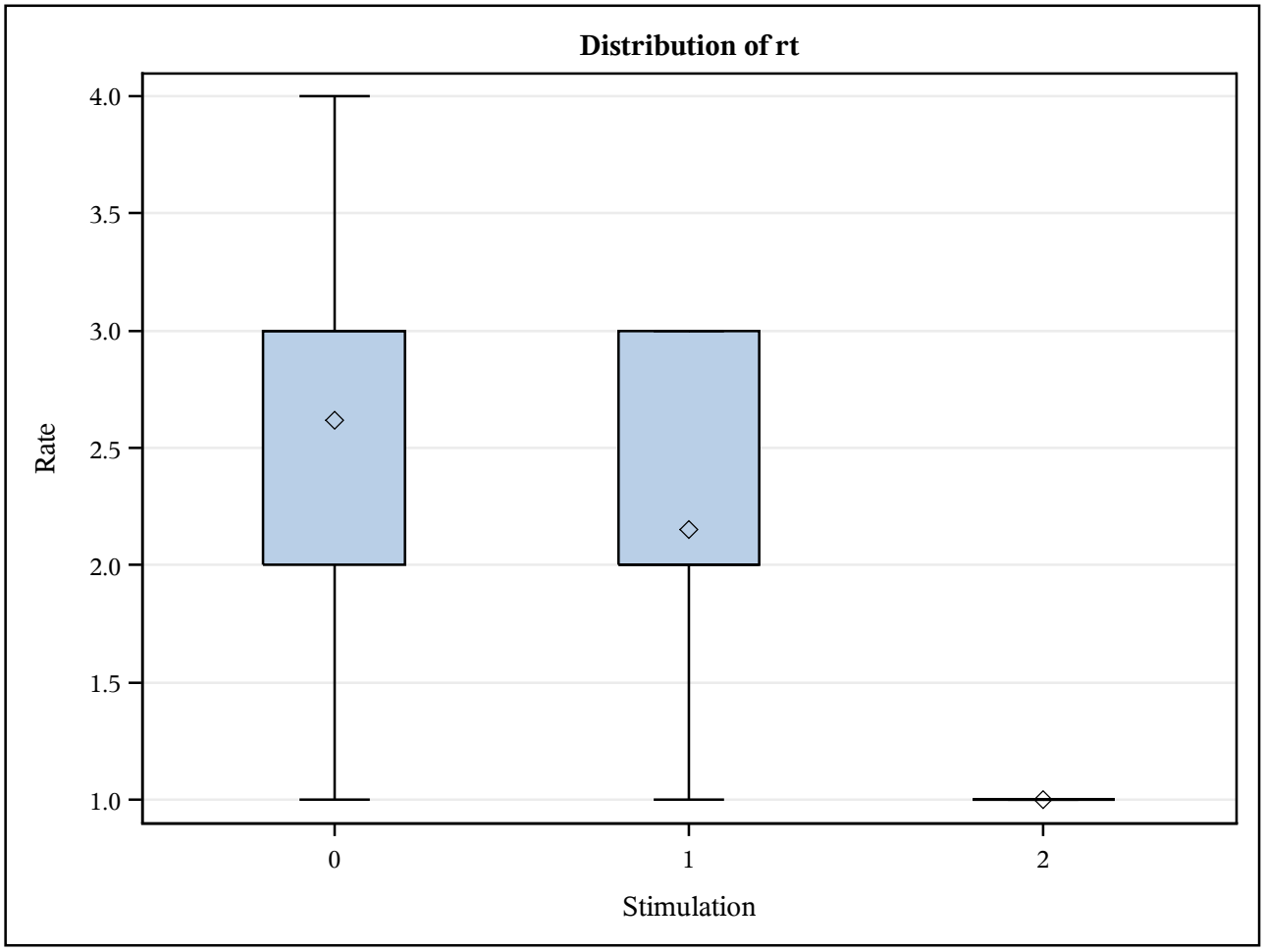
Note: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	45
Error Mean Square	0.505448
Critical Value of t	2.01410

Comparisons significant at the 0.05 level are indicated by *.**				
st Comparison	**Difference Between Means**	**95% Confidence Limits**		
0 - 1	0.4652	0.0451	0.8853	***
0 - 2	1.6190	0.8379	2.4002	***
1 - 0	-0.4652	-0.8853	-0.0451	***
1 - 2	1.1538	0.3848	1.9229	***
2 - 0	-1.6190	-2.4002	-0.8379	***
2 - 1	-1.1538	-1.9229	-0.3848	***

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Bonferroni (Dunn) t Tests for rt

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

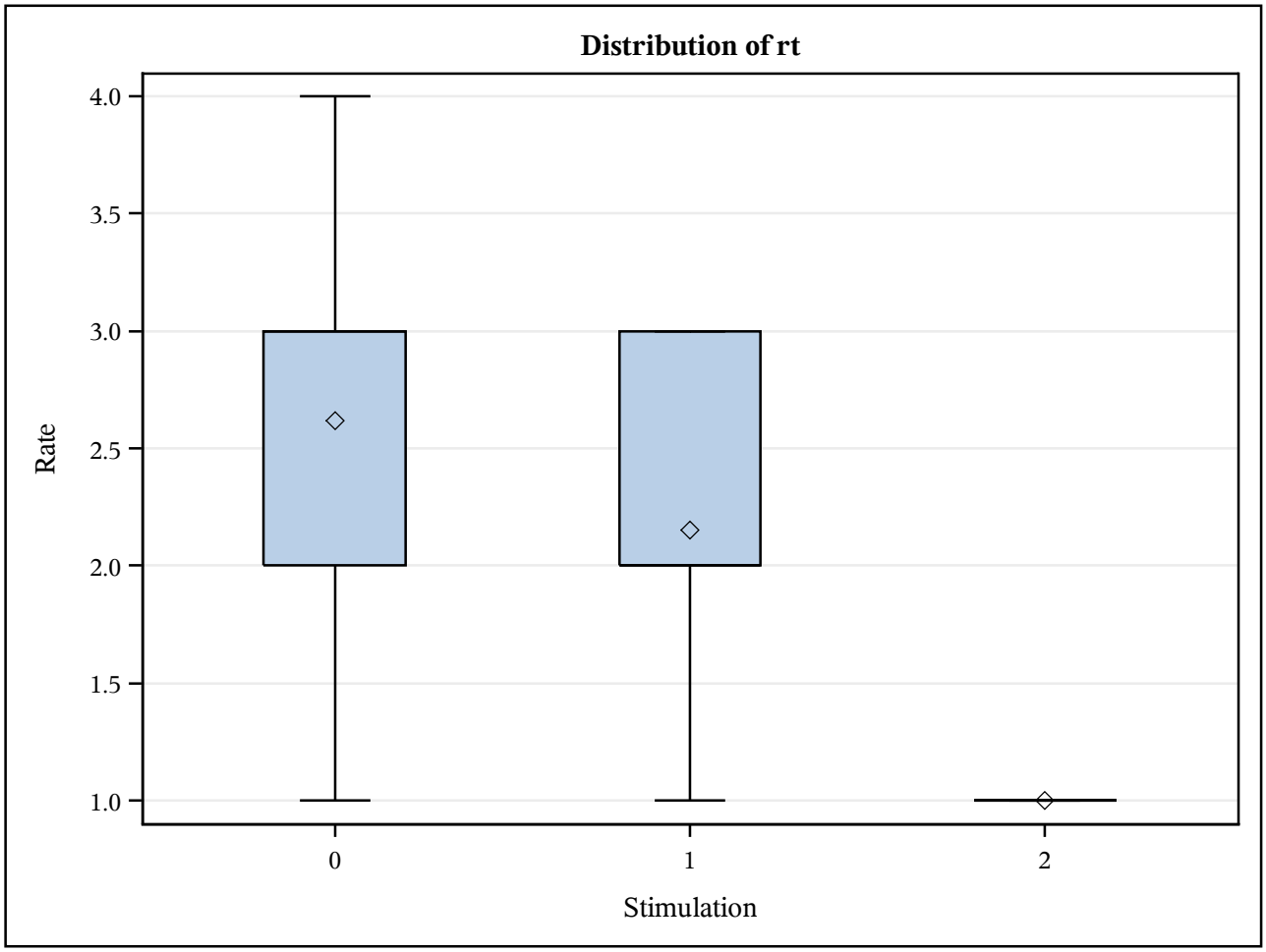
Alpha	0.05
Error Degrees of Freedom	45
Error Mean Square	0.505448
Critical Value of t	2.48678

Comparisons significant at the 0.05 level are indicated by *.**

st Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
0 - 1	0.4652	-0.0535	0.9839	
0 - 2	1.6190	0.6545	2.5836	***
1 - 0	-0.4652	-0.9839	0.0535	
1 - 2	1.1538	0.2043	2.1034	***
2 - 0	-1.6190	-2.5836	-0.6545	***
2 - 1	-1.1538	-2.1034	-0.2043	***

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Ryan-Einot-Gabriel-Welsch Multiple Range Test for rt

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	45
Error Mean Square	0.505448
Harmonic Mean of Cell Sizes	8.926431

Note: Cell sizes are not equal.

Number of Means	**2**	**3**
Critical Range	0.6777703	0.8155915

Means with the same letter are not significantly different.			
REGWQ Grouping	**Mean**	**N**	**st**
A	2.6190	21	0
A			
A	2.1538	26	1
B	1.0000	4	2

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
0&1 vs 2	1	6.91133193	6.91133193	13.67	0.0006
0 vs 2	1	8.67030140	8.67030140	17.15	0.0001
1 vs 2	1	4.55819198	4.55819198	9.02	0.0044

Parameter	Estimate	Standard Error	t Value	Pr > |t|
0&1 vs 2	1.45380953	0.39315586	3.70	0.0006
0 vs 2	1.65331646	0.39918757	4.14	0.0001
1 vs 2	-1.25430261	0.41768044	-3.00	0.0044

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
wo	4	1 2 3 4
impr	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	6	12.79474755	2.13245793	4.10	0.0024
Error	44	22.89152696	0.52026198		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	rt Mean
0.358534	31.98773	0.721292	2.254902

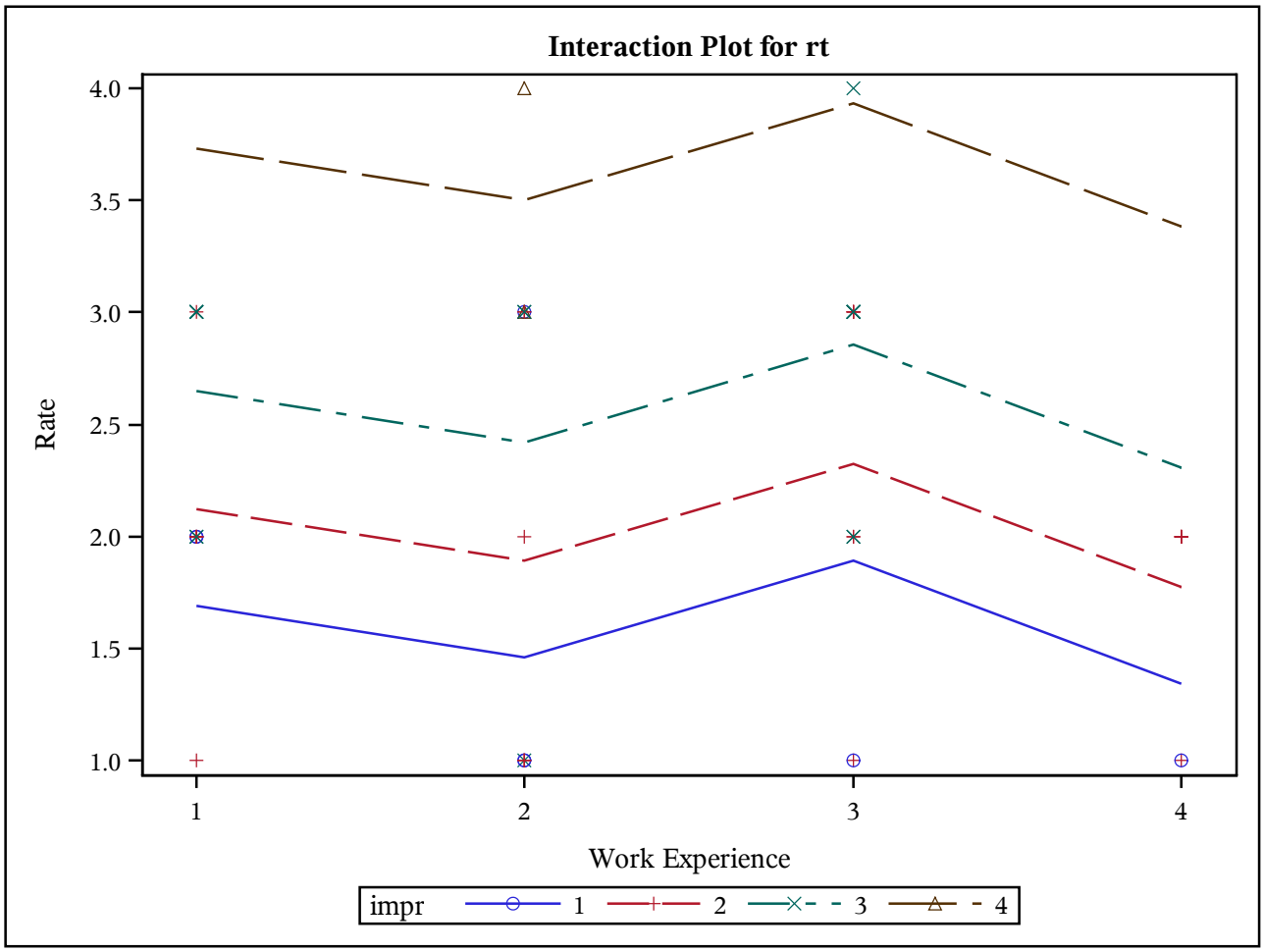
Source	DF	Type I SS	Mean Square	F Value	Pr > F
wo	3	3.74877451	1.24959150	2.40	0.0804
impr	3	9.04597304	3.01532435	5.80	0.0020

Source	DF	Type III SS	Mean Square	F Value	Pr > F
wo	3	1.81217052	0.60405684	1.16	0.3354
impr	3	9.04597304	3.01532435	5.80	0.0020

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

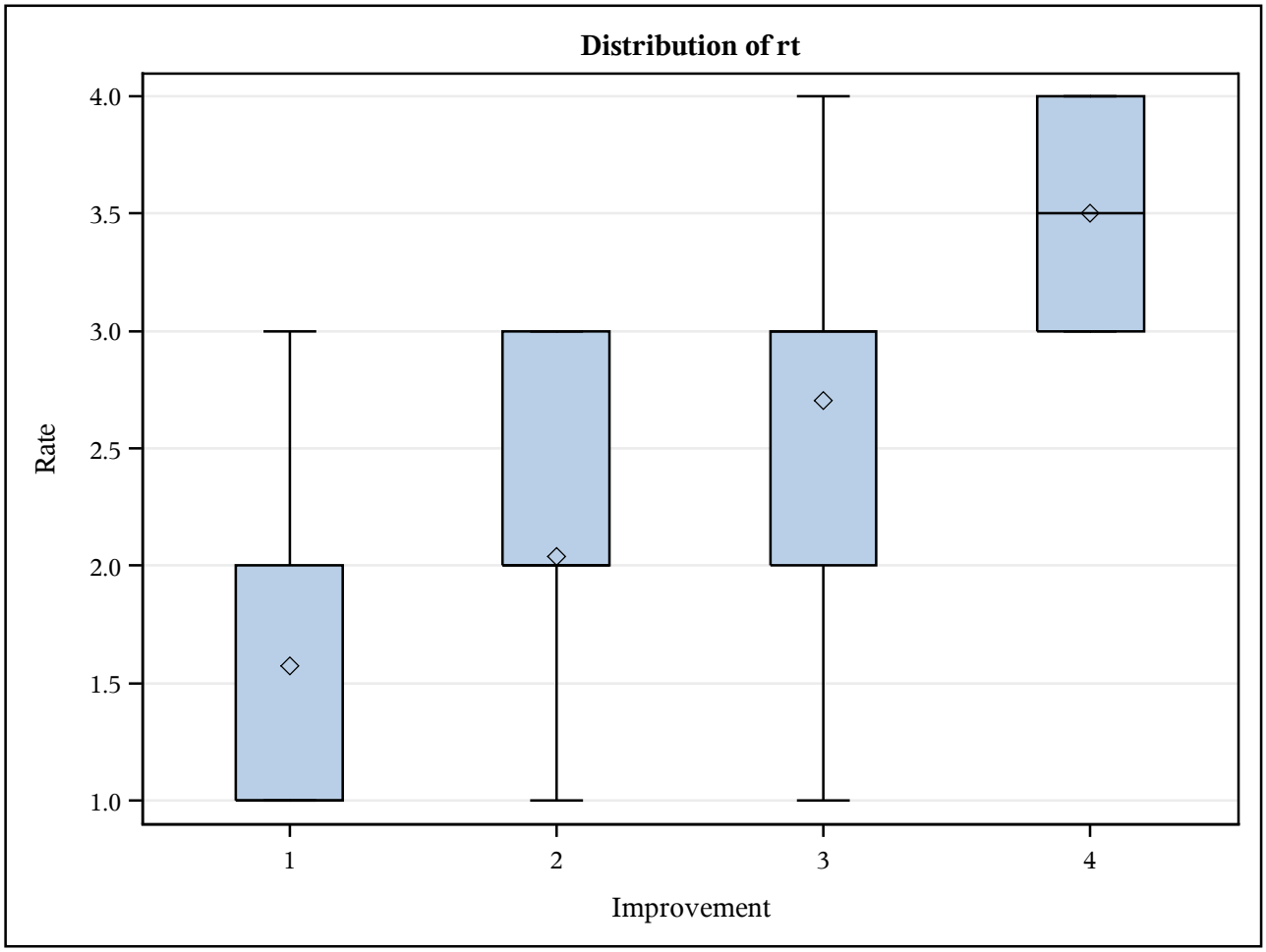
The GLM Procedure

Dependent Variable: rt Rate



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

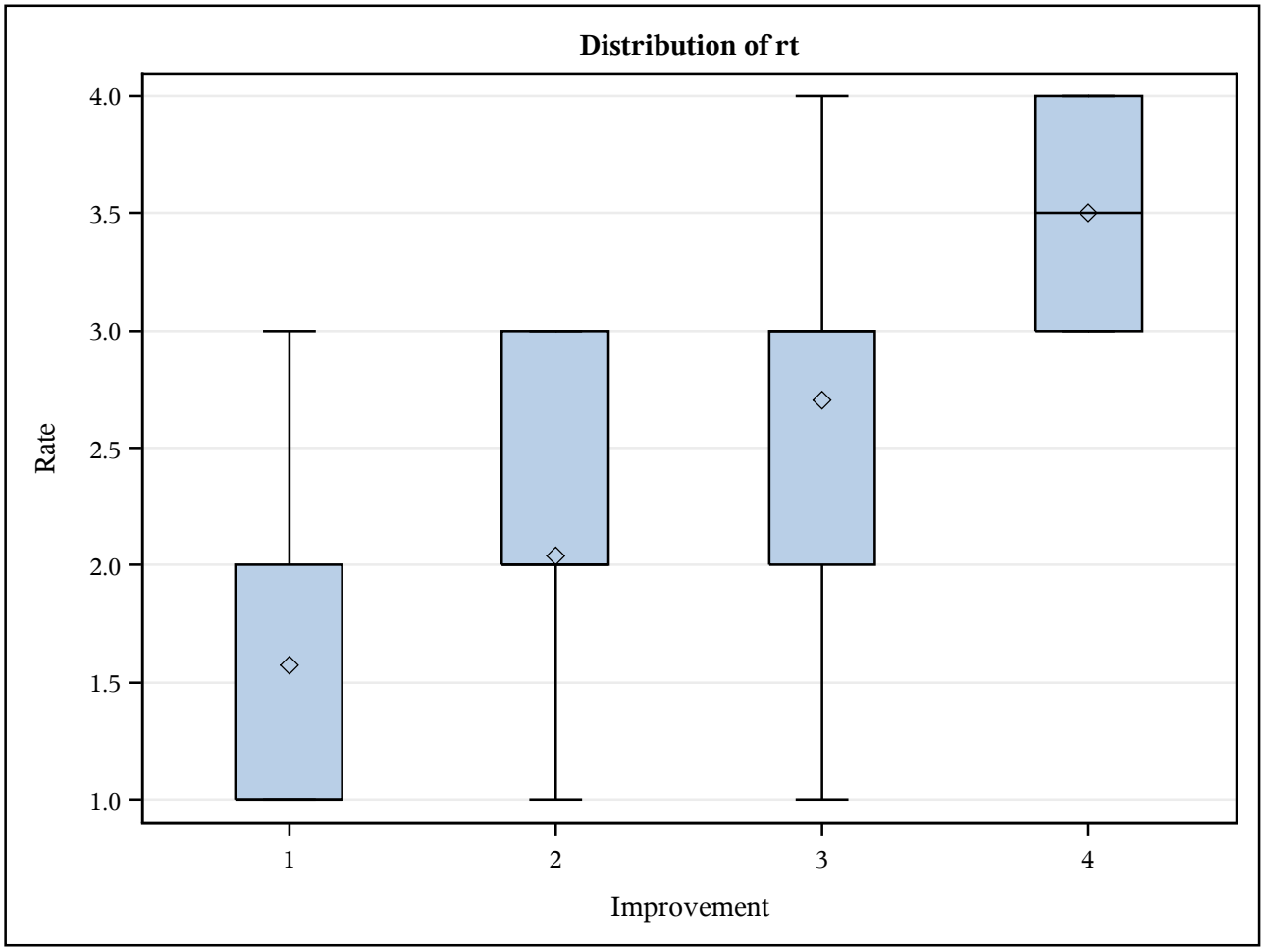
The GLM Procedure



Level of impr	N	rt Mean	rt Std Dev
1	7	1.57142857	0.78679579
2	25	2.04000000	0.73484692
3	17	2.70588235	0.68599434
4	2	3.50000000	0.70710678

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Bonferroni (Dunn) t Tests for rt

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

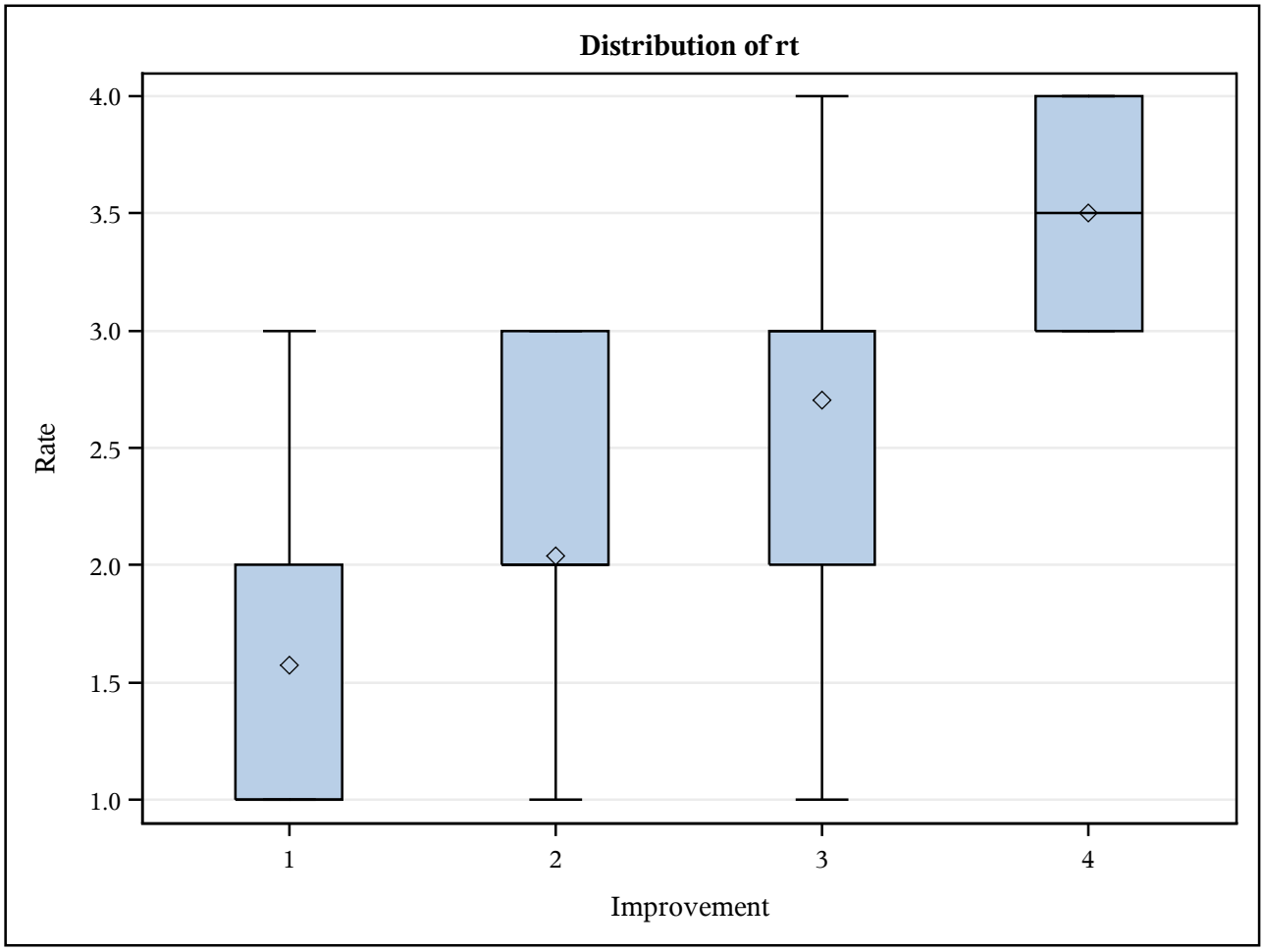
Alpha	0.05
Error Degrees of Freedom	44
Error Mean Square	0.520262
Critical Value of t	2.76281

Comparisons significant at the 0.05 level are indicated by *.**

impr Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
4 - 3	0.7941	-0.6956	2.2838	
4 - 2	1.4600	-0.0044	2.9244	
4 - 1	1.9286	0.3308	3.5264	***
3 - 4	-0.7941	-2.2838	0.6956	
3 - 2	0.6659	0.0394	1.2923	***
3 - 1	1.1345	0.2395	2.0294	***
2 - 4	-1.4600	-2.9244	0.0044	
2 - 3	-0.6659	-1.2923	-0.0394	***
2 - 1	0.4686	-0.3836	1.3207	
1 - 4	-1.9286	-3.5264	-0.3308	***
1 - 3	-1.1345	-2.0294	-0.2395	***
1 - 2	-0.4686	-1.3207	0.3836	

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure



SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Ryan-Einot-Gabriel-Welsch Multiple Range Test for rt

Note: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	44
Error Mean Square	0.520262
Harmonic Mean of Cell Sizes	5.393157

Note: Cell sizes are not equal.

Number of Means	**2**	**3**	**4**
Critical Range	1.0169742	1.0653644	1.1727806

Means with the same letter are not significantly different.				
REGWQ Grouping		**Mean**	**N**	**impr**
	A	3.5000	2	4
	A			
B	A	2.7059	17	3
B				
B	C	2.0400	25	2
	C			
	C	1.5714	7	1

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLM Procedure

Dependent Variable: rt Rate

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
1&2 vs 3&4	1	8.37550782	8.37550782	16.10	0.0002
1 vs 4	1	6.10436133	6.10436133	11.73	0.0013
1 vs 3	1	4.21896855	4.21896855	8.11	0.0067
2 vs 4	1	4.25802120	4.25802120	8.18	0.0064
2 vs 3	1	2.50016739	2.50016739	4.81	0.0337

Parameter	Estimate	Standard Error	t Value	Pr > |t|
1&2 vs 3&4	2.56879218	0.64022767	4.01	0.0002
1 vs 4	-2.03900123	0.59526235	-3.43	0.0013
1 vs 3	-0.96075116	0.33737960	-2.85	0.0067
2 vs 4	-1.60804102	0.56208793	-2.86	0.0064
2 vs 3	-0.52979095	0.24167462	-2.19	0.0337

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The FREQ Procedure

Frequency
Percent
Row Pct
Col Pct

Table of st by impr

st(Stimulation)	impr(Improvement) 1	2	3	4	Total
0	4 3.48 7.27 36.36	19 16.52 34.55 37.25	25 21.74 45.45 54.35	7 6.09 12.73 100.00	55 47.83
1	6 5.22 10.71 54.55	29 25.22 51.79 56.86	21 18.26 37.50 45.65	0 0.00 0.00 0.00	56 48.70
2	1 0.87 25.00 9.09	3 2.61 75.00 5.88	0 0.00 0.00 0.00	0 0.00 0.00 0.00	4 3.48
Total	11 9.57	51 44.35	46 40.00	7 6.09	115 100.00

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The FREQ Procedure

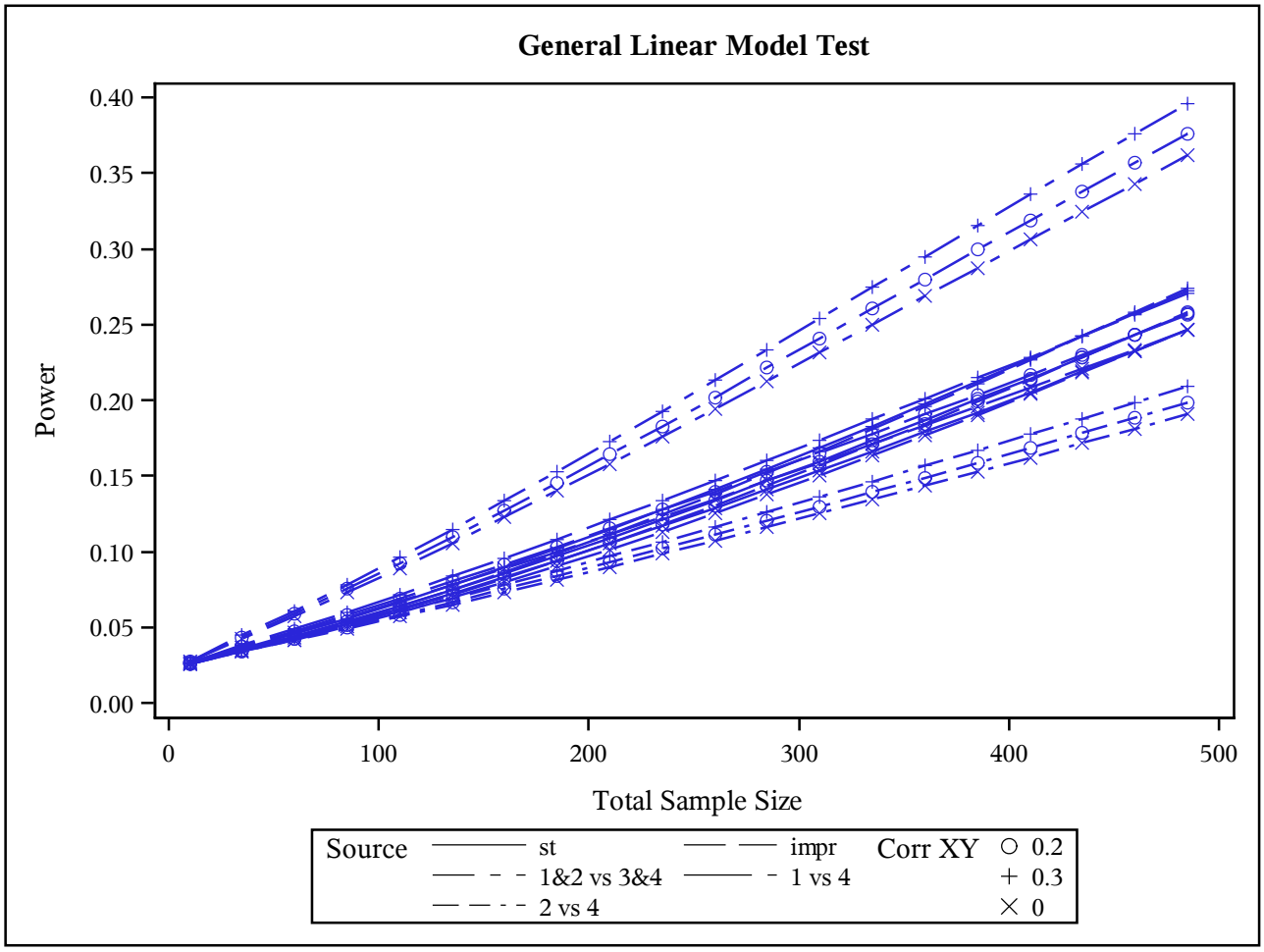
Statistics for Table of st by impr

Statistic	Value	ASE
Gamma	-0.4458	0.1273
Kendall's Tau-b	-0.2640	0.0804
Stuart's Tau-c	-0.2296	0.0716
Somers' D C|R	-0.2872	0.0878
Somers' D R|C	-0.2427	0.0740
Pearson Correlation	-0.2954	0.0817
Spearman Correlation	-0.2813	0.0866
Lambda Asymmetric C|R	0.0938	0.0987
Lambda Asymmetric R|C	0.1864	0.1113
Lambda Symmetric	0.1382	0.0928
Uncertainty Coefficient C|R	0.0688	0.0200
Uncertainty Coefficient R|C	0.0941	0.0276
Uncertainty Coefficient Symmetric	0.0795	0.0230

Sample Size = 115

SAS Program for Randomized Block Factorial Design
Factors Effecting People's Rate of MOOC --Stimulation & Improvement

The GLMPOWER Procedure



SAS Program for Two-way ANCOVA Design

Obs	Education	Career	Rate
1	3	2	2
2	4	2	2
3	4	4	3
4	3	2	2
5	4	2	1
6	3	4	3
7	4	2	1
8	4	3	1
9	3	2	2
10	4	3	3
11	3	2	2
12	3	2	2
13	3	3	3
14	4	1	1
15	3	2	1
16	3	2	2
17	4	3	3
18	5	2	1
19	4	2	3
20	4	3	2
21	4	2	2
22	4	2	2
23	4	2	1
24	4	2	2
25	2	2	3
26	3	3	3
27	3	2	1
28	3	3	3
29	3	4	4
30	3	4	2
31	3	2	1
32	3	2	3
33	3	1	2
34	1	3	2

SAS Program for Two-way ANCOVA Design

Obs	Education	Career	Rate
35	3	1	1
36	4	2	2
37	4	2	3
38	3	3	2
39	3	3	4
40	3	2	2
41	3	2	2
42	3	3	3
43	3	2	3
44	3	2	3
45	3	3	3
46	3	3	3
47	3	3	3
48	3	3	3
49	3	3	3
50	3	3	3
51	3	2	1

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
Career	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Two-way ANCOVA Design

The GLM Procedure

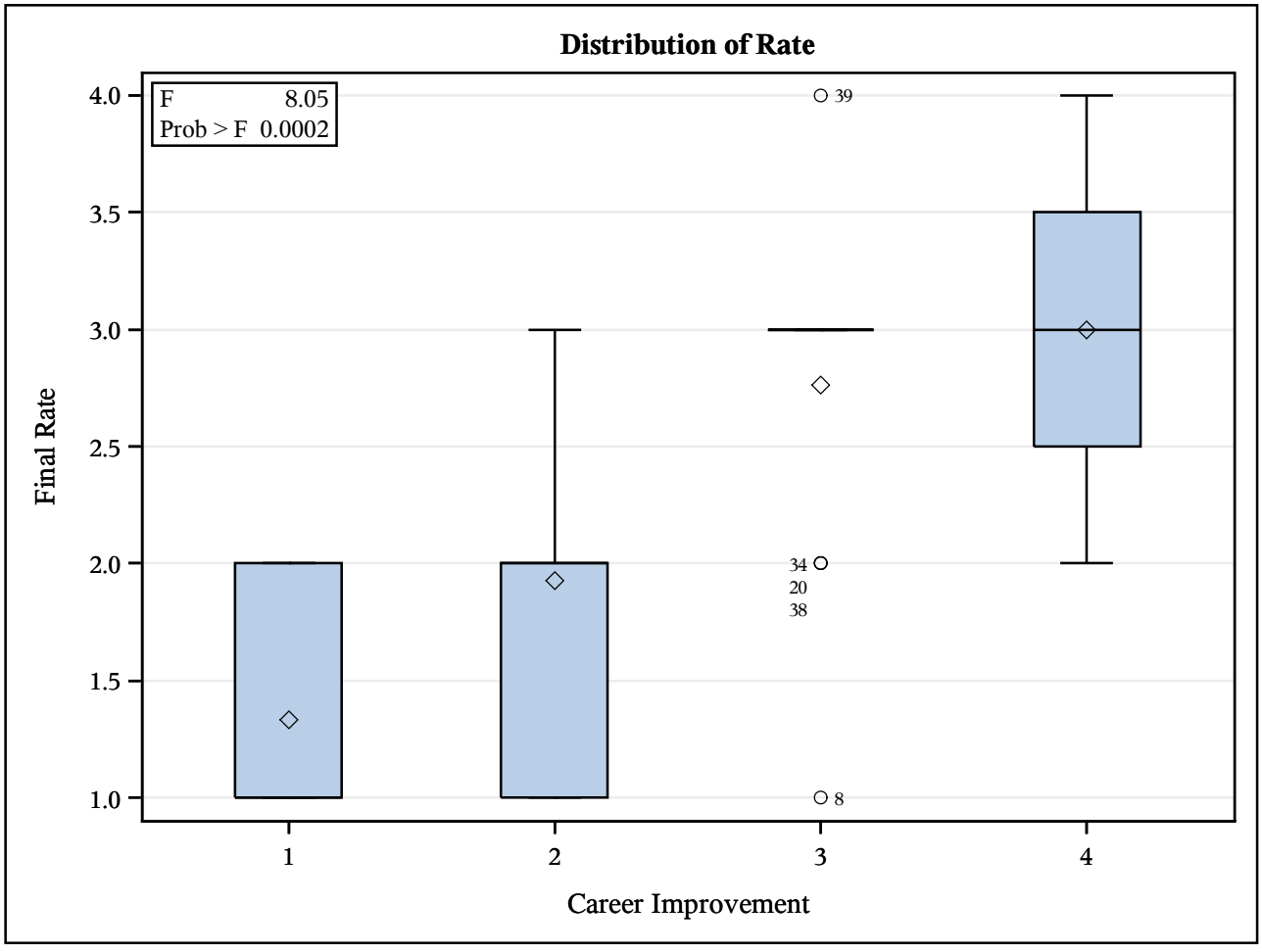
Dependent Variable: Rate Final Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	12.10893246	4.03631082	8.05	0.0002
Error	47	23.57734205	0.50164558		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.339316	31.41021	0.708269	2.254902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Career	3	12.10893246	4.03631082	8.05	0.0002

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Career	3	12.10893246	4.03631082	8.05	0.0002



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
Career	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	13.27593660	3.31898415	6.81	0.0002
Error	46	22.41033791	0.48718126		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.372018	30.95406	0.697984	2.254902

Overall Noncentrality	
Min Var Unbiased Estimate	22.066
Low MSE Estimate	21.063
90% Confidence Limits	(8.5315,46.564)

Proportion of Variation Accounted for	
Eta-Square	0.37
Omega-Square	0.31
90% Confidence Limits	(0.14,0.48)

SAS Program for Two-way ANCOVA Design

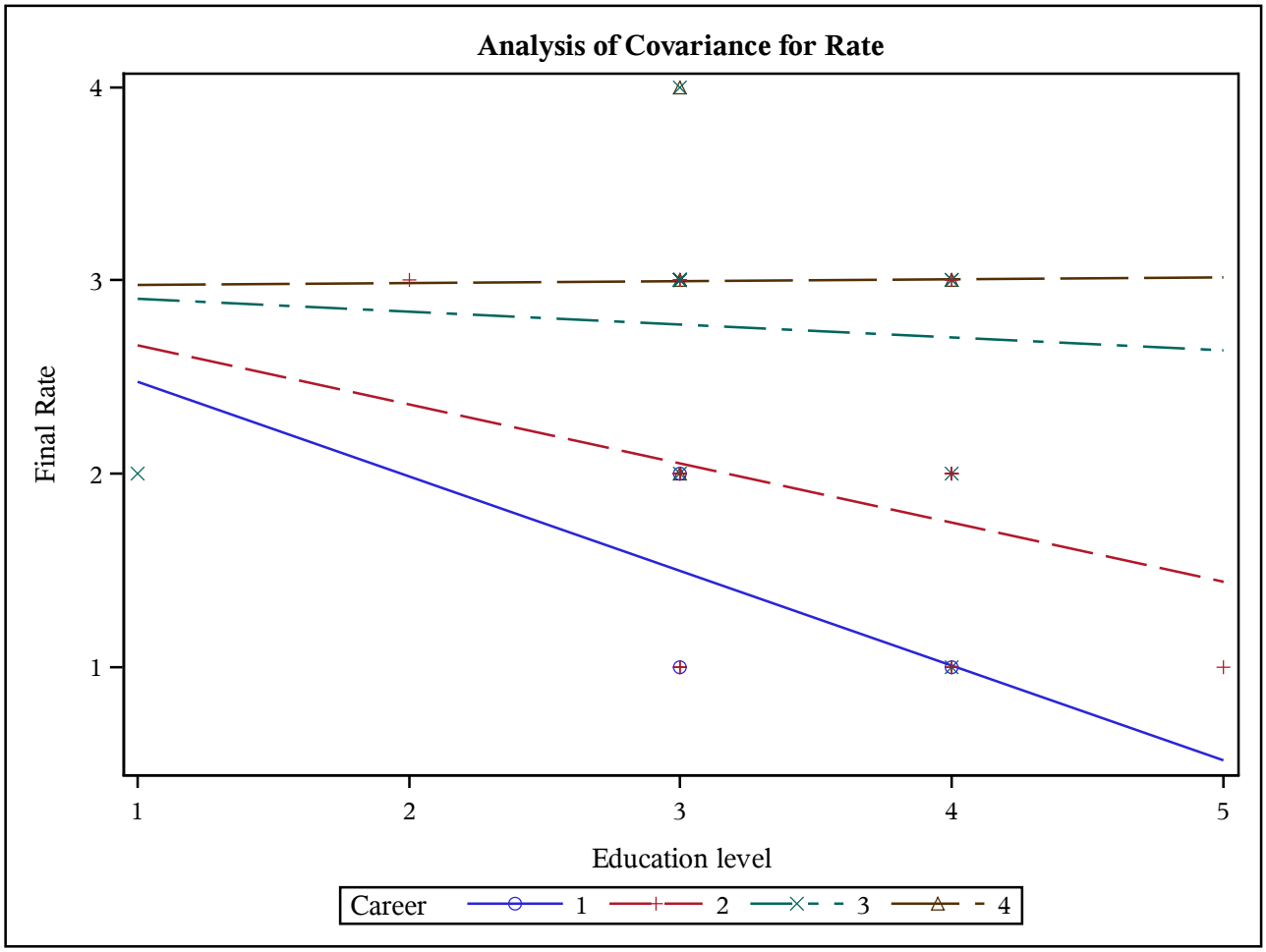
The GLM Procedure

Dependent Variable: Rate Final Rate

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Noncentrality Parameter			
						Min Var Unbiased Estimate	Low MSE Estimate	90% Confidence Limits	
Education*Career	4	13.27593660	3.31898415	6.81	0.0002	22.1	21.1	8.53	46.6

Source	Total Variation Accounted For			
	Semipartial Eta-Square	Semipartial Omega-Square	Conservative 90% Confidence Limits	
Education*Career	0.3720	0.3131	0.1433	0.4773

Source	Partial Variation Accounted For			
	Partial Eta-Square	Partial Omega-Square	90% Confidence Limits	
Education*Career	0.3720	0.3131	0.1433	0.4773



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	2.26151261	2.26151261	3.32	0.0747
Error	49	33.42476190	0.68213800		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.063372	36.62760	0.825916	2.254902

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Education	1	2.26151261	2.26151261	3.32	0.0747

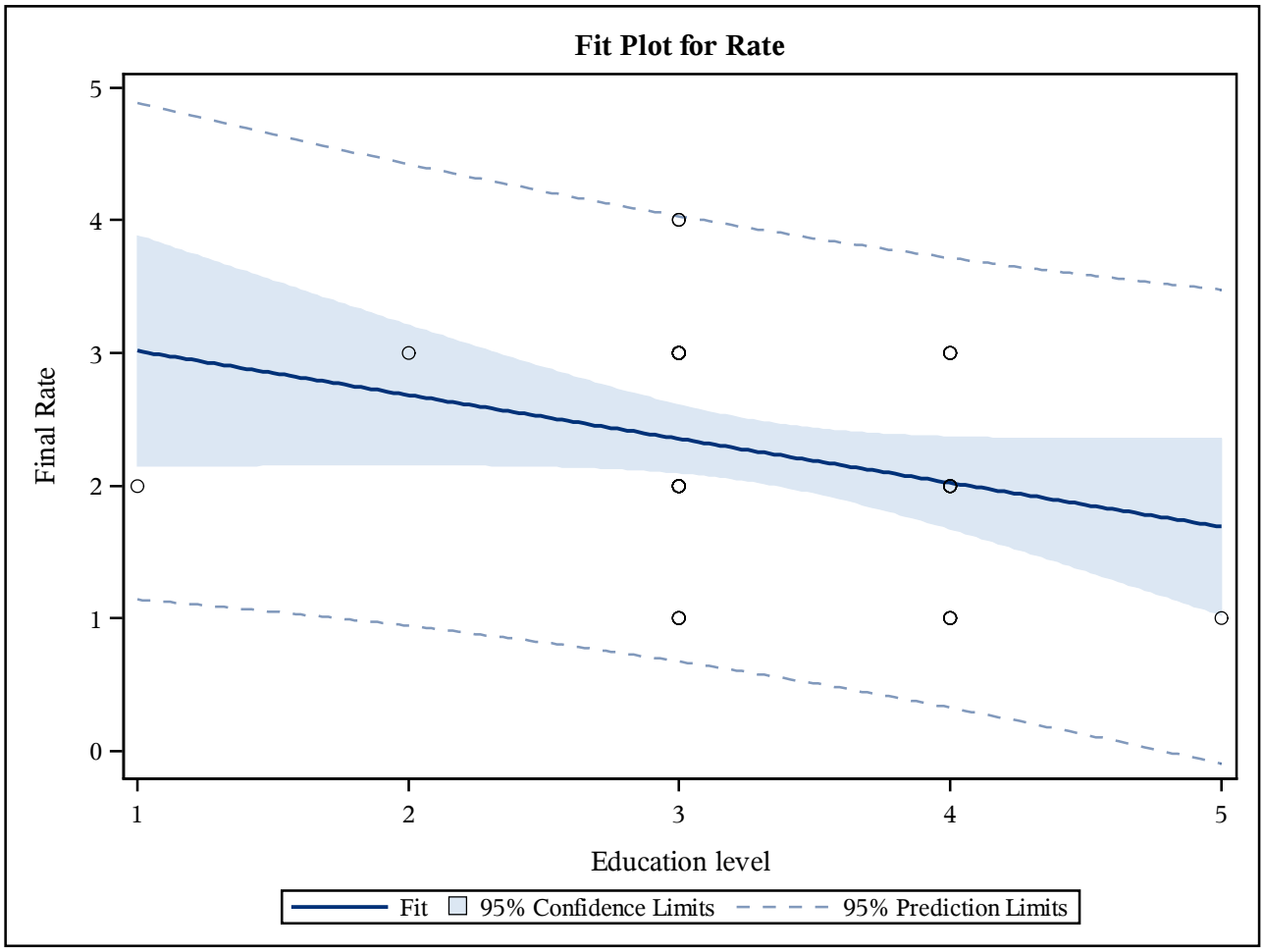
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	2.26151261	2.26151261	3.32	0.0747

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	3.346666667	0.61065711	5.48	<.0001
Education	-0.331428571	0.18202312	-1.82	0.0747

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Career Improvement=1

Number of Observations Read	3
Number of Observations Used	3

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.16666667	0.16666667	0.33	0.6667
Error	1	0.50000000	0.50000000		
Corrected Total	2	0.66666667			

R-Square	Coeff Var	Root MSE	Rate Mean
0.250000	53.03301	0.707107	1.333333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Education	1	0.16666667	0.16666667	0.33	0.6667

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	0.16666667	0.16666667	0.33	0.6667

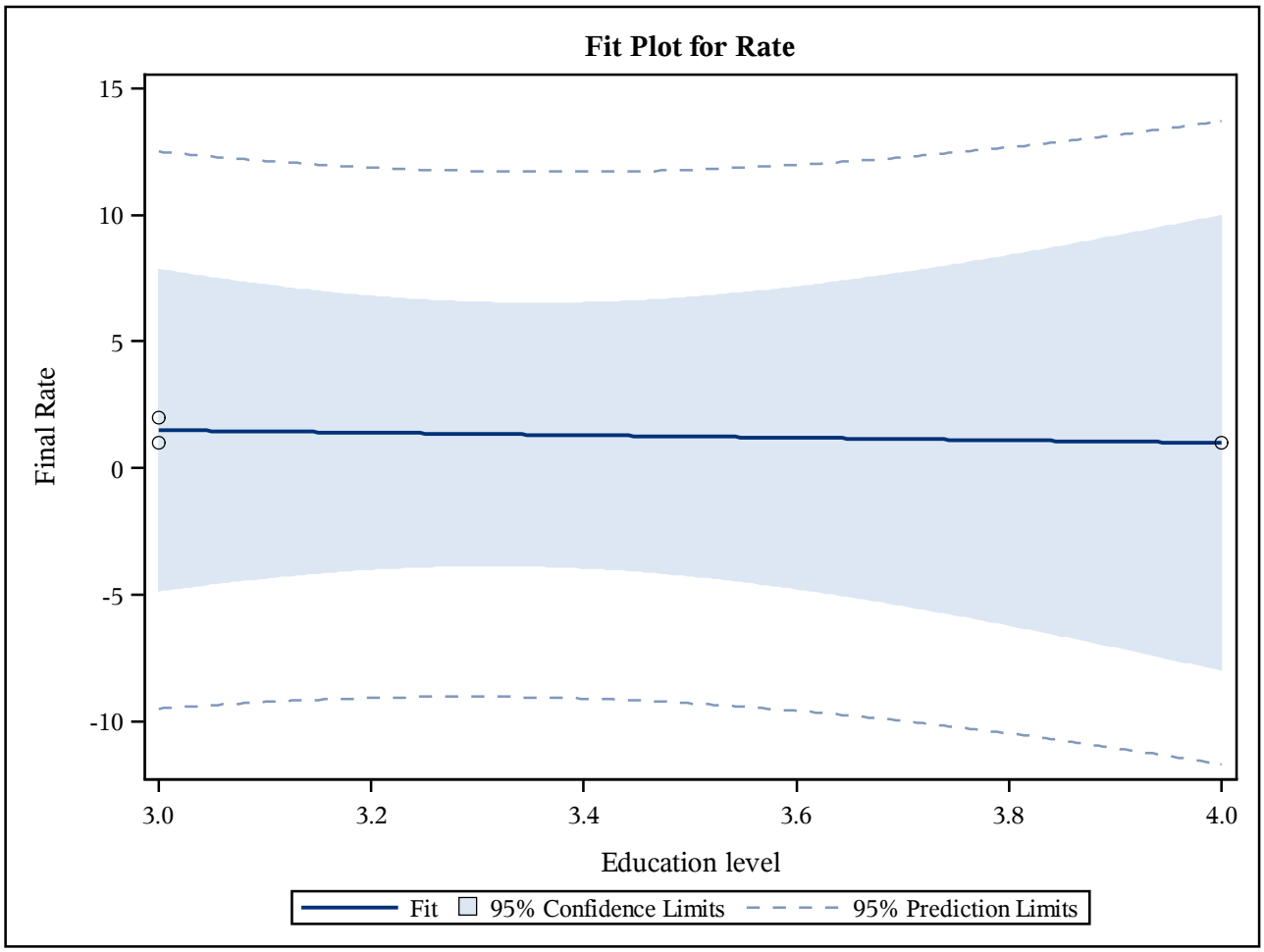
Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	3.000000000	2.91547595	1.03	0.4909
Education	-0.500000000	0.86602540	-0.58	0.6667

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=1



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Career Improvement=2

Number of Observations Read	27
Number of Observations Used	27

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.96452791	0.96452791	1.87	0.1835
Error	25	12.88732394	0.51549296		
Corrected Total	26	13.85185185			

R-Square	Coeff Var	Root MSE	Rate Mean
0.069632	37.27965	0.717978	1.925926

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Education	1	0.96452791	0.96452791	1.87	0.1835

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	0.96452791	0.96452791	1.87	0.1835

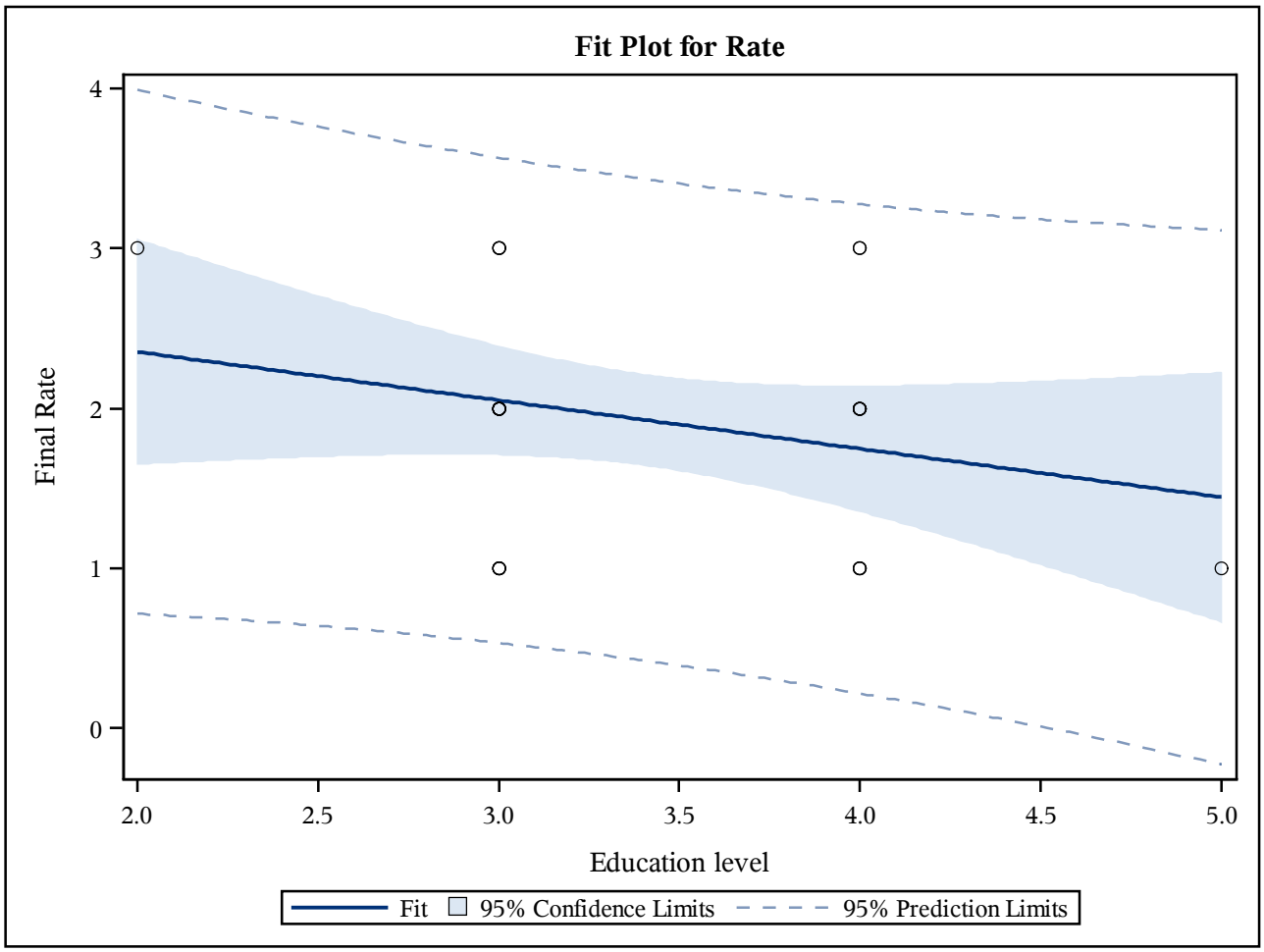
Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	2.957746479	0.76687522	3.86	0.0007
Education	-0.302816901	0.22137781	-1.37	0.1835

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=2



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Career Improvement=3

Number of Observations Read	17
Number of Observations Used	17

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=3

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.03609626	0.03609626	0.08	0.7851
Error	15	7.02272727	0.46818182		
Corrected Total	16	7.05882353			

R-Square	Coeff Var	Root MSE	Rate Mean
0.005114	24.74904	0.684238	2.764706

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Education	1	0.03609626	0.03609626	0.08	0.7851

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	0.03609626	0.03609626	0.08	0.7851

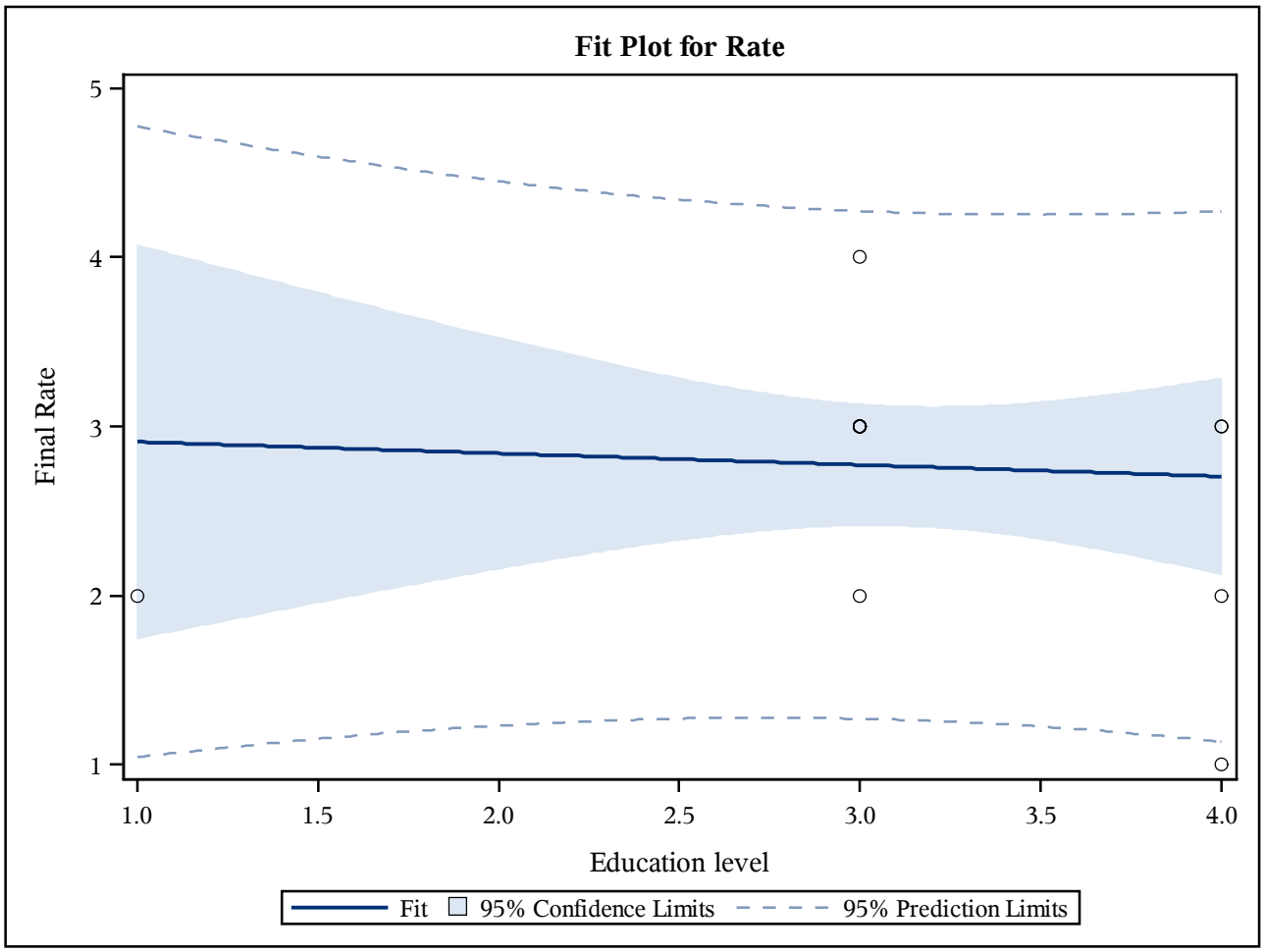
Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	2.977272727	0.78332747	3.80	0.0017
Education	-0.068181818	0.24555273	-0.28	0.7851

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=3



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Career Improvement=4

Number of Observations Read	4
Number of Observations Used	4

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=4

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.00000000	0.00000000	0.00	1.0000
Error	2	2.00000000	1.00000000		
Corrected Total	3	2.00000000			

R-Square	Coeff Var	Root MSE	Rate Mean
0.000000	33.33333	1.000000	3.000000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Education	1	0	0	0.00	1.0000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	0	0	0.00	1.0000

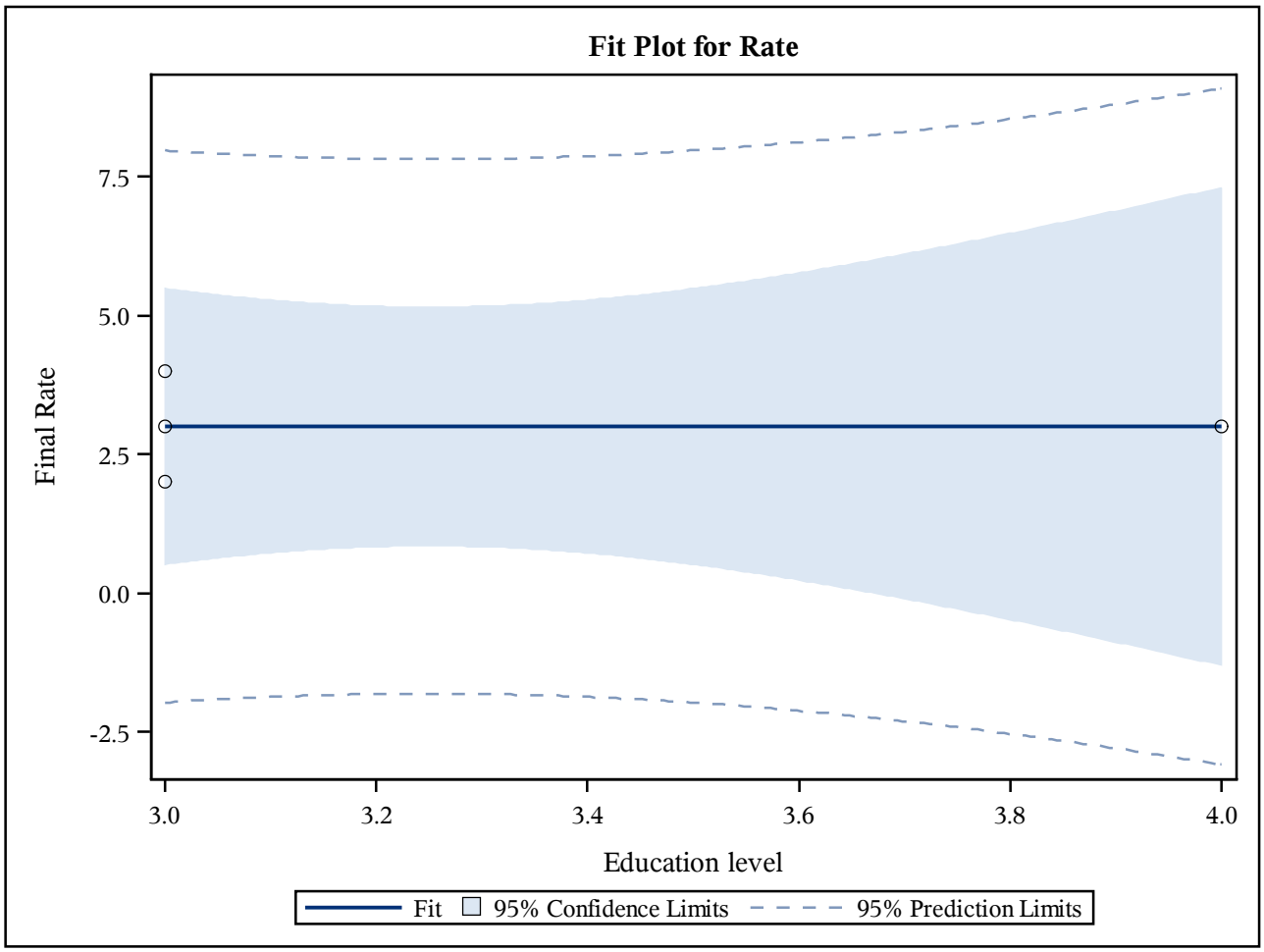
Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	3.000000000	3.78593890	0.79	0.5112
Education	0.000000000	1.15470054	0.00	1.0000

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Career Improvement=4



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
Career	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	13.27622329	1.89660333	3.64	0.0036
Error	43	22.41005122	0.52116398		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.372026	32.01544	0.721917	2.254902

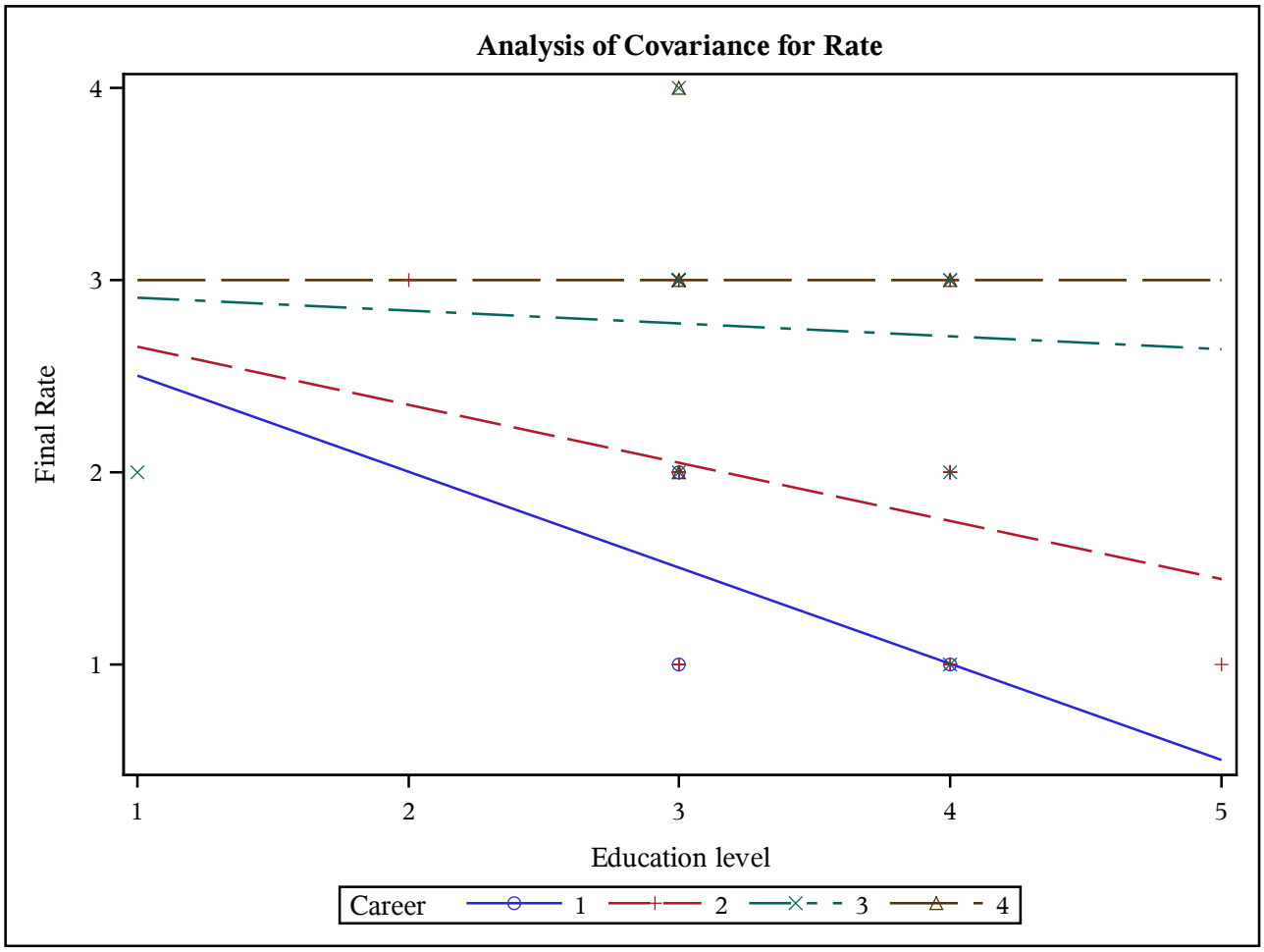
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Career	3	12.10893246	4.03631082	7.74	0.0003
Education*Career	4	1.16729083	0.29182271	0.56	0.6929

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Career	3	0.00028669	0.00009556	0.00	1.0000
Education*Career	4	1.16729083	0.29182271	0.56	0.6929

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate



SAS Program for Two-way ANCOVA Design

The GLM Procedure

Class Level Information		
Class	**Levels**	**Values**
Career	4	1 2 3 4

Number of Observations Read	51
Number of Observations Used	51

SAS Program for Two-way ANCOVA Design

The GLM Procedure

Dependent Variable: Rate Final Rate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	12.94070049	3.23517512	6.54	0.0003
Error	46	22.74557402	0.49446900		
Corrected Total	50	35.68627451			

R-Square	Coeff Var	Root MSE	Rate Mean
0.362624	31.18472	0.703185	2.254902

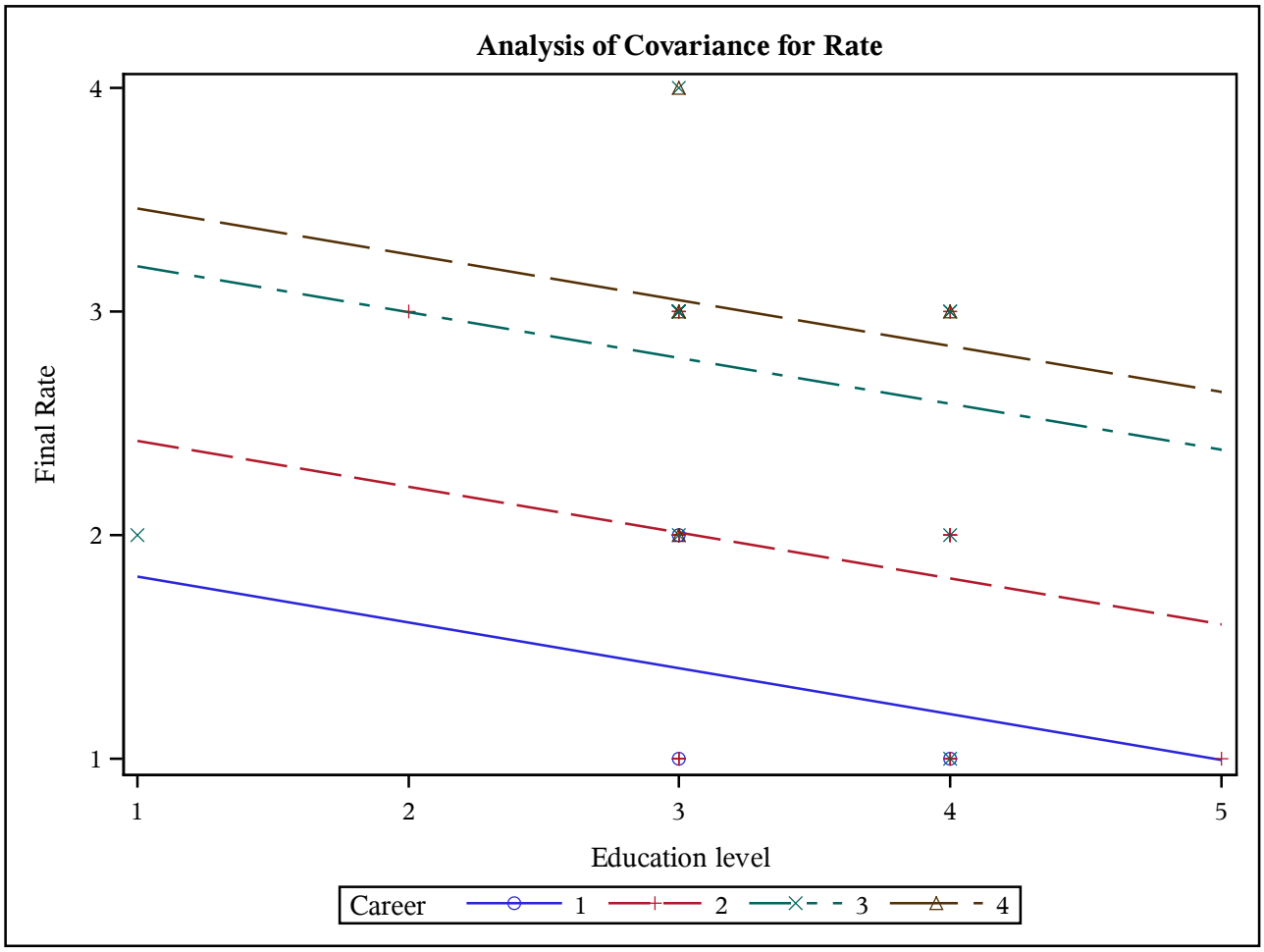
Source	DF	Type I SS	Mean Square	F Value	Pr > F
Education	1	2.26151261	2.26151261	4.57	0.0378
Career	3	10.67918789	3.55972930	7.20	0.0005

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Education	1	0.83176803	0.83176803	1.68	0.2011
Career	3	10.67918789	3.55972930	7.20	0.0005

SAS Program for Two-way ANCOVA Design

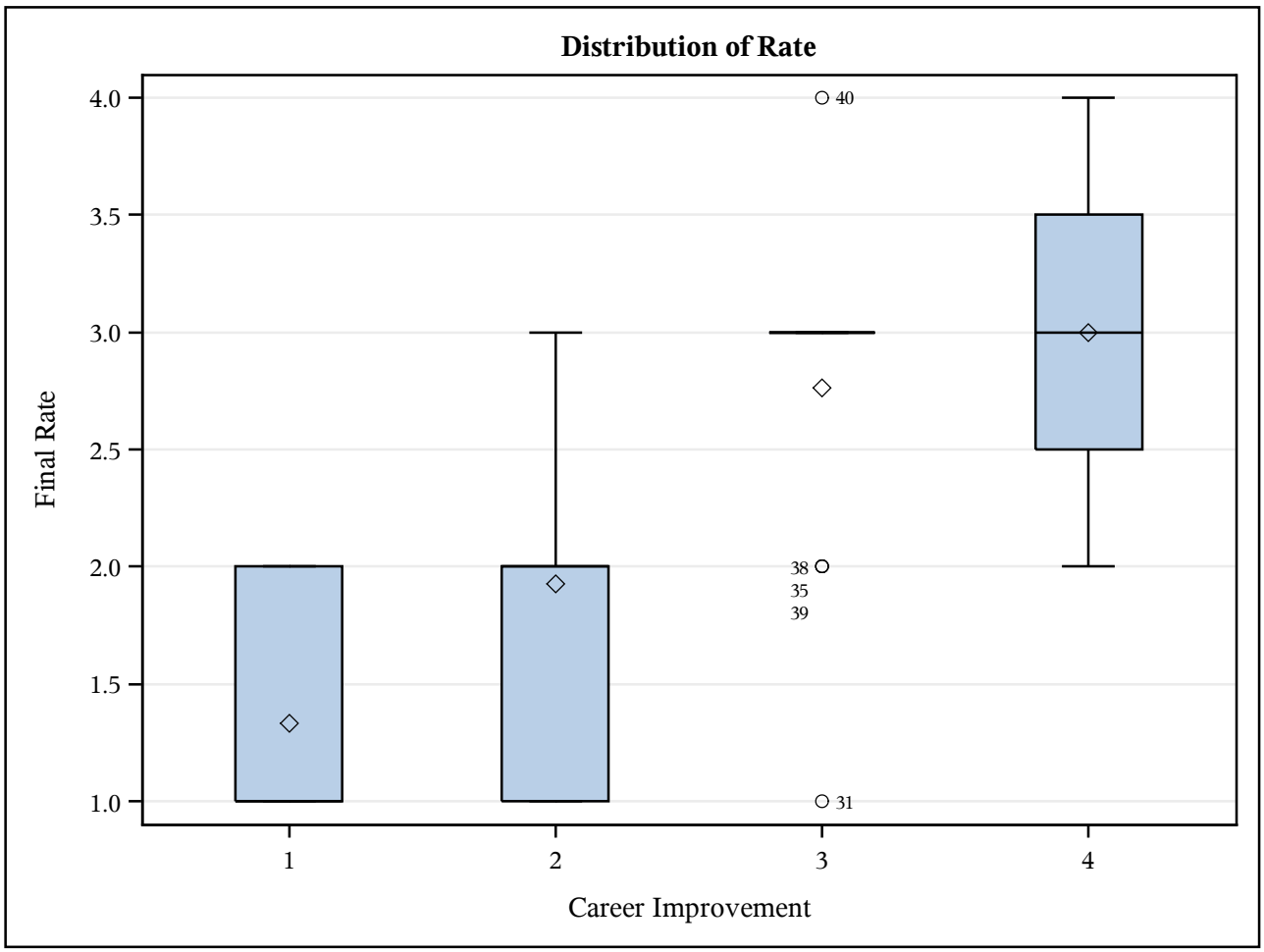
The GLM Procedure

Dependent Variable: Rate Final Rate



SAS Program for Two-way ANCOVA Design

The GLM Procedure



Level of Career	N	Rate		Education	
		Mean	Std Dev	Mean	Std Dev
1	3	1.33333333	0.57735027	3.33333333	0.57735027
2	27	1.92592593	0.72990652	3.40740741	0.63604906
3	17	2.76470588	0.66421116	3.11764706	0.69663055
4	4	3.00000000	0.81649658	3.25000000	0.50000000

SAS Program for Two-way ANCOVA Design

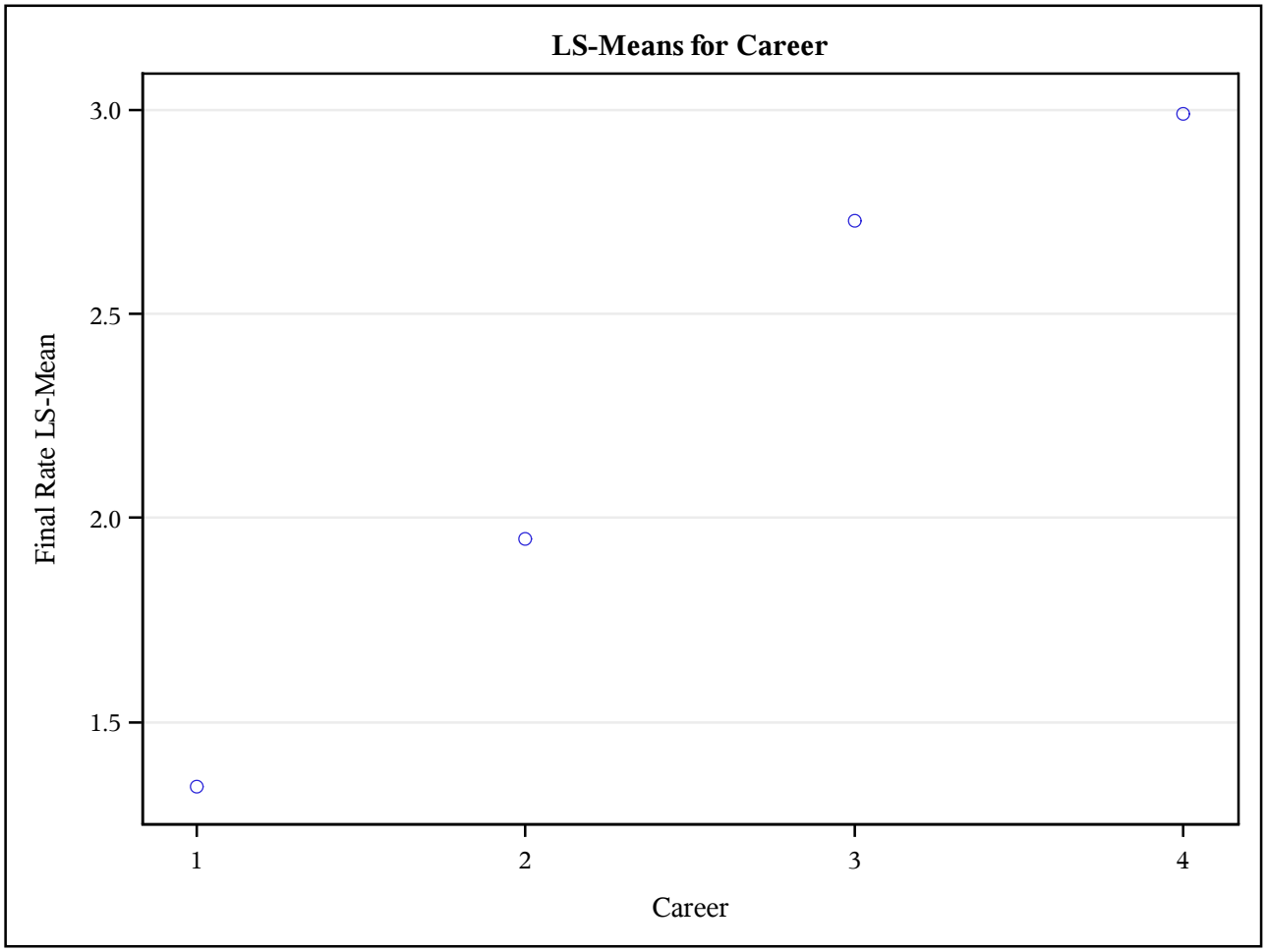
The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer

Career	Rate LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	1.34139137	0.40603153	0.0019	1
2	1.94920469	0.13651306	<.0001	2
3	2.72844474	0.17282383	<.0001	3
4	2.99093471	0.35166192	<.0001	4

Least Squares Means for effect Career
Pr > |t| for H0: LSMean(i)=LSMean(j)

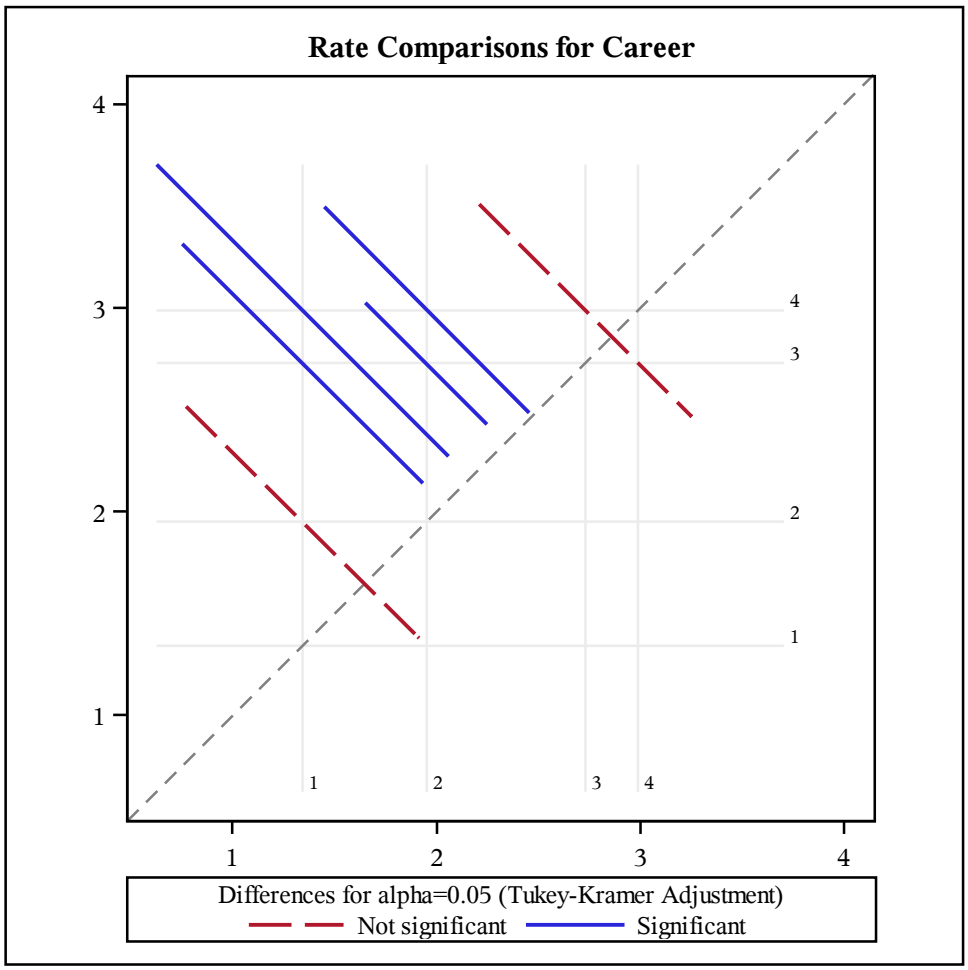
Dependent Variable: Rate

i/j	1	2	3	4
1		0.4938	0.0151	0.0182
2	0.4938		0.0055	0.0399
3	0.0151	0.0055		0.9076
4	0.0182	0.0399	0.9076	



SAS Program for Two-way ANCOVA Design

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey-Kramer



SAS Program for Two-way ANCOVA Design

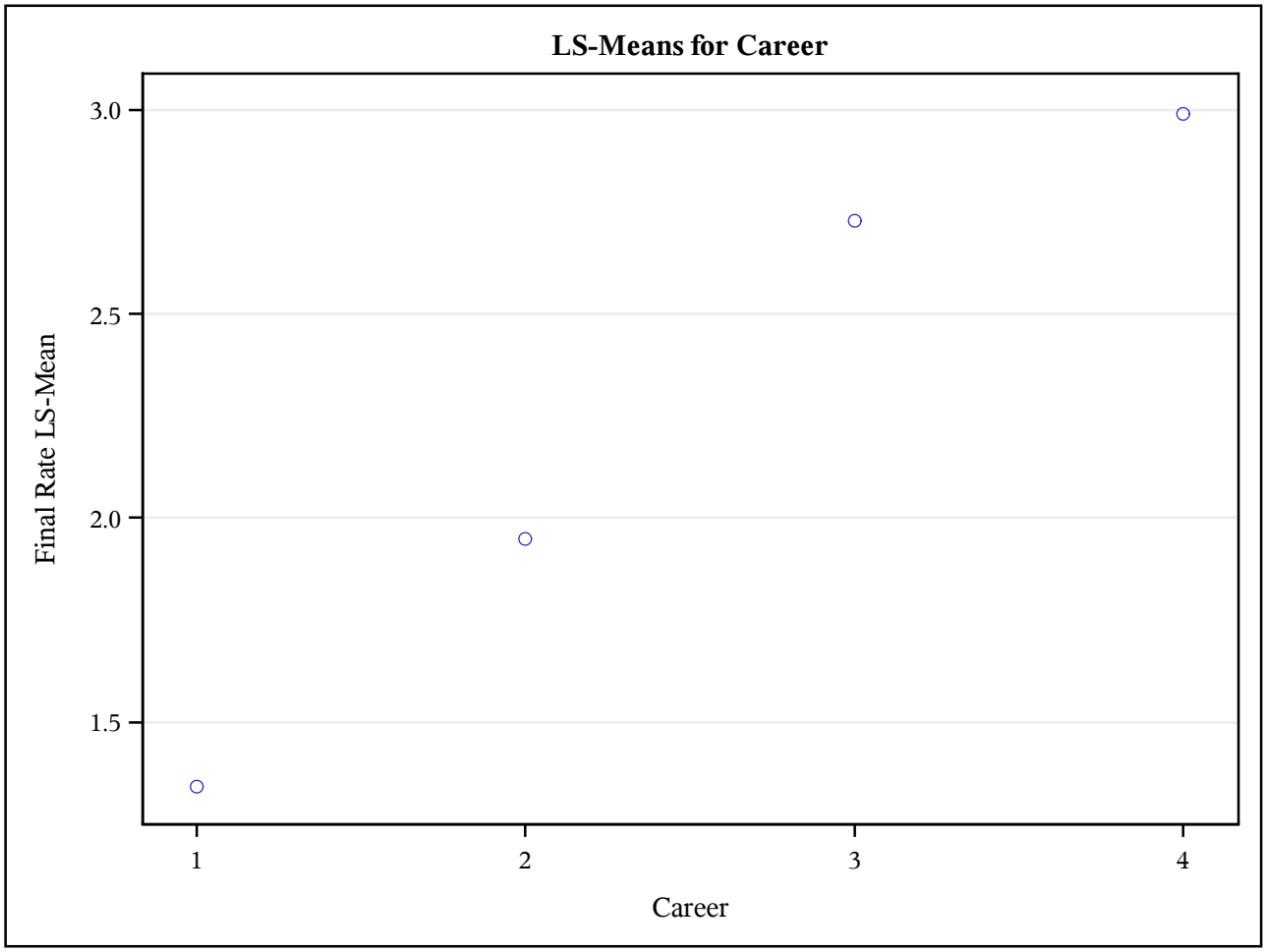
The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

Career	Rate LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	1.34139137	0.40603153	0.0019	1
2	1.94920469	0.13651306	<.0001	2
3	2.72844474	0.17282383	<.0001	3
4	2.99093471	0.35166192	<.0001	4

Least Squares Means for effect Career
Pr > |t| for H0: LSMean(i)=LSMean(j)

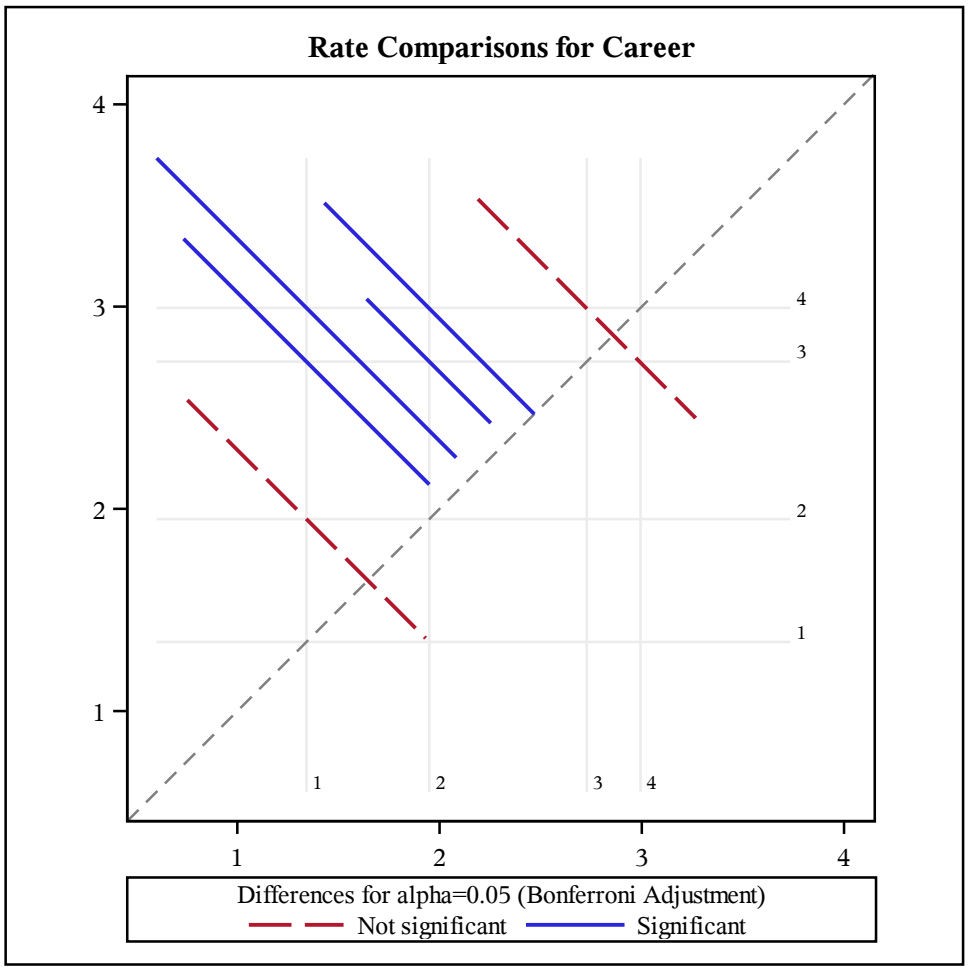
Dependent Variable: Rate

i/j	1	2	3	4
1		0.9745	0.0177	0.0215
2	0.9745		0.0062	0.0497
3	0.0177	0.0062		1.0000
4	0.0215	0.0497	1.0000	



SAS Program for Two-way ANCOVA Design

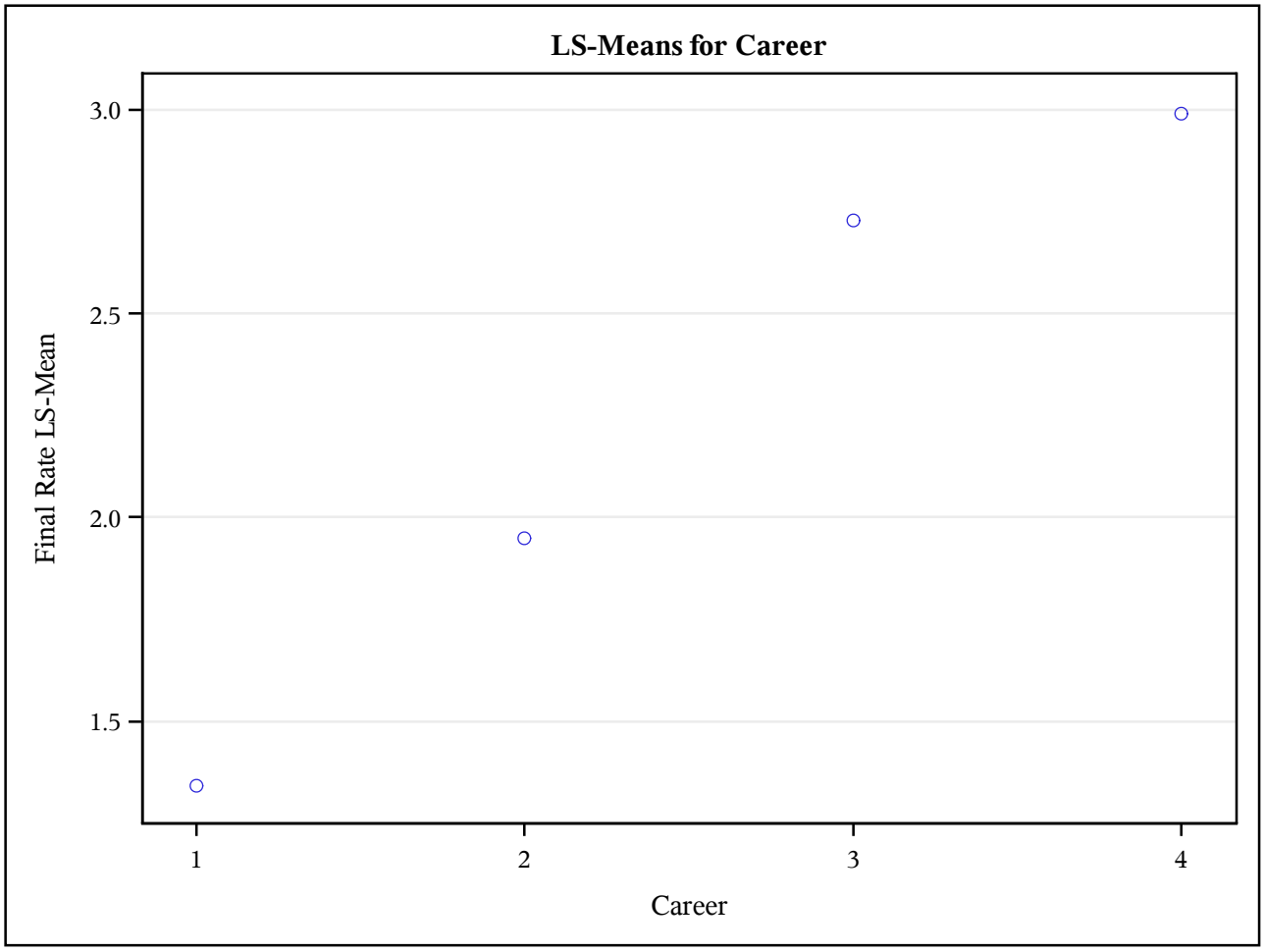
The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni



SAS Program for Two-way ANCOVA Design

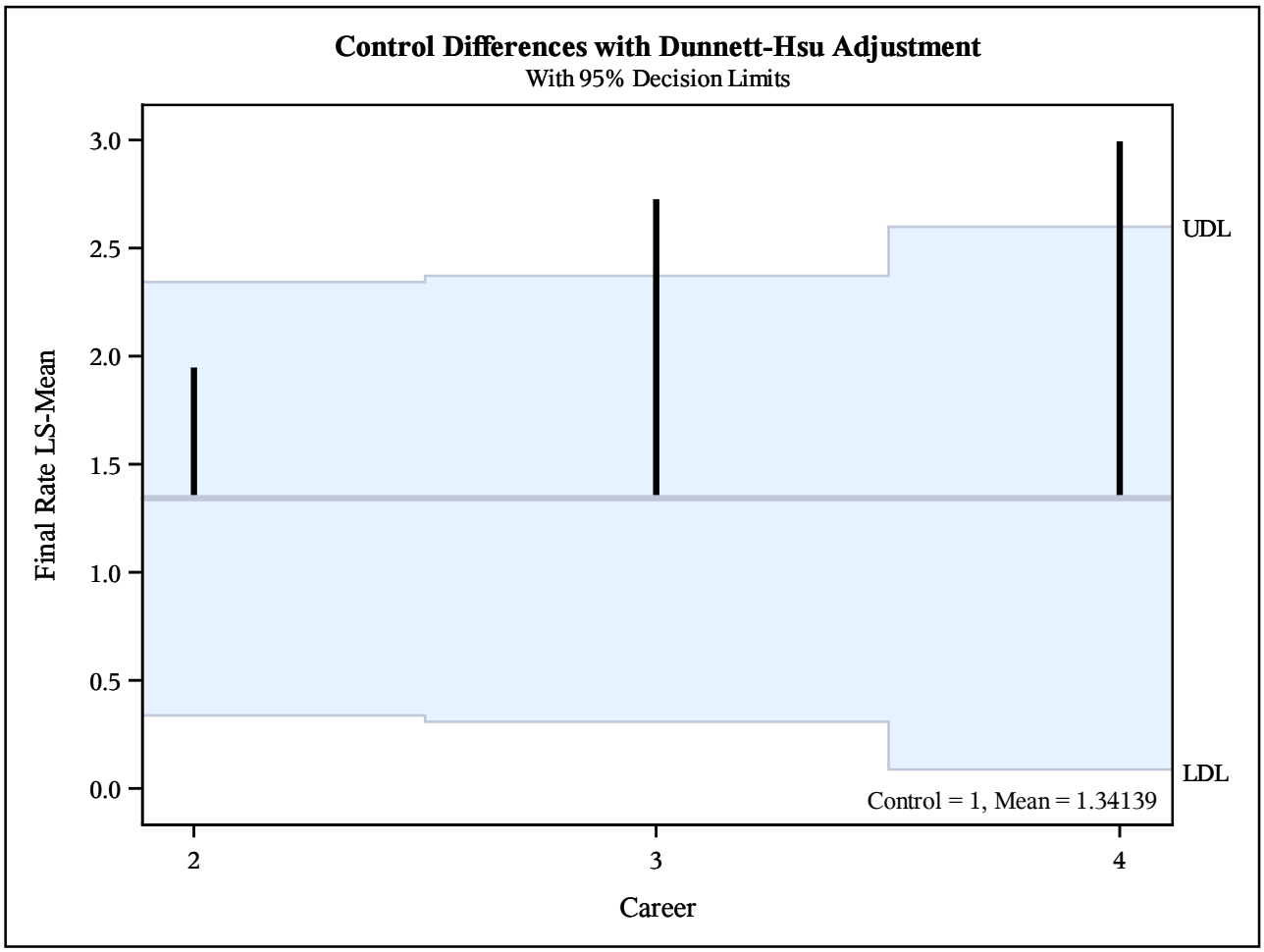
The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Dunnett-Hsu

Career	Rate LSMEAN	Standard Error	H0:LSMEAN=0 Pr > |t|	H0:LSMean=Control Pr > |t|
1	1.34139137	0.40603153	0.0019	
2	1.94920469	0.13651306	<.0001	0.2934
3	2.72844474	0.17282383	<.0001	0.0068
4	2.99093471	0.35166192	<.0001	0.0082



SAS Program for Two-way ANCOVA Design

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Dunnett-Hsu



SAS Program for Two-way ANCOVA Design

The FREQ Procedure

Frequency Percent Row Pct Col Pct

Table of Career by Education

Career(Career Improvement)	Education(Education level) 4	3	5	2	1	Total
1	1 0.87 25.00 3.13	3 2.61 75.00 3.90	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	4 3.48
2	19 16.52 36.54 59.38	29 25.22 55.77 37.66	1 0.87 1.92 100.00	3 2.61 5.77 100.00	0 0.00 0.00 0.00	52 45.22
3	9 7.83 19.15 28.13	36 31.30 76.60 46.75	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2 1.74 4.26 100.00	47 40.87
4	3 2.61 25.00 9.38	9 7.83 75.00 11.69	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	12 10.43
Total	32 27.83	77 66.96	1 0.87	3 2.61	2 1.74	115 100.00

Statistics for Table of Career by Education

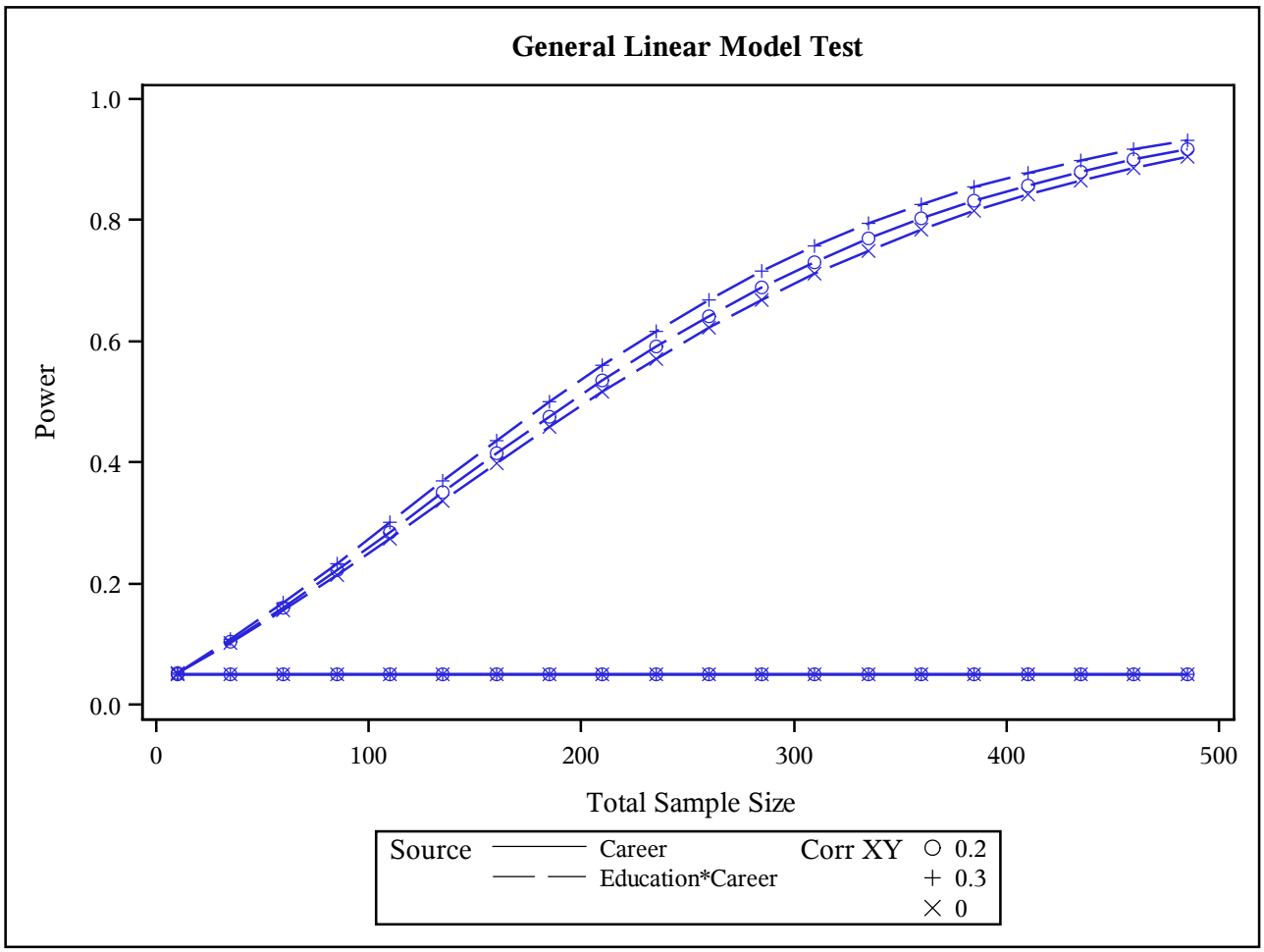
Statistic	DF	Value	Prob
Chi-Square	12	12.2547	0.4254
Likelihood Ratio Chi-Square	12	14.4986	0.2700
Mantel-Haenszel Chi-Square	1	1.5353	0.2153
Phi Coefficient		0.3264	
Contingency Coefficient		0.3103	
Cramer's V		0.1885	

WARNING: 75% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

Sample Size = 115

SAS Program for Two-way ANCOVA Design

The GLMPOWER Procedure



SAS Program for Two-way ANCOVA Design

The GLMPOWER Procedure

Fixed Scenario Elements	
Dependent Variable	Rate
Alpha	0.05
Error Standard Deviation	0.84
Total Sample Size	51
Error Degrees of Freedom	43

Computed Power			
Index	**Source**	**Test DF**	**Power**
1	Career	3	0.050
2	Education*Career	4	0.136

Evaluation survey about one MOOC(Massive Open Online Course) you took

This is a survey about evaluation of a massive open online course (MOOC), and we are interesting about one course you took recently, no matter whether you completed it or not. We know you can answer this questionnaire very well! Now, think a MOOC and choose your answer relevant to this course.

* Required

1. Gender *

- Female
- Male
- I don't want to say

2. The highest level of education you've achieved *

- High School
- College degree
- Bachelor degree
- Masters degree
- Doctorate degree or higher

3. How long have you been working at your job *

- no experience

- ◯ < 1 year
- ◯ 1 to 3 years
- ◯ 3 to 5 years
- ◯ > 5 years

4. Which field is your major or work most relevant to *

If you are working, tell us about your work; if you are a student, tell us about your major

- ◯ Humanities and Arts
- ◯ Business related
- ◯ Science
- ◯ Computer related
- ◯ Engineering
- ◯ Others

5. For this MOOC you took, how far did you complete the course?

If the course is in progress, please choose from the first row; if the course ended, please choose from this last row.

	Just begin	Completed about 25%	Completed about a half	Completed about 75%	Completed all or almost all
The course is in progress	◯	◯	◯	◯	◯
The course ended	◯	◯	◯	◯	◯

6. How about the reputation of the school from which you took this MOOC? *

How this school viewed by the world

- ◯ Almost everyone knows this sckool (about top 10 in the world)
- ◯ This school has very high reputation (about top 50 in the world)
- ◯ This school has high reputation in some fields (about top 100 in the world)
- ◯ Just ok
- ◯ I don't know the reputation of this school

7. For this MOOC you took, is it difficult for you? *

- ◯ It was so hard that I couldn't continue

- ○ It was hard for me, but after more efforts, I could accomplish it
- ○ It was neither too hard or too easy, I could handle it with normal efforts
- ○ It was relative easy for me
- ○ It was too easy for me that I didn't want to learn

8. For this MOOC you took, how valuable are the exercises in this course in helping you learn? *

e.g., quizzes, assignments and projects

- ○ Extremely valuable
- ○ Very valuable
- ○ Moderately valuable
- ○ Slightly valuable
- ○ Not at all valuable

9. For this MOOC you took, how about the professor's pronunciation? *

1 means worst accent and 5 means best pronunciation

- ○ 1 The pronunciation was so bad that I couldn't understand
- ○ 2 The pronunciation was bad
- ○ 3 The pronunciation was ok
- ○ 4 The pronunciation was good
- ○ 5 The pronunciation was so excellent that I could totally understand

10. For this MOOC you took, what kinds of ways the professor took to stimulate your interest? *

- ☐ Off - line discussion
- ☐ Interview with other experts in this field
- ☐ Introduce interesting background knowledge about this topic
- ☐ Have T-shirt or logan of this course
- ☐ Have other ways
- ☐ Nothing

11. For this MOOC you took, how frequent was your interaction with other students in this course? *

e.g., forums, instant messaging software, e-mail, face-to-face discussion etc.

- ○ Very frequent

- Moderately frequent
- Several times
- Not at all

12. For this MOOC you took, how would you rate your improvement in understanding of this field after you learnt this course? *

This field means the field that this MOOC relevant to

- Excellent improvement
- Good improvement
- Slightly improvement
- Not at all

13. For this MOOC you took, how helpful do you think this course will be in advancing your career?

e.g., finding a new job, improving job performance, getting a promotion etc.

- Extremely helpful
- Good helpful
- Slightly helpful
- Not at all

14. For this MOOC you took, how will you rate it?

- Highly recommend
- Recommend
- No bad
- Bad
- Very bad

Submit

100%: You made it.

Never submit passwords through Google Forms.