CHAPTER FOUR
DATA ANALYSIS

4.1 Introduction

This chapter presents the results of data analysis. Statistical Package for Social Sciences (SPSS) 18.0 was used to analyze the data. In general, this chapter provide the findings of the study in accordance to the objectives listed in chapter one. It started with the response rate and statistic of data collection, followed by the profile of the respondents. Analysis on goodness of measures to test the validity and reliability of the variables is discussed next. Finally, the results related to the relationship tests between variables are presented.

4.2 Factors Analysis Factors Associated with E-Learning Adoption

In this study, separate factor analyses were performed on the technological variables, organization variables, personal variables, institutional forces and the impact of e-learning in terms of study and job to ensure that the ratio of variables to sample size was maintained at 1:34 (Hair *et al*., 2006). Another purpose of conducting separate factors analysis is to ensure the stability of the factor loading of the various constructs. During factor analysis, variables were retained according to the following criteria. First factor loading greater than 0.5 and (2) no cross-loading of variables (King & Teo, 1996). In other words, variables will be dropped when loading are less than 0.5 or where their loading are greater 0.5 on two or more factors (King and Teo, 1996).

Hair *et al.*, (2006) suggest three stages to identify factors before deriving the final factor solution. First, the initial unrotated factor matrix is computed to provide preliminary indications of the number of factors to extract. The results could be compared with factors identified from the scree plot. Next, the factors are rotated and that generally improves interpretation by reducing some of the ambiguities which often accompany initial unrotated solutions. The last step is whether to delete any variables from the analysis or to extract a different number of factors. These stages are repeated again by returning to the initial extraction stage, extracting factors and interpreting the factors again.

4.2.1 Factors Analysis on Technology Variables

KMO MSA and BTS were used to determine whether factor analysis is appropriate. The outputs of these tests are shown in Table 4.1 below.

Table 4.1 KMO and BTS for Technological Factors

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.795
Bartlett's Test of Sphericity	Approx. Chi-Square	11012.893
	df	465
	Sig.	.000

Table 4.1 above shows that KMO and MSA value was .795 which is middling according to Kaiser (1974). The BTS value is large (11012.893) and significant ($p<0.001$). The KMO MSA and BTS values indicated that technological variables are suitable for factor analysis.

Table 4.2 presents information regarding the twenty nine possible factors and their relative explanatory power as indicated by their eigenvalues. Using the latent root criterion, six factors could be retained. The scree plot which displays graphically the eigenvalues for each factor shows the curve begins to flatten out from the seventh factors, which indicates there are six factors (Figure 4.1 below).

Table 4.2 Results of Extraction of Component for Technology Factor

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	1	5.276	17.020	17.020	5.276	17.020	17.020	3.992	12.878	12.878
	2	4.009	12.932	29.953	4.009	12.932	29.953	3.782	12.200	25.078
	3	3.554	11.463	41.416	3.554	11.463	41.416	3.694	11.917	36.995
	4	3.439	11.092	52.508	3.439	11.092	52.508	3.693	11.914	48.909
	5	2.830	9.130	61.638	2.830	9.130	61.638	3.564	11.497	60.405
	6	2.762	8.911	70.549	2.762	8.911	70.549	3.145	10.144	70.549
	7	.926	2.986	73.535						
	8	.789	2.546	76.081						
	9	.684	2.208	78.289						
	10	.658	2.122	80.411						
	11	.610	1.966	82.378						
	12	.503	1.623	84.000						
	13	.474	1.528	85.528						
	14	.462	1.491	87.020						
	15	.419	1.353	88.373						
dimension0	16	.383	1.234	89.608						
	17	.338	1.089	90.697						
	18	.315	1.018	91.714						
	19	.307	.990	92.705						
	20	.285	.920	93.625						
	21	.282	.911	94.536						
	22	.254	.818	95.354						
	23	.242	.780	96.135						
	24	.232	.749	96.884						
	25	.206	.663	97.547						
	26	.178	.573	98.120						
	27	.157	.507	98.627						
	28	.147	.474	99.101						
	29	.113	.364	99.465						
	30	.095	.308	99.773						
	31	.070	.227	100.000						

Extraction Method: Principal Component Analysis.

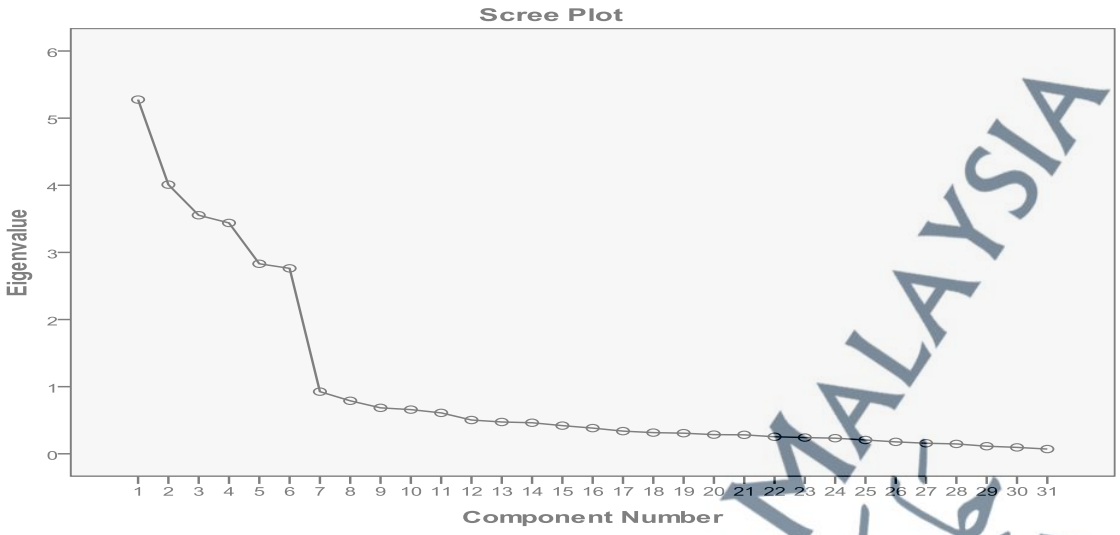

Figure 4.1 Scree Plot for Technological Factors

The next step to determine the number of factors is based on factor loading using varimax rotation criterion to reduce the variables in each factor and make them more meaningful.

Table 4.3 Loading on Final six Factors Using Varimax Rotation

	Component					
	1	2	3	4	5	6
TCom2	**.924**					
TCom3	**.884**					
TCom4	**.867**					
TCom1	**.858**					
TCom5	**.838**					
TRA6						
IQ5		**.919**				
IQ3		**.861**				
IQ2		**.851**				
IQ1		**.832**				
IQ4		**.804**				
TRA5			**.865**			
TRA2			**.864**			
TRA4			**.858**			
TRA1			**.842**			
TRA3			**.823**			
Tlex2				**.902**		
Tlex1				**.868**		
Tlex3				**.846**		
Tlex5				**.816**		
Tlex4				**.787**		

SyQ3					**.889**	
SyQ4					**.875**	
SyQ5					**.864**	
SyQ2					**.796**	
SyQ1					**.764**	
SeQ2						**.822**
SeQ4						**.817**
SeQ3						**.800**
SeQ5						**.767**
SeQ1						**.714**
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 5 iterations.						

Table 4.3 above showed the final factor structure and the component variables. Six different factors with the variables in each factor were identified. The table also showed thirty one items were retained by the six factors which explained about 70 percent of the variance (Table 4.2 above).

In order to provide meanings to each factor, these factors were labeled based on the meanings of the variables in each factor. Factor 1 consists of 5 variables related to compatibility; therefore, this factor was labeled as compatibility. Factor 2 had five variables related to information quality, so this factor was labeled as information quality. Factor 3 had six variables related to relative advantage; there was a delete one variable 'TRA 6', which had values less than 0.5, so this factor was labeled as relative advantage. Factor 4 had five variables related to complexity. This factor was labeled as complexiy. Factor 5 had five variables and all of them were related to system quality, hence, it was labeled as system quality. Factor 6 had five variables and all of them were related to service quality, hence, it was labeled as service quality.

To test the reliability of these factors, reliability test using Cronbach's alpha was conducted to determine the consistency of the constructs. Cronbach's alpha ranges from 0 to 1.0 and high scores above 0.70 suggest that the measurement is reliable (Nunnally, 1978). In this study, Table 4.4 below shows the alpha-value ranges from .926 to .848 for the final six factors.

Table 4.4 Summary of Reliability Test for Final 6 Factors for Technological Factors

Factor	N. item	Alpha-Value
Compatibility	5	.926
Information quality	5	.893
Relative advantage	5	.908
Complexity	5	.908
System quality	5	.912
Service quality	5	.848

The results showed that the Cronbach's alpha values were above the minimum accepted value of 0.7 suggested by Nunnally (1978). This provides confidence to use these factors for further analysis.

4.2.2 Factors Analysis on Organisation Variables

In testing whether factor analysis was appropriate for the organizational variables, similar tests using KMO MSA and BTS were conducted.

Table 4.5 KMO and BTS for Organizational Factors

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.854
Bartlett's Test of Sphericity	Approx. Chi-Square	7540.229
	df	120
	Sig.	.000

The KMO measurement for organizational variables showed a value of 0.854 (Table 4.5). This reflects a meritorious adequacy according to Kaiser's scale and appropriate for factor analysis to be conducted. The large BTS of 7540.229 and a very low significance level (P> 0.001) provided further confidence to conduct factor analysis. Overall, the results from the KMO measure and BTS clearly reflect that the sixteen organizational items met the criteria for subsequent factor analysis.

Table 4.6 below showed the results of components extraction for organizational variables using latent root criterion. Three factors were extracted which explained about 73 percent of the variance. Figure 4.2 below represents the eigenvalues for each factor in the scree plot provided support for the extraction results. The results showed the curve flattens out from the third factor.

Table 4.6 Results of Extraction of Component for Organizational Factors

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension0	1	5.837	36.481	36.481	5.837	36.481	36.481	4.389	27.430	27.430
	2	3.060	19.128	55.608	3.060	19.128	55.608	4.093	25.584	53.014
	3	2.667	16.669	72.278	2.667	16.669	72.278	3.082	19.264	72.278
	4	.833	5.206	77.484						
	5	.632	3.953	81.437						
	6	.567	3.543	84.979						
	7	.412	2.575	87.554						
	8	.350	2.188	89.742						
	9	.312	1.951	91.693						
	10	.279	1.744	93.437						
	11	.246	1.535	94.971						
	12	.234	1.464	96.435						
	13	.209	1.306	97.741						
	14	.181	1.133	98.875						
	15	.177	1.103	99.978						
	16	.004	.022	100.000						
Extraction Method: Principal Component Analysis.										

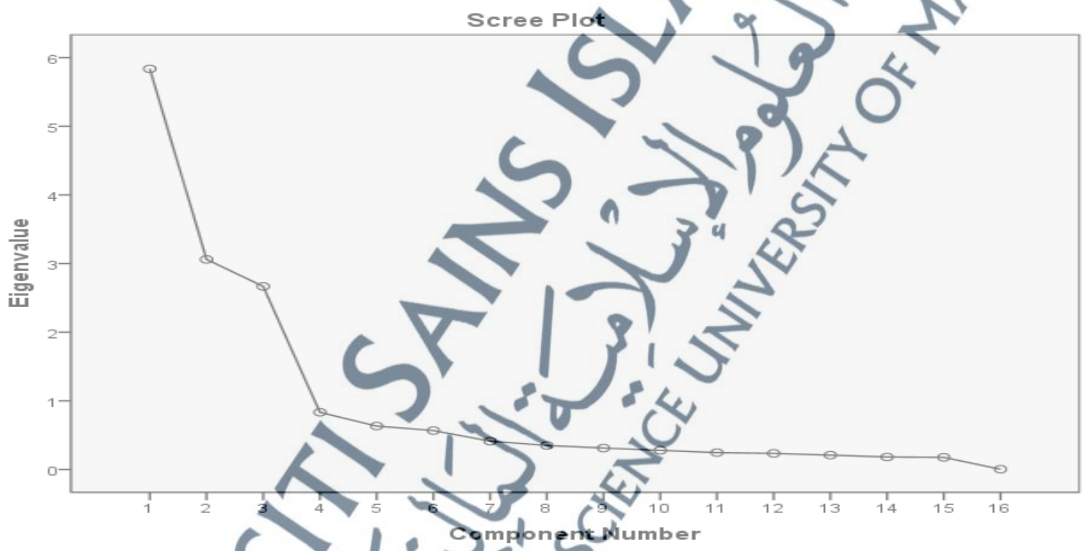

Figure 4.2 Scree Plot for Organizational Factors

The next step to determine the number of factors is based on factor loading using varimax rotation criterion to reduce the variables in each factor and make them more meaningful.

Table 4.7 Loading on Final Three Facto Using Varimax Rotation

	Component		
	1	2	3
OCu4	**.885**		
OCu2	**.858**		
OCu1	**.820**		
OCu6	**.837**		
OCu5	**.840**		
OCu3	**.794**		
OTMS4		**.929**	
OTMS5		**.927**	
OTMS2		**.868**	
OTMS3		**.867**	
OTMS1		**.842**	
OStr4			**.864**
Ostr3			**.839**
OStr2			**.827**
OStr1			**.802**
OStr5			**.534**
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Table 4.7 above showed the final factor structures and the component variables comprised of three factors. In addition, the table showed sixteen out of the sixteen variables were retained.

In order to provide meanings to each factor, these factors were labeled based on the meanings of the variables in each factor. Factor one had six variables related to organizational culture; this factor was labeled as organizational culture. Factor two had five variables related to organizational top management support. Therefore, this factor

was labeled as top management support. Factor three consists of five variables all related to organizational structure. Therefore, this factor was labeled as organizational structure.

Using Cronbach's alpha, reliability test was conducted to determine the consistency of these factors. Table 4.8 shows the values of Cronbach's alpha for the final three factors and they were above the minimum accepted value 0.7 suggested by Nunnaly (1978). The results provided confidence to use these factors for subsequent analysis.

Table 4.8 Summary of Reliability Test for Final three Factors for Organizational Factor

Factor	No. of Variables	Alpha-Value
Top management support	5	.944
organizational culture	6	.836
organizational structure	5	.925

4.2.3 Factors Analysis on Personal Variables

Factor analysis was conducted on these variables showed the KMO value of 0.832 (Table 4.9). This had exceeded the value of .50 recommended by Kaiesr (1974) which indicates that the data were middling and hence appropriate for factor analysis. The BTS value of 7831.513 was highly significant (p=.00), supporting the correlation matrix (Table 4.20). The result of scree plot in Figure 4.3 also showed five factors could be identified as the curve began to flatten after the fifth factor.

Table 4.9 KMO and BTS for Personal Factors

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.832
Bartlett's Test of Sphericity	Approx. Chi-Square	7831.513
	df	210
	Sig.	.000

The results for extracted components for personal variables are shown in Table 4.10. Five factors were extracted which explained about 78 percent of the variance.

Table 4.10 Results of Extraction of Component for Personal Factors

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension0	1	4.574	21.781	21.781	4.574	21.781	21.781	4.069	19.377	19.377
	2	4.211	20.050	41.832	4.211	20.050	41.832	3.320	15.809	35.186
	3	3.089	14.710	56.542	3.089	14.710	56.542	3.120	14.858	50.044
	4	2.825	13.452	69.993	2.825	13.452	69.993	3.015	14.358	64.402
	5	1.680	8.000	77.993	1.680	8.000	77.993	2.854	13.591	77.993
	6	.571	2.721	80.714						
	7	.454	2.162	82.876						
	8	.407	1.936	84.812						
	9	.402	1.913	86.724						
	10	.351	1.670	88.395						
	11	.343	1.633	90.028						
	12	.315	1.501	91.529						
	13	.287	1.368	92.897						
	14	.281	1.339	94.236						
	15	.242	1.152	95.388						
	16	.211	1.006	96.394						
	17	.190	.906	97.300						
	18	.184	.875	98.175						
	19	.165	.785	98.960						
	20	.122	.581	99.541						
	21	.096	.459	100.000						
Extraction Method: Principal Component Analysis.										

Figure 4.3 which presented the eigenvalues for each factor in the scree plot further supported the extraction results. The curve flattened out from the fifth factor which indicated there were five factors.

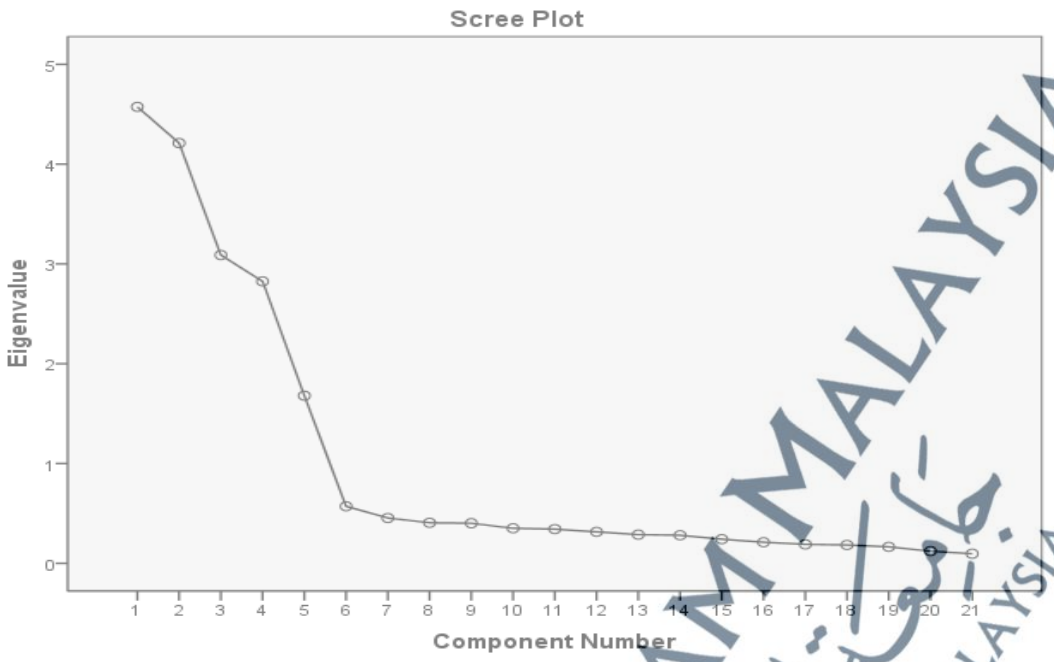

Figure 4.3: Scree Plot for Personal Factors

The next step is to determine the number of factors is based on factor loading using Varimax rotation criterion to reduce the variables in each factor and make them more meaningful (Table 4.11).

Table 4.11 Loading on Final Five Factors Using Varimax Rotation

	Component				
	1	2	3	4	5
PPAD2	**.934**				
PPAD3	**.906**				
PPAD1	**.886**				
PPAD4	**.883**				
PPAD5	**.870**				
PSC1		**.938**			
PSC2		**.914**			
PSC4		**.879**			
PSC3		**.879**			
PCI2			**.903**		
PCI1			**.877**		
PCI4			**.868**		
PCI3			**.866**		

PSS1				**.891**	
PSS2				**.849**	
PSS3				**.842**	
PSS4				**.800**	
PEE1					**.860**
PEE4					**.853**
PEE3					**.837**
PEE2					**.708**
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 5 iterations.					

The result showed that the final factor structures and the component variables comprised of twenty one factors. The results showed only twenty one variables were retained by the five factors. However, Table 4.11 showed the 21 variables for the personal were similar to the original factors. Therefore, the five labels were retained. Factor 1 consists of five variables related to professional advancement. Hence, this factor was labeled professional advancement. Factor 2 had four variables related to social contact. This factor was labeled as social contact. Factor 3 has four variables related to cognitive interest. Thus, this factor was labeled as cognitive interest. Factor 4 had four variables related to social stimulation. This factor was labeled as social stimulation. Factor 5 consisted of four variables related to external expectations. Consequently, this factor was labeled as external expectations.

To test for the reliability of these factors, reliability test using Cronbach's alpha was conducted to determine the consistency of the constructs. Table 4.12 shows the values of Cronbach's alpha for the final five factors. The results showed the values of Cronbach's alpha were above the minimum accepted value of 0.70 suggested by Nunnaly (1978). These results provide confidence that the factors were highly reliable and can be used for further analysis.

Table 4.12 Summary of Reliability Test for Final 5 Factors for Personal Factors

Factor	No. of Variables	Alpha-Value
Professional advancement	5	.941
Social contact	4	.928
Cognitive interest	4	.904
Social stimulation	4	.890
External expectations	4	.858

4.2.4 Factors Analysis on Institutional Forces

In testing whether factor analysis was appropriate for the institutional forces, KMO and Bartlett test were used, with results shown in Table 4.13.

Table 4.13 KMO and BTS for Institutional Forces

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.743
Bartlett's Test of Sphericity	Approx. Chi-Square	3677.708
	df	36
	Sig.	.000

Table 4.13 showed the value of KMO MSA was .743 percent which is 'meddling' according to Kaiser (1974). The value for BTS is large (3677.708) and significant ($p<0.001$). The KMO MSA and BTS values indicated that factor analysis is suitable for these variables.

The results for extracted variables for institutional forces variables are shown in Table 4.14. Two factors were extracted which explained 85 percent of the variance.

Table 4.14 Results of Extraction of Component for Institutional Forces

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension0	1	3.986	44.284	44.284	3.986	44.284	44.284	2.618	29.085	29.085
	2	2.078	23.091	67.375	2.078	23.091	67.375	2.537	28.194	57.279
	3	1.549	17.206	84.581	1.549	17.206	84.581	2.457	27.301	84.581
	4	.413	4.588	89.169						
	5	.350	3.888	93.057						
	6	.279	3.099	96.157						
	7	.176	1.958	98.115						
	8	.107	1.183	99.298						
	9	.063	.702	100.000						
Extraction Method: Principal Component Analysis.										

Figure 4.4 which presented the eigenvalues for each factor in the scree plot further supported the extraction results. The curve flattened out from the second factor which indicated there were three factors.

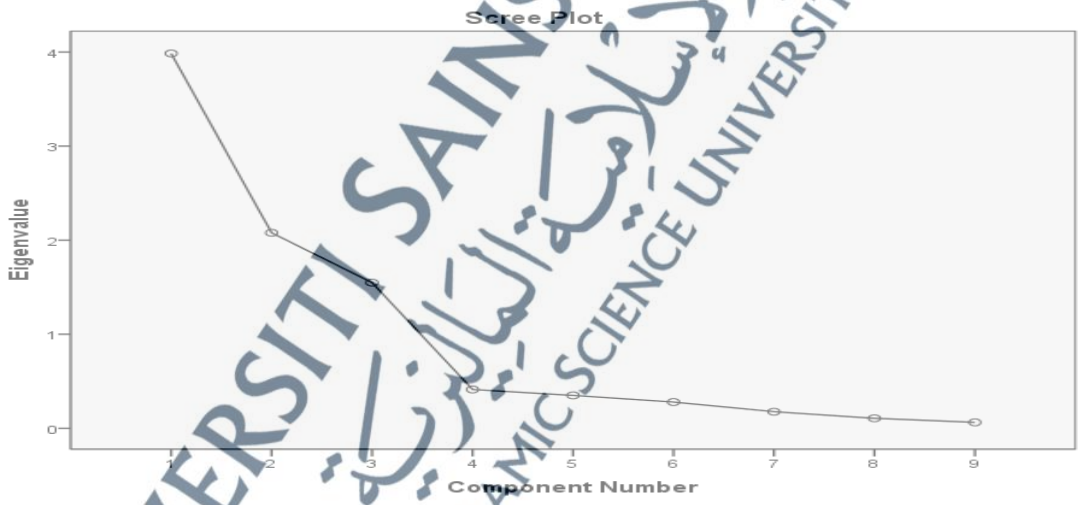

Figure 4.4 Scree Plot for Institutional Forces

Using the varimax rotation the variables were loaded and reduced to 3 meaningful factors (Table 4.15).

Table 4.15 Loading on Final Factor Using Varimax Rotation

	Component		
	1	2	3
IMF1	**.951**		
IMF3	**.936**		
IMF2	**.846**		
INF3		**.937**	
INF2		**.917**	
INF1		**.792**	
ICF3			**.920**
ICF1			**.895**
ICF2			**.841**
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Table 4.15 showed the final factor structure and the component variables. Three different factors were identified. The table also showed nine items were retained by the three factors which explained about 85 percent of the variance (Table 4.14 above).

In order to provide meanings to each factor, these factors were labeled based on the meanings of the variables in each factor. Factor 1 consists of three components related to mimetic forces. Hence, this factor was labeled as mimetic forces. Factor 2 consists of three components related to normative forces. Hence, this factor was labeled as normative forces. Factor 3 consisted of three variables related to coercive forces. Consequently, this factor was labeled as coercive forces.

To determine the consistency of the constructs, reliability test was conducted using Cronbach's alpha. Cronbach's alpha ranges from 0 to 1.0 and high scores above 0.70 suggest that the measurement is reliable (Nunnally, 1978). Table 4.16 shows the

alpha-value ranges from .920 to .882 for the final two factors extracted from factor analysis.

Table 4.16 Summary of Reliability Test for Final Three Factors for Institutional Forces

Factor	No. of Variables	Alpha-Value
Mimetic forces	3	.920
Normative forces	3	.900
Coercive forces	3	.882

4.3 Factor Analysis on Outcome of E-Learning

4.3.1 Impact of E-Learning on Adult Workers in terms of their Study

In testing whether factor analysis was appropriate for the e-learning impact on adult workers in terms of their study, KMO and Bartlett test were used, with results shown in Table 4.17.

Table 4.17 KMO and BTS for Impact of E-Learning in terms of Study

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.849
Bartlett's Test of Sphericity	Approx. Chi-Square	1933.390
	df	21
	Sig.	.000

Table 4.17 showed the value of KMO MSA was 0.849 percent which is 'meddling' according to Kaiser (1974). The value for BTS is large (1933.390) and

significant ($p<0.001$). The KMO MSA and BTS values indicated that factor analysis is suitable for these variables.

The results for extracted variables for e-learning impact on their study variables are shown in Table 4.18. One factors were extracted which explained 61 percent of the variance.

Table 4.18 Results of Extraction of Component for Impact of E-Learning in terms of Study

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	1	4.226	60.370	60.370	4.226	60.370	60.370
	2	.806	11.520	71.889			
	3	.660	9.424	81.314			
	4	.511	7.301	88.615			
	5	.310	4.435	93.049			
	6	.282	4.027	97.076			
	7	.205	2.924	100.000			
Extraction Method: Principal Component Analysis.							

Figure 4.5 which presented the eigenvalues for each factor in the scree plot further supported the extraction results. The curve flattened out from the second factor which indicated there were one factors.

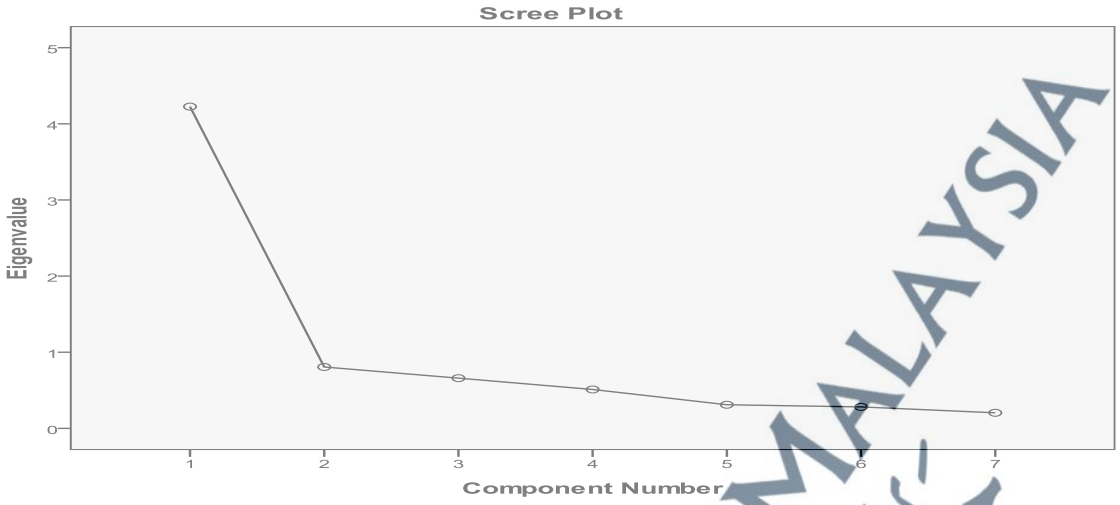

Figure 4.5 Scree Plot for Impact of E-Learning in terms of Study

Using the varimax rotation the variables were loaded and reduced to 1 meaningful factor (Table 4.19).

Table 4.19 Loading on Final Factor Using Varimax Rotation

	Component
	1
Study6	**.850**
Study5	**.820**
Study3	**.803**
Study2	**.791**
Study7	**.742**
Study1	**.731**
Study4	**.690**
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Factor 1 consisted of seven variables related to academic performance. Consequently, this factor was labeled as academic performance.

To determine the consistency of the constructs, reliability test was conducted using Cronbach's alpha. Cronbach's alpha ranges from 0 to 1.0 and high scores above 0.70 suggest that the measurement is reliable (Nunnally, 1978). Table 4.30 shows the alpha-value 0.889, for the final two factors extracted from factor analysis.

Table 4.20 Summary of Reliability Test for Final two Factors for Impact of E-Learning on their Study

Factor	No. of Variables	Alpha-Value
Academic performance	7	0.889

4.3.2 Impact of E-Learning on Adult Workers in terms of their Performance

In testing whether factor analysis was appropriate to examine e-learning impact on adult workers in terms of their job, KMO and Bartlett test were used. The results are shown in Table 4.21.

Table 4.21 KMO and BTS for Impact of E-Learning in terms of Job

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.907
Bartlett's Test of Sphericity	Approx. Chi-Square	2780.481
	df	21
	Sig.	.000

Table 4.21 showed the value of KMO MSA was .907 which is 'meddling' according to Kaiser (1974). The value for BTS is large (2780.481) and significant ($p<0.001$). The KMO MSA and BTS values indicated that factor analysis is suitable for these variables.

The results for extracted variables for e-learning impact on their job variables are shown in Table 4.22. One factor was extracted which explained about 72 percent of the variance.

Table 4.22 Results of Extraction of Component for Impact of E-Learning in terms of Job

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
dimension0	1	4.985	71.220	71.220	4.985	71.220	71.220
	2	.665	9.505	80.725			
	3	.428	6.110	86.835			
	4	.282	4.034	90.869			
	5	.253	3.612	94.481			
	6	.209	2.987	97.469			
	7	.177	2.531	100.000			
Extraction Method: Principal Component Analysis.							

Figure 4.6 which presented the eigenvalues for each factor in the scree plot further supported the extraction results. The curve flattened out from the first factor which indicated there was one factor.

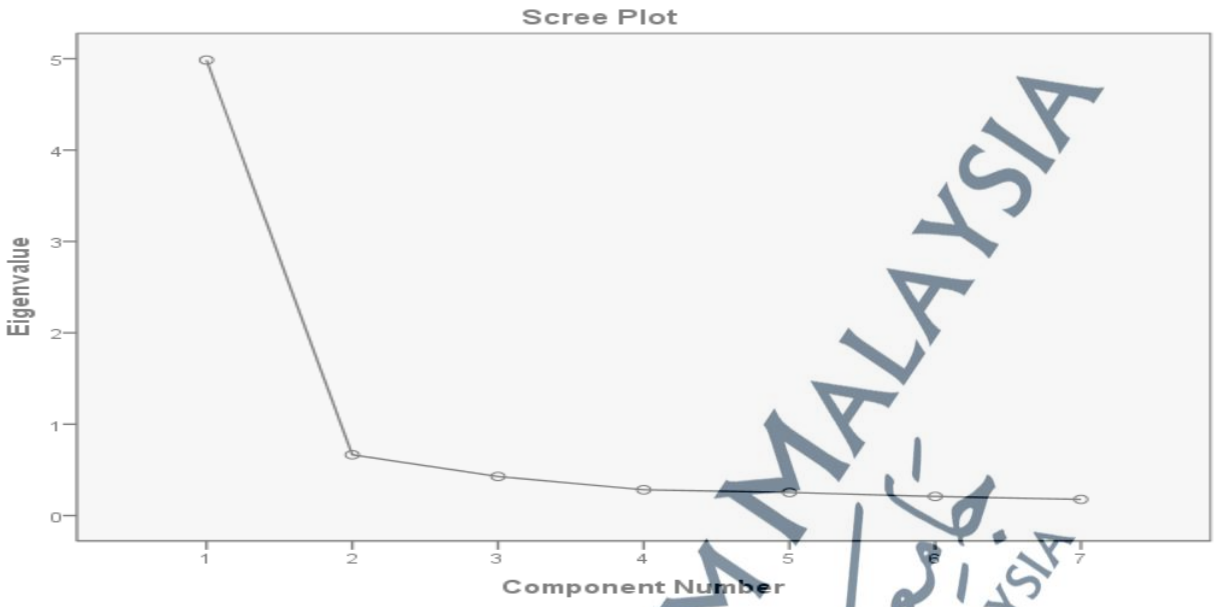

Figure 4.6 Scree Plot for Impact of E-Learning in terms of Job

Using the varimax rotation the variables were loaded and reduced to 1 meaningful factor (Table 4.23).

Table 4.23 Loading on Final Factor Using Varimax Rotation

	Component
	1
Job5	**.885**
Job3	**.877**
Job2	**.865**
Job7	**.834**
Job6	**.826**
Job1	**.814**
Job4	**.803**
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Table 4.23 showed the 7 items for impact of e-learning on job were reduced to one factor. Factor 1 consisted of seven variables related to job performance. Consequently, this factor was labeled as job performance.

To determine the consistency of the constructs, reliability test was conducted using Cronbach's alpha. Cronbach's alpha ranges from 0 to 1.0 and high scores above 0.70 suggest that the measurement is reliable (Nunnally, 1978). In this study, Table 4.24 below shows the alpha-value .932, for the final two factors resulted from factor analysis.

Table 4.24 Summary of Reliability Test for Final two Factors for Impact of E-Learning on their Job

Factor	No. of Variables	Alpha-Value
Job performance	7	.932

4.4 Descriptive Statistics of Study Variables

In this section, using the descriptive statistics to determine the main characteristics of the population can provide a better understanding on the nature of the population. Specifically, mean and standard deviation were computed. The results of the descriptive statistics were presented separately for each variable.

4.4.1 Statistics for Technological Factors

Table 4.25 shows the characteristics of the overall technological factors. In addition, the descriptive statistics of technological factors were also conducted for each item in each factor. The results indicated that the mean for the overall technology factors in this phase ranged from 3.71 to 2.03 and the mean value for all technology factors were above the score of 2.03. Service quality of technology had the highest mean (3.70), while system quality had the lowest mean (2.03).

Table 4.25 Results of Descriptive Statistics for Technological Factors

N.	Statement	N	Mean	Std. Deviation
Relative advantage				
1	E-learning cost is relatively lower	502	3.15	1.217
2	E-learning offers more flexibility	502	3.16	1.265
3	E-learning allows me to work at my own pace	502	3.11	1.261
4	E-learning enables me to access my course material easily	502	3.18	1.241
5	E-learning increases the efficiency of my study	502	3.16	1.259
Overall Relative advantage		502	3.15	1.068
Compatibility				
1	E-learning is compatible to my perception of education quality	502	3.61	1.228
2	E-learning is more suitable to my learning style	502	**3.82**	1.237
3	E-learning is more suitable to my life style	502	**3.82**	1.219
4	E-learning meets my personal career goal	502	3.52	1.220
5	E-learning meets my personal learning needs	502	3.61	1.244
Overall Compatibility		502	3.68	1.080
Complexity				
1	E-learning needs higher level of computer knowledge than I currently have	502	3.17	1.028

2	There are some technologies that I am not aware of in e-learning	502	3.15	1.062
3	E-learning system is easy to use	502	3.16	1.027
4	I require more mental effort to participate in e-learning	502	3.15	1.058
5	Overall, e-learning is difficult to participate due to its complexity	502	3.10	1.059
Overall Complexity		502	3.15	.895
System quality				
1	E-learning system provides high availability	502	2.19	1.017
2	E-learning system is user-friendly	502	**1.91**	.840
3	E-learning system provides a personalized information presentation	502	2.01	.838
4	E-learning system has attractive features to appeal to the users	502	2.06	.907
5	E-learning system provides high-speed information access	502	1.99	.860
Overall System quality		502	**2.03**	.749
Information quality				
1	E-learning system provides information that is exactly what you need	502	3.35	.896
2	E-learning system provides information you need at the right time	502	3.38	.799
3	E-learning system provides information that is relevant to your job	502	3.43	.839
4	E-learning system provides information that is easy to understand	502	3.34	.918
5	E-learning system provides up-to-date information	502	3.39	.845
Overall Information quality		502	3.38	.740
Service quality				
1	E-learning system provides a proper level of on-line assistance and explanation	502	3.69	1.120
2	E-learning system developers interact extensively with users during the development of the e-learning system.	502	3.68	1.118
3	The IS department staff provides high availability for consultation	502	3.71	1.126
4	The IS department responds in a cooperative manner to your suggestion for future enhancements of e-learning system	502	3.72	1.133
5	The IS department provides satisfactory support to users using the e-learning system	502	3.74	1.124
Overall Service quality		502	**3.71**	.887

Table 4.25 showed that there were two items with highest score (3.82) and this items are related to the compatibility of the technology. The item related *to e-learning is more suitable to my learning style*. Second item related to *e-learning is more suitable to my life style*. On the other hand, the lowest score was 1.91 for system quality related to *e-learning system is user-friendly*. The mean for technological factors were ranked based on their importance in the following order; service quality (3.71), compatibility (3.68), Information quality (3.38), relative advantage (3.15), complexity (3.15), and system quality (2.03).

4.4.2 Statistics for Organizational Factors

Descriptive statistics for organizational factors were conducted for each item in each factor. Table 4.26 presented the results of the descriptive statistics for overall organizational factors and the organizational variables items. The results showed that the mean value for organizational factors ranged from 3.85 to 2.16. Organizational culture had the highest mean (3.51) while organizational structure had the lowest mean (2.16).

Table 4.26 Results of Descriptive Statistics for Organizational variables

N.	Statement	N	Mean	Std. Deviation
Top Management Support				
1	Top management provides resources for its employees to adopt e-learning	502	3.46	.917
2	Top management endorse e-learning in the organization	502	3.45	.902
3	Top management is aware of the benefits of e-learning adoption	502	3.55	.939

4	Top management understand the strategic importance of e-learning adoption	502	3.50	919
5	Top management enthusiastically supports its employees to adopt e-learning	502	3.50	.919
Overall Top management support		502	**3.49**	.831
Organizational Structure				
1	My organization has a large number of explicit work rules and policies	502	**2.09**	.942
2	My organization employees follow the clearly defined task procedures made by the organization	502	2.20	.947
3	My organization employees have autonomy to do their work	502	2.23	1.015
4	My organization employees participate in the decision-making process	502	2.14	.939
5	My organization employees search for problem solutions from many channels	502	2.15	.930
Overall Organizational structure		502	**2.16**	.742
Organizational Culture				
1	My organization is very responsive to changes	502	3.66	.992
2	In my organization, people identify skills they need for future work tasks	502	3.87	.976
3	In my organization, employees' comments and recommendations often lead to changes	502	3.80	1.007
4	In my organization , most people have input into the decisions that affect them	502	3.97	.945
5	My organization works on building e-learning culture	502	4.09	1.017
6	In my organization, people are rewarded for learning	502	3.71	.997
Overall Organizational culture		502	**3.85**	.844

Table 4.26 showed that there was one item with highest score (3.85) and this items are related to the organizational culture. The item related to *my organization works on building e-learning culture*. The lowest score 2.09 was related to organizational structure. The item related to *my organization has a large number of explicit work rules*

and policies. The mean for organizational factor were ranked based on their importance in the following order; organizational culture (3.85), top management support (3.49) and organizational structure (2.16).

4.4.3 Statistics for Personal Factors

Descriptive statistics for personal factors on each item of the factors is presented in Table 4.27. The mean value ranged from (4.12) to (3.23). Cognitive interest had the highest mean of (4.12), while social contact had lowest mean (3.23).

Table 4.27 Results of Descriptive Statistics for Personal Factors

N.	Statement	N	Mean	Std. Deviation
	Social Contact			
1	I want to make new friends	502	3.20	1.042
2	I want to improve my relationship with others	502	**3.16**	1.050
3	I want to be accepted by others	502	3.19	1.056
4	I want to share a common interest with my friend	502	3.37	1.149
	Overall Social contact	502	**3.23**	.974
	Social Stimulation			
1	I want to relief myself from boredom	502	3.67	1.088
2	I want to overcome the frustration of day to day living	502	3.51	1.045
3	I want have a few hours away from responsibilities	502	3.61	.979
4	I want to get a break in the routine of home or work	502	3.63	1.072
	Overall Social stimulation	502	3.60	.907
	Professional Advancement			
1	I want to get a promotion	502	3.44	1.248
2	I want to have a better working environment	502	3.58	1.294
3	I want get salary increment	502	3.59	1.319
4	I want to keep up with competition	502	3.38	1.235
5	I want to increase my job competence	502	3.49	1.310

Overall Professional advancement		502	3.50	1.153
External Expectations				
1	I am being encouraged by my employers	502	3.34	1.156
2	I am being encouraged by friends	502	3.38	1.162
3	I am being encouraged by family members	502	3.36	1.134
4	I am being encouraged by government initiatives	502	3.26	1.174
Overall External expectations		502	3.34	.968
Cognitive Interest				
1	I want to learn for the joy of learning	502	4.15	.893
2	I want to satisfy my enquiring mind	502	4.10	.861
3	I want to seek knowledge for its own sake	502	4.07	.839
4	I want to learn just for the sake of learning	502	**4.16**	.874
Overall Cognitive Interest		502	**4.12**	.764

Table 4.27 showed one item with highest score (4.16) which is related to personal cognitive interest. This item implied that *respondents want to learn just for the sake of learning*. While, one item with the lowest score of 3.16 related to social *contact which are related to respondent who wants to improve his relationship with others*. The mean personal factors were ranked based on their importance in the following order; cognitive interest (4.12), social stimulation (3.60), professional advancement (3.50), external expectations (3.34) and social contact (3.23).

4.4.4 Statistics for Institutional Forces Factors

Descriptive statistics for institutional forces factors were conducted for each item in each factor. Table (4.28) presented the results of the descriptive statistics for overall social environmental factors and the social environmental variables items. The results showed that the mean value for social environmental factors ranged from (3.89) to (3.21). Social environmental of normative had the highest mean (3.89) while Social environmental of mimetic had the lowest mean (3.21).

Table 4.28 Results of Descriptive Statistics for Institutional Forces Variables

N.	Statement	N	Mean	Std. Deviation
Social environmental of coercive				
1	Many of my on- job training requires me to use e-learning	502	3.63	.872
2	Many training courses can be accomplished only when using e-learning	502	3.69	.760
3	My learning interactions with my company, friends, and other businesses force me to use e-learning	502	3.77	.791
Overall coercive		502	3.70	.728
Social environmental of normative				
1	I have seen what others do using e-learning	502	3.88	1.027
2	Many people in my social network (friends, family, workmates, and classmates) use e-learning	502	3.88	1.031
3	E-learning is very visible in my social network (friends, family, workmates, and classmates)	502	**3.89**	1.034
Overall normative		502	**3.88**	.941
Social environmental of mimetic				
1	People around me who use e-learning have more prestige than those who do not	502	3.21	.935
2	People around me who use e-learning have a high profile	502	3.21	.951
3	Using e-learning is a status symbol for people around me	502	3.22	.932
Overall mimetic		502	**3.21**	.872

The results showed the highest score was (3.85) related to social environmental of normative as the item related to *e-learning is very visible in my social network*, while the two items with lowest score (3.21) was related to *social environmental of mimetic which is related to People around me who use e-learning have a high profile and People around me who use e-learning have more prestige than those who do not*. The mean for social environmental factors were ranked based on their importance in the following order; normative (3.88), coercive (3.70) and mimetic (3.21).

4.4.5 Statistics for Impact of E-Learning on Adult Workers' Study

The means for overall impact of e-learning on adult workers' study were shown in Table 4.39. The results indicated that academic performance had the highest mean (3.78).

Table 4.29 Results of Descriptive Statistics of Impact on Adult Workers in Terms of Their Study

N.	Statement	N	Mean	Std. Deviation
Academic performance				
1	The use of e-learning has helped me develop new skills	502	3.80	1.101
2	I learned a good amount of knowledge	502	**4.12**	.945
3	Use of e-learning changed how I learn	502	3.67	1.141
4	Using e-learning has helped me to learn my subject more quickly	502	3.51	1.020
5	Use of e-learning has helped me improve my computing skills	502	3.69	1.058
6	I feel that I will be able to apply what I have learned	502	3.97	1.084
7	Overall, I was satisfied with the e-learning	502	3.70	1.129
Overall Academic performance		502	**3.78**	3.78

The descriptive statistics for e-learning impact on adult workers' study were conducted for each item in each factor. The results showed the highest score of 4.12 was

related to item that indicate *the respondent feel that he or she will be able to apply what he or she have learned*. The mean values for e-learning impact on adult workers' study were academic performance (3.78).

4.4.6 Statistics for Impact of E-Learning on Adult Workers' Performance

The means value for overall impact of e-learning on adult workers' job were shown in Table 4.30. The results indicated that job performance had the highest mean (3.86).

Table 4.30 Results of Descriptive Statistics of Impact on Adult Workers in terms of their Job

N.	Statement	N	Mean	Std. Deviation
Job Performance				
1	E-learning helps me to enhance my job efficiency	502	3.80	1.021
2	E-learning enables me to respond more quickly to change	502	**4.10**	.982
3	E-learning helps me to provide better products/service to customers	502	3.88	.958
4	E-learning helps me to provide new products/service to customers	502	3.82	.979
5	E-learning helps me to improve my job performance	502	3.99	.920
6	E-learning helps me to think through problems	502	3.69	.994
7	E-learning helps me to achieve my goals	502	3.74	.976
Overall Job performance		502	**3.86**	3.86

The descriptive statistics for e-learning impact on adult workers' job were conducted for each item in each factor. The results showed the highest score was 4.10 intricately that e-learning enables respondent to respond more quickly to change. The mean values for e-learning impact on adult workers' job were job performance (3.86).

4.5 E-Learning Adoption and Identifying Adoption Groups

This section presents the use of the framework developed in chapter three to characterize and measure adoption of e-learning among adult workers in Jordan. The adult workers were asked to determine the types of e-learning applications adopted by them and, at the same line, to indicate the extent of usage for each application. The level of adoption aimed to provide a description on the current state of e-learning applications adopted among adult workers. The extent of usage aimed to provide answer to questions on how these applications are used among adult learners.

4.5.1 Level of Adoption

In the present study, the level of adoption aimed to provide a description on the current state of e-learning applications adopted among adult workers. The level of e-learning adoption provides an initial picture of the types of applications adoption among adult learners in Jordan. Figure 4.7 illustrates the distribution of e-learning applications adopted by these adult learners. The results of level of adoption indicate that e-mail is the most widely adopted which presented 100% of the adult learners; this is followed by online library 99.1%. In terms of online grades and online registration, 97.6% of the adult learners have adopted these two applications, and 88% have adopted online course material. In terms of online assessment and online test 69.7% of the adult learners have adopted these two applications. Only 52% of adult learners have adopted live chat. While, two applications with low adoption rate among the adult learners; these are live audio and live video, with similar adoption rate of 18.8% respectively.

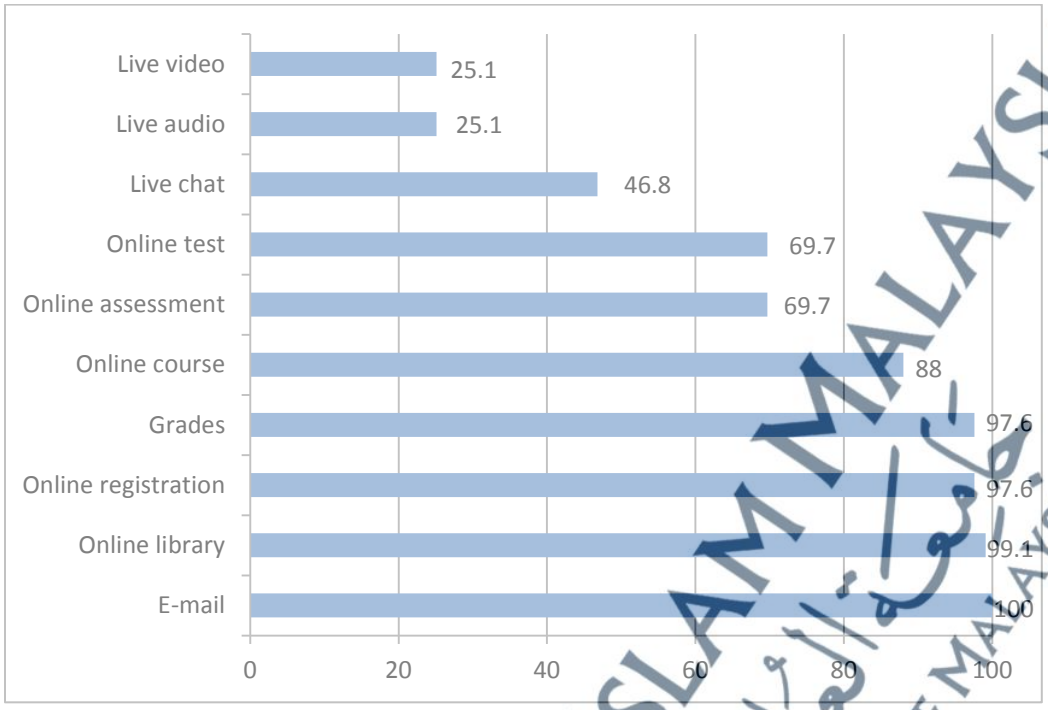

Figure 4.7 Level of Adoption

4.5.2 Extent of Usage

In this study, the extent of usage aimed to provide a description on the current state of e-learning application among adult learners. The level of e-learning applications' adoption is the aggregate adoption of four categories of usage, namely not using, used sometime, used most of the time and used all the time (Thi, 2006; Masri, 2010; Alzoubi, 2011). In addition, it is aimed to provide answers to questions on how these applications are used among adult learners.

Figure 4.8 Extent of Usage

The live audio and live video are the least adopted applications of e-learning among adult learners (Figure 4.8). Adult learners who have adopted live audio and live video were 3.4% used it sometime. About, 20% of the adult learners used these two applications most of the time. Only 2% of the adult learners used these two applications all the time. This is followed by 97.9% of the adult learners who have not used these two applications. Live chat showed about 25.1% of the adult learners used it most of the time, about 2% of adult learners used all the time and about 19.7% of adult learners used it sometime. Slightly more than half of the adult learners have not adopted live chat. Adult learners who have adopted online test mainly used most of the time as they represent about 62.7% of the sample. While 7% of adult learners have used it all the time and the adult learners have not used online test sometimes. Approximately 30.3% of the total number of respondents has not used online test. On the other hand, adult learners that adopted online assessment represent 39.8% as they mainly used it most of the time,

while 29.9% of adult learners used it all the time and the adult learners have not used online assessment sometimes. Approximately 30.3% of the total number of respondents has not used online assessment. Slightly, half of the adult learners have adopted online course (44%), they are mainly used it most of the time, whereas 29.9% of adult learners used it all the time and only 14.1% of adult learners used sometimes. The rest of the adult learners represented 12% as they are not using online course. In addition, 48.4% of the adult learners who have adopted online grades mainly used it most of the time, with 32.1% of total number of respondent mainly used all the time and 17.1% of adult learners sometimes. The rest of adult learners represented 2.4% as they not using online grades. In terms of online registration, less than a half of total numbers of respondent (46.2%) have used it some of the time, while 32.1% of adult learners have used it all the time and only 19.3% of adult learners have used it sometimes. The rest of adult learners represented 2.4% as they not using online registration. The majority of the adult learners (84.5%) have adopted online library, this was mainly used it most of the time, 9.2% of adult learners used it all the time and only few number of respondent which present 5.4% mainly used it sometime. Only few adult learners represented 8.1% as they are not using online library. The majority of the adult learners (62.9%) have adopted e-mail, this was mainly used it most of the time, 32.1% of adult learners used it all the time and only few number of respondent which present 5% mainly used it sometime.

To sum up, these adult learners who have adopted e-learning applications such as e-mail, online library, online registration, online course, grades, online video, online audio, live chat, online assessment and online test are using these ten applications most of

the time. While, only 126 of the adult learners have adopted these ten applications mainly sometime or used all the time. It is observed across the ten e-learning applications that e-mail showed the highest level of usage; in contrast, live audio and live video showed the lowest level of usage.

4.6 Adoption Grouping Approach

The previous sections provide the current state of e-learning adoption by exploring the level of adoption and the extent of usage. The next section explains an alternative approach to measure e-learning adoption. Pervious researches on e-learning adoption have explored an adoption framework, using cluster approach (e.g. Chau & Tam, 1997; Hung *et al.,* 2009). In the present study, to characterize and measure the nature of e-learning adoption which is based on two dimensions, namely level of e-learning applications adopted and the extent each application has been used. Furthermore, the categorical scale representing the extent of usage; 1= not using, 2= used sometime, 3= used most of the time, 4= used all the time are adopted in this study to examine the extent of usage (Thi, 2006; Masri, 2010; Alzoubi, 2011).

4.6.1 Cluster Analysis Methods

Cluster analysis is defined as a technique for classifying observations into groups such that observations in each group are similar to each other while observation in one group should be different from those of other groups (Everett, *et al.*, 2001). In other words, cluster analysis is a group of techniques whose purpose is to produce a classification of respondents (Hair *et al.,* 1998). The intention is to produce homogeneous groupings-based responses. According to Hair *et al.,* (1998) when adopting cluster analysis, researchers should complement strictly empirical judgement with any conceptualization of theoretical relationships that may suggest a natural number of groups.

In this aspect, cluster analysis is perceived to rely on researcher's judgement (Ketchen & Shook, 1996). Regar and Huff (1993) also point out that, too often, clustering dimensions seem to be selected haphazardly. Clusters that are being identified without sound theoretical foundation may not reflect real conditions, and they are simply just statistical artifact (Thomas and Venkatraman, 1998). Hence, outcomes based upon these clusters could be questioned.

In this particular study, the extent of usage were being split under the headings of "Not using", "Used sometime", "Used most of the time" and "Used all the time", it is clear these non-metric constructed cannot create distance function required in most clustering algorithms. For this reason, a visual approach to cluster e-learning adoption based on level application and extent of usage was used. The dimensions, namely the level of adoption, consisting of ten types of applications, and the extent of usage were

structured in a manner to capture information on the nature of usage. The initial aim was to identify the number of distinct adoption patterns within the sample. This was followed by examining segments that were formed based on corresponding adoption characteristics represented by these two dimensions, i.e. the level of adoption, and extent of using each application. By identifying similar adult learners on the basis of these two dimensions, distinct groups were formed which were then used for further examination. This approach provides a rich source of information by combining dimensions the types of application adopted on their extent of usage.

4.6.2 Cluster Using Visual Approach

The study is exploratory in the field of innovation diffusion. A visual approach was employed to identify e-learning adoption pattern. This approach was adopted because the measure was designed to capture the adoption in both dimensions, i.e. types of applications adoption (level of adoption) and current state of use (extent of usage).

As a first attempt to explore adoption patterns using an ad hoc and data-driven approach, many of the decisions made were largely based on practical judgement, and on a trial and error basis to obtain the most logical number of adoption groups.

The task began by examining the ten e-learning applications representing the level of e-learning adoption. Descriptive statistics displaying frequency distribution of each application variable were computed (*refer to Figure 4.6*). The results indicated that simple applications were adopted first, before adult workers embarked on more complex

applications. The sequencing of e-learning applications by frequency e-mail which had the highest number of adopted placed first, while the online assessment and online test were placed last, because they were the least adopted applications among adult workers.

4.6.3 Transferring Data to Spreadsheet

The data describing the level of adoption and extent of usage were transferred from SPSS to Microsoft Excel spreadsheet for easy manipulation. To simplify the calculation process and help to display the visual result clearly, the original categorical scale representing the extent of usage; 1= not using, 2= used sometime, 3= used most of the time, 4= used all the time, was modified (Figure 4.8). This was to simplify the calculations and help to display outcomes prominently. The revised measures of extent of usage were 0 = not using, 1= used sometime, 2= used most of the time, 3= used all the time, (Figure 4.9).

Mail	Library	Registration	Grades	Course	Video	Chat	Audio	Assessment	Test
3	3	3	3	1	1	1	1	1	1
3	3	3	3	3	3	3	1	1	1
3	3	3	3	2	2	3	4	1	1
2	2	2	2	2	3	4	4	2	2
3	3	3	3	1	1	1	1	1	1
3	3	3	3	3	3	3	3	1	1
3	3	4	1	1	1	1	1	1	1

Figure 4.9 Spreadsheet with Original Measures of Extent of Usage

Mail	Library	Registration	Grades	Course	Video	Chat	Audio	Assessment	Test
2	2	2	2	0	0	0	0	0	0
2	2	2	2	2	2	2	0	0	0
2	2	2	2	1	1	2	3	0	0
1	1	1	1	1	2	3	3	1	1
2	2	2	2	0	0	0	0	0	0
2	2	2	2	2	2	2	2	0	0
2	2	3	0	0	0	0	0	0	0

Figure 4.10 Spreadsheet with Original Revised of Extent of Usage

The number "0" representing "not using", was replaced by a blank cell on the spreadsheet (Figure 4.10). This was to allow patterns to be displayed more clearly. However, this had on influence on the computations to create a unique number for each adult learner.

Mail	Library	Registration	Grades	Course	Video	Chat	Audio	Assessment	Test
2	2	2	2						
2	2	2	2	2	2	2			
2	2	2	2	1	1	2	3		
1	1	1	1	1	2	3	3	1	1
2	2	2	2						
2	2	2	2	2	2	2	2		
2	2	3							

Figure 4.11 Spreadsheet with "0" (non-usage) Deleted

The spreadsheet would now display only three measures of usage; 1= used sometime, 2= used most of the time, 3= used all the time. The different measures representing the extent of usage were then differentiated in different colors. This helped to further enhance the visibility of the patterns and assist in the task of identifying adoption pattern using a visual approach (Figure 4.11, Figure 4.12).

Mail	Library	Registration	Grades	Course	Video	Chat	Audio	Assessment	Test
2	2	2	2						
2	2	2	2	2	2	2			
2	2	2	2	1	1	2	3		
1	1	1	1	1	2	3	3	1	1
2	2	2	2						
2	2	2	2	2	2	2	2		
2	2	3							

Figure 4.12 Spreadsheet with differentiated Measures Extent of Usage

4.7 Identifying Adoption Groups

Visual approach was adopted to identify adult workers' applications with similar patterns. The main advantage of this visual approach as compared to dendogram was that the level of adoption, which provides information on types of application adopted, and extent of usage for each e-learning application could be examined simultaneously. This two-dimensional approach to depict e-learning adoption was adopted in this study. The final grouping was based on practical judgement (researcher) and to see whether the grouping makes sense. Some adult learners were regrouped to coincide with adult learners with close identical adoption patterns that obtained from matrix table. The adjusted adoption pattern is shown on Appendix (G). The pattern identification approach provided an alternative method to examine what applications had been adopted. Working adults with similar adoption patterns were grouped and their adoption behavior could be described individually and collectively. Preliminary results suggested six groups could be identified. The groupings that represent six major adoption patterns were further refined to obtain a smaller number of meaningful groups with similar patterns.

After identifying six groups from the matrix table, the following Table 4.32 provides a brief summary of the characteristics of each of the six adoption groups.

Table 4:31 Preliminary Groupings

Group	No. of Learners	Description	Cases
1	60	**Level of Adoption** More than half of adult learners (56.1%) have adopted e-mail and online library, whereas about 40% of adult learners have adopted e-mail, online library, online registration and Grades.	200,195,291,217,366,191,208,289, 214,220,286,344,362,492,498,212. 222,202,205,124,150,346,352,219, 304,490,495,501,186,190,194,201, 206,211,216,221,290,292,296,305 316,345,348,349,351,354,355,360,

		Extent of Usage 49% of adult learners have adopted e-learning application most of the time. 51% of adult learners have adopted e-learning application sometime. In the first group, the adult learners have not adopted e-learning application all the time.	361,363,367,375,389,397,416,455, 494,496,499,159
2	92	**Level of Adoption** All adult learners in this group have adopted five e-learning applications; these are: e-mail, online library, online registration, online grades and online course. **Extent of Usage** 46% of adult learners have adopted e-learning application sometime. 54% of adult learners have adopted e-learning application most of the time. In the second group, the adult learners have not adopted e-learning application all the time.	179,182,15.22,23,24,28,88,89,111, 118,119,127,134,135,136,137,141, 143,144,112,130,140,154,166,176, 178,181,183,404,439,447,469,470, 472,474,475,476,477,131,163,164, 170,175,310,381,433,452,467,479, 480,482,483,484,486,487,6,33,37, 93,95,100,101,169,171,172,308,309 ,319,325,326,328,333,336,339,370, 411,421,426,462,463,464,466,488, 5,30,38,302,311,329,331,334
3	115	**Level of Adoption** Adult learners have adopted all applications ranging from e-mail to online test. **Extent of Usage** 77% of adult learners have adopted e-learning application all the time. Only 23% adult learners have adopted e-learning application most of the time.	1,2,7,13,14,16,25,26,29,31,32,36,39 ,41,42,43,46,47,48,49,50,51,53,54, 57,58,59,61,62,63,66,67,69,70,71, 76,77,78,79,82,83,85,86,,90,92,94, 96,99,109,110,173,174,192,193,199 ,213,207,215,218,223,224,225,227, 228,229,230,231,232,234,235,236, 237,239,240,242,243,245,246,247, 249,250,251,252,253,255,256,257, 259,260,261,262,263,264,266,267, 268,270,271,272,273,275,276,277, 278,280,281,282,284,285,303,327, 330,332,405,,502
4	109	**Level of Adoption** Adult learners have adopted all applications ranging from e-mail to online Chat. **Extent of Usage** 90% of adult learners have adopted e-learning applications most of the time. While only 10% adult learners have adopted it sometime.	376,377,378,379,380,382,383,3 84, 385,386,387,388,390,391,392,3 93, 394,395,396,398,399,400,401,4 02, 403,406,407,408,409,410,412,4 13, 414,415,417,418,419,420,422,4 23, 424,425,427,428,429,430,431,4 32, 434,435,436,437,438,440,441,4 42, 443,444,445,446,449,450,451,4 53, 454,456,458,459,460,461,465,4 68 471,473,478,481,485,489,491,4 93,

			497,500,196,197,198,293,294,295, 337,338,342,343,347,350,353,356, 357,358,359,364,365,368,369,371, 372,373,374,448,457
5	80	**Level of Adoption** Adult learners have adopted ten out of ten applications. **Extent of Usage** All adult learners have adopted e-learning applications most of the time.	3,4,8,9,10,11,12,17,18,19,20,21,27, 34,35,40,44,45,55,56,60,64,65,74, 75,81,97,98,102,103,107,108,113, 115,120,122,123,125,126,128,129, 133,138,139,142,145,147,149,151, 152,153,155,156,157,158,160,162, 165,167,177,180,184,185,187,188, 203,204,209,210,226,233,238,241, 244,248,254,258,265,269,279
6	46	**Level of Adoption** Adult learners have adopted ten out of ten applications. **Extent of Usage** 69% of adult learners have adopted e-learning applications all the time. 19% of adult learners have adopted it most of the time, while only 12% adult learners have adopted it sometime.	274,283,287,288,297,298,299,300, 301,306,307,73,80,105,117,132,146 72,148,161,168,189,312,313,314, 315,317,318,320,321,322,323,324, 335,340,341,52,68,84,87,91,104, 106,114,116,121

As shown in Table 4.31, the grouping that represent six major adoption patterns were further refined to obtain a smaller number of meaningful groups with similar patterns. First group had adopted two applications mainly ranging from e-mail to library were used on a most of the time. Also from this group, more than half (32) of adult workers had adopted four applications mainly ranging from e-mail to Grades.

Second group had small sample size. All adult learners in the second group have adopted five applications mainly e-mail, library, registration, grades and online course.

From the first and second groups, adult workers who had adopted applications mainly ranging from e-mail to library were used on a most of the time. In addition, adult workers who had adopted applications mainly ranging from registration to grads were used on a sometime, while other applications ranging from registration to online course were also used on a sometime. The result from these two groups indicates the low level of application adoption and the extent of usage. Therefore, the two groups were merged to form the low-adopters category.

Third group had adopted seven applications mainly ranging e-mail to online test were the majority of seven applications used on all the time. A small number of adult learners used on most of the time. Similar to group three, group four had adopted eight applications ranging from e-mail to online chat. From group four, 90% of the application usages were used on most of the time, in the other side of the usage, a small number of adult workers who had adopted eight applications used on sometime, It can be observed from table matrix, group four indicate the similar level of adoption and usage to group three. The group 3 and 4 which implied moderate level of adoption and usage, therefore both of them were merged to form the moderate-adopters.

Fifth group had adopted ten applications ranging from e-mail to live Video. From group five, the all of the applications usages were used on most of the time. Sixth group had adopted ten applications ranging from e-mail to live Video. From group sixth, the majority of ten applications usages were used on all the time. In the other side of the usage, a small number of adult workers who had adopted ten applications used on most of the time, while the rest applications from group six were used on sometime. As those

adult workers had adopted the whole range of applications with high usage, they were labeled high-adopters. Summary of usage, many adult workers had used e-learning applications on most of the time.

This approach worked fairly well in identifying adoption patterns that were present in the sample. Adult workers were subsequently grouped based on similar adoption patterns. Table 4.32 below, presented the cluster members and final three adoption groups that derived from the matrix table. In addition, these final three adoption group's solution, labeled as low-adopters, moderate-adopters and high-adopters. The low-adopters group were presented about 31% of the total number of adult learners in this study. Moderate-adopters represented more than half of the total number of adult learners 44.62 %. High-adopters were the smallest group which presented about 26% of total number of adult learners.

Table 4.32 Derivation of Final Groups and Cluster Members

Group No	**Preliminary Group**	**Final Group**
1	60	152 (Low-adopters)
2	92	
3	115	224 (Moderate-adopters)
4	109	
5	80	126 (High-adopters)
6	46	
Total	502	502

4.7.1 Logistic Regression Analysis

Logistic regression is common used by health science researchers, and the technique is being adopted to predict discrete outcome of disease or not disease (Tabachnick & Fidell, 2007). Additionally, the model of logistic regression has been widely used in IT research (Zhu *et al.*, 2003, Hong & Zhu, 2006).

Hosmer and Lemeshow (2000) highlighted that the logistic regression is analogous to a multiple regression analysis, exclude that the outcome variable is binary. Similar to multiple regressions analysis, predictor variables could be metric or categorical measurements. If the results of dependent and independent variables are a metric measure, multivariate regression is more suitable. The use of categorical variables in multiple regressions would break the assumptions set for utilizing this analysis technique.

Discriminant analysis could also apply when the dependent variable is categorical. However, to use discriminant analysis, all the independent or predictor variables have to be metric. Hair *et al.*, (2006) noted that logistic regression is more flexible compared to discriminant analysis because it has no assumptions about distribution of the predictor variables. In logistic regression, the predictors need not be normally distributed, linearly related, or of equal variance with other predictors (Hair *et al.*, 2006). Pres and Wilson (1978) highlighted that logistic regression is preferable to discriminant analysis in cases where the predictor variables do not have multivariate normal distributions.

Similar to other multivariate techniques, logistic regression is also a multivariate approach that can consider the entire profile of factors that affect the dependent variable, the interrelationship between attributes can be taken into consideration, and the results are easy to interpret. Furthermore, logistic regression could be extended beyond the analysis of binary groups. The resulting model is called polychotomous or polychromous logistic regression (Hosmer & Lemeshow, 2000; Menard, 2002).

In this study, the dependent variable is categorical and comprised of three adoption groups. The predictor variables are both continuous and discrete in nature; therefore, the multinomial logistic regression is utilized in order to identify factors that are linked with e-learning adoption groups.

4.7.2 Assumptions in Applying Logistic Regression

To achieve the second research question namely, to identify the technological, organizational, personal factors and social environmental factors that influence the adoption of e-leaning among adult worker, the logistical regression was used. Nevertheless, some requirements must to be fulfilled before conducting logistic regression analysis. These assumptions are normality, linearity, outliers, homoscedasticity and multicollinearity (Tabachnick & Fidell, 2007; Hair *et al.*, 2006).

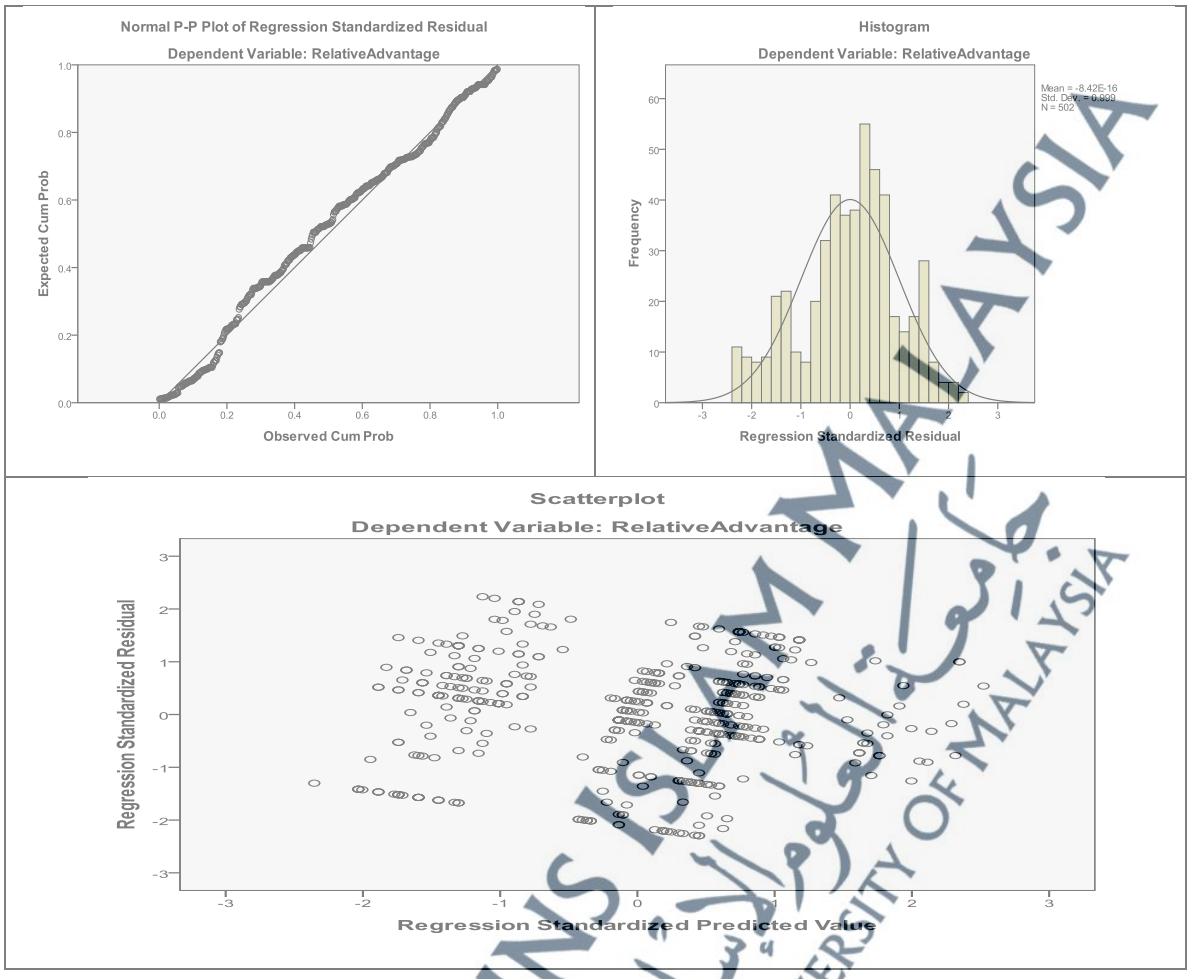

Figure 4.13 Example of Violations Assumptions Results

Normality is concerned about the data distribution. This assumption can be tested using different tests such as histogram of residual plots and the normal probability plot of the regression. A histogram in general is a graphical demonstration displays the regularity of the record values to observe the distribution shape (Hair *et al.*, 2006). For the purpose of this study, these two approaches were used to examine the assumption of normality.

An example for results of histogram of residual plots was shown in Figure 4.13 and the rest were presented in (Appendix F). The results indicated that the assumption of normality was not violated. The figures showed that the distribution appeared normal and

there was no cluster or skewness. These results supported the normal distribution of data as regression standardized residual lie around the instantly sloping line from bottom left to top right (Appendix F).

The second assumption for the regression is the linearity of the variables. Linearity is the degree of how the relationship between the variables can be portrayed in a straight line (Johnson and Wichern, 2007; Tabachnick and Fidell, 2007). To assess the assumption, linearity residual plots as suggested by Hair *et al.*, (2006) was employed. The results of the histogram of residual plots as shown in the above Figure 4.13 and Appendix F revealed the assumption of linearity was met as the figures showed the distribution scatter around the center of the shape. The results of linearity assumption provide justification on the use of multiple regressions to explore the relationship between the dependent and independent variables.

Homoscedasticity appears when the variance over a variety predictor variable seems to be constant. In other words, the values of the variance of the dependent variable concentrate in only a limited range of the independent variable (Hair *et al.*, 2006). Homoscedasticity assumption examined through the residual plot as it was satisfied if there was no pattern of increasing or decreasing residual. As shown in Figure 4.13 and Appendix F, the assumption of homoscedasticity was fulfilled and there was no concerned about using multiple regression analysis.

Multicollianearity is a degree to which the other variables can explicate a variable in the analysis (Hair *et al.*, 2006). According to Tabachnick and Fidell (2007)

multicollianearity appears if there is a high degree of correlation between the variables. The difficulty to clarify the effect of any single variable due to their association and multicollianearity is the rationale behind this assumption. In order to examine the multicollianearity among the variables in this study, variance inflated factor (VIF) and tolerance tests were adopted.

Tolerance is defined by Hair *et al.*, (2006) as the amount of variability of the selected independent variable not explained by the other independent variables, while VIF is the opposite of tolerance value. For the purpose of this study the two tests were conducted to determine the multicollianearity assumption and the values of VIF and tolerance used showed no multicollianearity between the variables as their values less than 10 for the VIF and more than 0.10 for tolerance as suggested by Field (2003).

Since regression analysis is very sensitive to outliers (standardized residual values above 3.0 or less than 3.0); it was deleted by casewise diagnostic in the regression analysis in SPSS package version 18. Finally, the interruption of the regression analysis is based on the standardized coefficient beta and R square which provides evident whether to support the hypotheses stated earlier in the chapter.

4.8 Testing for Multicollinearity

When the cases are sufficient, the next step is to generate and examine the within-groups correlations matrix, since multicollinearity among the predictor variables will affect the outcomes of multivariate analysis. The correlation matrix will indicate the extent to which one variable is correlated with another, either negatively or positively.

Collinearity diagnostics based upon the variance inflation factor (VIF) and tolerance statistics are used to test for multicollinearity in the regression model. Although there are no hard and fast rules about the values of VIF, field (2003) quoting from Myers (1990) suggests that a VIF value of 10 and above shall be a cause of concern.

Similarly, Menard (2002) proposes that tolerance values below 0.2 are of concern which indicates existence of multicollinearity among predictors. The results of the tests to check for multicollinearity among predictor variables for this study are shown in Table (4.34).

Table 4.33 Collinearity Statistics

Model	Collinearity Statistics	
	Tolerance	VIF
Relative Advantage	.903	1.108
Compatibility	.874	1.144
Complexity	.778	1.286
System Quality	.921	1.085
Information Quality	.730	1.370
Service Quality	.915	1.093
Top Management	.754	1.326
Structure	.942	1.062
Culture	.570	1.755
Social Contact	.809	1.235
Social Stimulation	.744	1.345
Professional Advancement	.810	1.235

External Expectations	.744	1.345
Cognitive Interest	.936	1.069
Coercive	.803	1.245
Normative	.688	1.454
Mimetic	.830	1.204

The Table 4.33 indicate that the tolerance for each of the 17 predictor variables had values above 0.6, and the result of Collinearity did not show any evidence occurring among the predictor variables (Menard, 2002). In addition, the VIF results for each of the 17 predictors had values of less than 10. The results of multicollinearity tests provided further confidence in interpreting the outcomes generated from multinomial logistic regression.

4.9 Research Conceptual Framework Evaluation

In this section, multinomial logistic regression analysis was conducted to explore factors that were associated with adoption groups namely, low adopters; moderate adopters and high adopters as the three-group dependent variable and 17 predictor variables. Backward eliminations, a method of stepwise regression were used as it would retain only the predictor variables that were statistically significant in the model (Menard, 2002).

The preliminary results of the chi-squared tests and pseudo R square values that measure the effectiveness of the regression model (testing the overall fit of the model) showed that the chi-squared differences was significant at 0.00 level (Table 4.35 below). In other words, the improvement in the results after the predictor variables were included provides evidence that the predictors were indeed associated with adoption.

Table 4.34 Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1.073E3			
Final	934.118	138.937	34	.000

In addition, Table 4.35 below revealed that Nagelkerke R square value of 0.129 for the overall model. The results indicate the model could explain approximately 29 percent of the variance in the dependents variables. Nagelkerke R square is chosen because it is a modification over the Cox and Snell R square and has a range of 0 to 1.

Table 4.35 Pseudo R-Square

Cox and Snell	.242
Nagelkerke	.274
McFadden	.129

The Wald statistic is used to evaluate the statistical significance of each predictor variable in explaining the dependent variable, and Wald statistic indicates whether the *β*-coefficient for a predictor is significantly different from zero. If so, then the predictor variable is assumed to make a significant contribution to the prediction of the outcome of the dependent variable.

Table 4.36 Multinomial Logistic Regression

	Low-adopters vs. High-adopters		**Moderate-adopters vs. High-adopters**		**Moderate-adopters vs. Low-adopters**	
	Coff (β)	Wald p-value	Coff (β)	Wald p-value	Coff (β)	Wald p-value
Relative Advantage	.286	**.023**	-.217	.054	.069	.504
Compatibility	-.020	868	-.067	.528	-.087	.399
Complexity	.715	**.000**	-.239	.109	.477	**.000**
System Quality	.349	**.046**	.145	.346	-.203	.169
Information Quality	.687	**.000**	-.310	.075	.377	**.016**
Service Quality	.259	.076	-.011	.931	.247	**.045**
Top Management	.540	**.002**	.211	.165	.329	**.023**
Structure	.408	**.018**	.165	.288	-.243	.094
Culture	.682	**.000**	-.299	.082	.382	**.006**
Social Contact	.341	**.012**	.265	**.036**	.077	.488
Social Stimulation	-.180	.229	.161	.238	-.019	.885
Professional Advancement	.392	**.001**	-.145	.181	.247	**.009**
External Expectations	.146	.311	-.008	.951	.138	.269
Cognitive Interest	.480	**.004**	.223	.219	.703	**.000**
Coercive	-.304	.110	.109	.537	-.196	.215
Normative	.617	**.000**	-.225	.163	.392	**.002**
Mimetic	.455	**.005**	-.147	.328	.307	**.020**

The summary of the results from the multinomial logistics regressions were shown in Table 4.36. Thirteen predictor variables, namely relative advantage, complexity, system quality, information quality, service quality, top management, structure, culture, social contact, professional advancement, cognitive interest, normative and mimetic were found to be significantly associated with e-learning adoption.

The results indicate a set of significant factors that could differentiate between each group of adopter, namely low, moderate and high adopters. The study found that the relative advantage, complexity, system quality, information quality and service quality had a positive impact on the probability of e-learning adopting for low-adopters vs. high-adopters and moderate-adopters vs. low-adopters compare to moderate-adopters vs. high-adopters. The relative advantage, complexity, system quality, information quality and

service quality are significantly related to adult workers' adoption to use e-learning. The result supported findings from prior studies of the significant of relative advantage, complexity, system quality, information quality and service quality on e-learning adoption among adult workers (Liao & Lu, 2008; Hung *et al.,* 2009).

In addition, the findings indicated that organizational structure, organizational culture and top management support had significantly impact on e-learning adoption among adult workers. This implied that organizational structure, organizational culture and top management support could promote the initial phase of e-learning adoption by the adult workers in Jordan. These findings support previous studies in the literature (Hung *et al.,* 2009; Naveh *et al.,* 2010). Consequently, the Table above 4.52 shows three factors of personal were significantly impact on e-learning adoption among adult workers, namely social contact, professional advancement and cognitive interest. These findings support previous studies in the literature (Miller, 1967; Kim & Merriam, 2004). Two social environmental factors were significantly impact on e-learning adoption among adult workers, namely normative and mimetic. These findings support previous studies in the literature (Lu, 2012; Yilmaz, 2012). The Figure 4.14 showed the summery of the significant of factors that assessed with e-learning adoption's group.

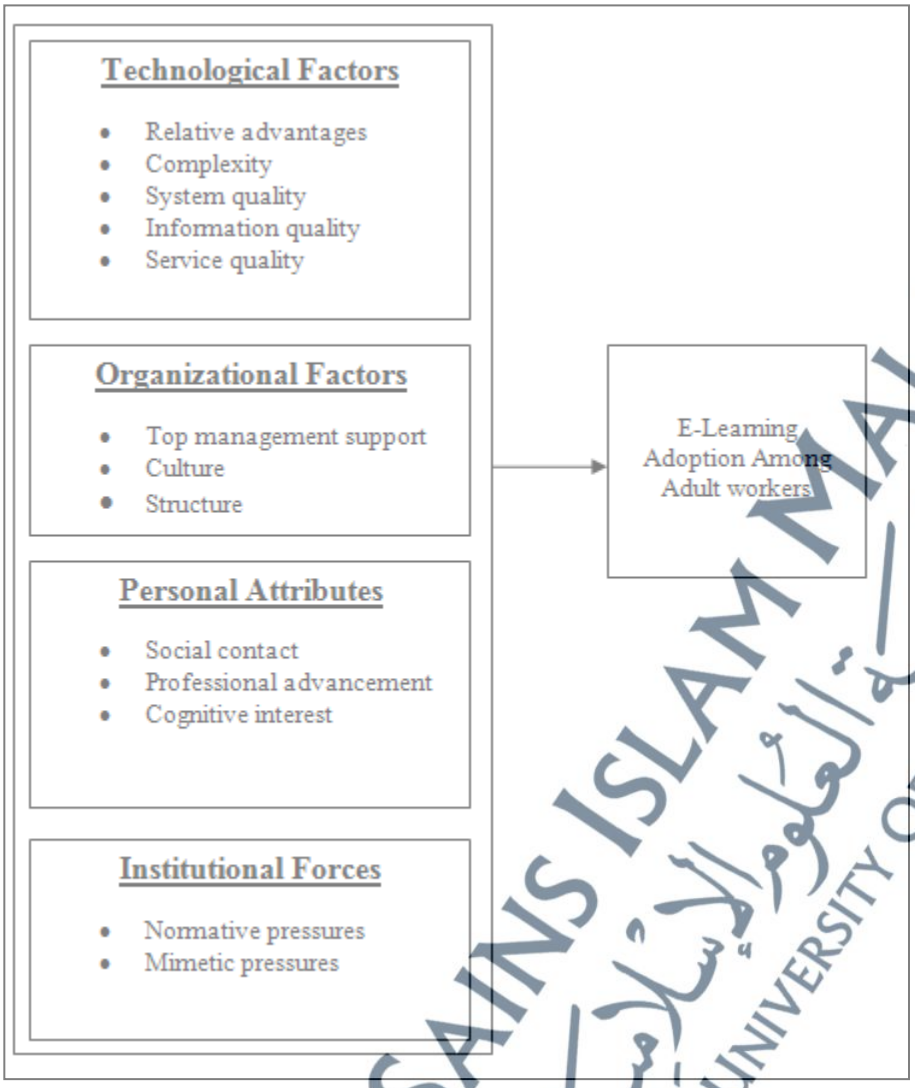

Figure 4.14 Final TOPS Framework

In summary, this section presented the results from multinomial logistic regression analyses that were meant to identify factors that were perceived to be associated with e-learning adoption. Drawing upon technological diffusion theory, a framework was developed for assessing e-learning adoption, incorporating seventeen factors related to e-learning adoption among adult workers. Thirteen variables were found to be associated with e-learning adoption. Five of the eight variables were technological context variables, and three of the eight variables were organizational context variables,

three of the eight variables were personal context variables. The other variables were social environmental context. The next section examines the outcomes of the e-learning adoption that impact on adult workers.

4.10 E-Learning Adoption and Impacts on Adult Workers

This section presents the association between e-learning adoption and its impact on adult workers in terms of their study and their job. It is also aimed to proved answer the third research question namely, to determine the impact of e-learning adoption on adult workers.

4.10.1 Exploring Relationship between E-Learning Adoption and Impacts

As discussed in section 4.6 (factor analyses) two measures have been derived to examine the impact on e-learning adoption among adult workers. The high reliability of these measures (Cronbach alpha > 0.70) provided confidence in the results obtained. The two measures of impact identified through factor analyses, namely academic performance and job performance.

To find score for each factor, Singleton *et al.*, (1993) proposed taking the average (mean) of the scores of the individual that constitute each factor. This method has been adopted by other similar studies (e.g. Waight & Stewart, 2005). Figure 4.15 reproduces a partial diagram of the research framework discussed in Chapter 3.

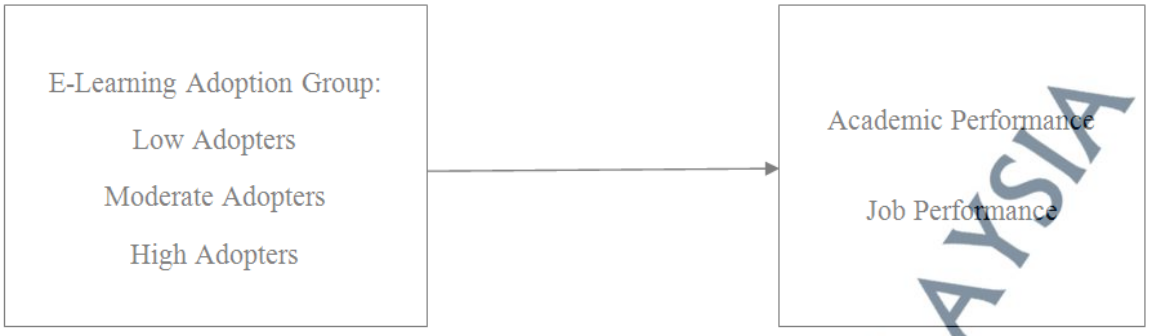

Figure 4.15 Relationship between E-learning Adoption and Impacts on Adult Workers

The mean objective of correlation analysis was used to inspect whether relationship exists between the extent of e-learning adoption and the two impact measures. A non-parametric correlation test, namely Spearman's rho, is used for this purpose because the variables used, i.e. e-learning adoption and impact measures, comprised of an ordinal scale. The results in Table 4.37 and Table 4.38 show that two is a significant correlation between e-learning adoption and academic performance (positive correlation of **.**126**) and job performance (positive correlation of .149**). Further analysis is conducted to provide a better understanding on the differences of impacts gained by the various adoption groups.

Table 4.37: Correlation Coefficients between E-learning Adoption and Impact Measures

Impact / **EL Adoption**	Academic performance		Job performance	
	Sig.	**r**	**Sig.**	**r**
Adoption	**.005**	**.126****	**.001**	**.149****

Table 4.38 Correlation Coefficients between E-Learning Adoption and Impact Measures

		Academic	Job	Adoption
Academic performance	Pearson Correlation	1	.450**	.126**
	Sig. (2-tailed)		.000	.005
	N	502	502	502
Job performance	Pearson Correlation	.450**	1	.149**
	Sig. (2-tailed)	.000		.001
	N	502	502	502
Adoption	Pearson Correlation	**.126****	**.149****	1
	Sig. (2-tailed)	**.005**	**.001**	
	N	502	502	502
**. Correlation is significant at the 0.01 level (2-tailed).				

4.10.2 Preliminary Analysis

Preliminary analysis using error bar charts was performed to identify any between-group differences for each adoption group and the impact measures identified in this study. The error bar charts are used to compare the confidence interval or the standard error, which centered on the mean of a distribution that extends above and below to show a confidence interval or a specified number of standard error or standard deviations. If the confidence intervals between groups do not overlap, it implies differences occur between these groups.

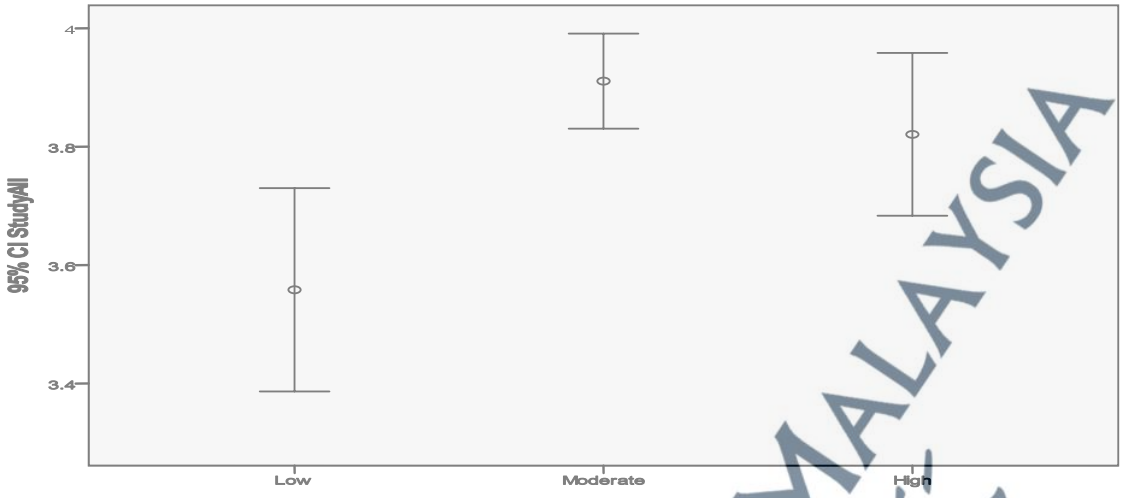

Figure 4.17 Error Bar Chart for Impact on Academic performance

Figure 4.17, the error bar chart shows the impact on academic overall performance between groups of adult workers. Some of the groups' confidence intervals overlap, which implies there are differences in terms of their academic performance. The confidence intervals that do not overlap or slightly overlap are between low-adopters and high-adopters, between high-adopters and moderate-adopters. These results indicate that there are significant differences in their academic performance.

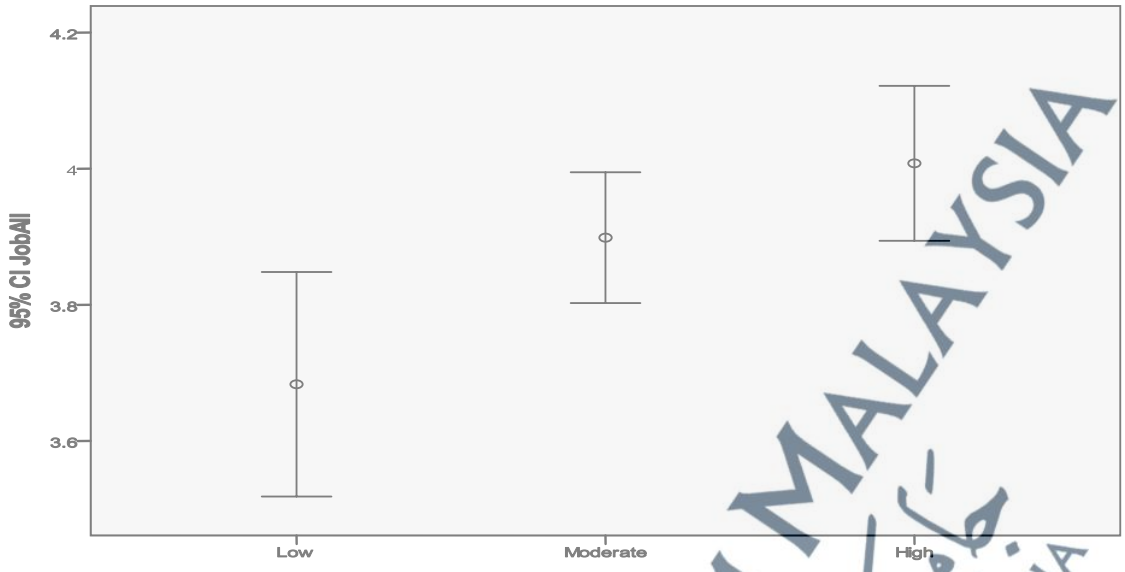

Figure 4.18 Error Bar Chart for Impact on Job Performance

Figure 4.18, the error bar chart shows the impact on job overall performance between groups of adult workers. Some of the groups' confidence intervals overlap, which implies there are differences in terms of their job performance. The confidence intervals that do not overlap or slightly overlap are between low-adopters and high-adopters, between moderate-adopters and high-adopters. These results indicate that there are significant differences in their job performance.

In summary, the preliminary result from the error bar charts provided early indications that there is between-group no differences in relation to adult workers overall academic performance and job performance. The next section presents one-way ANOVA to provide further evidence whether there is any between-group difference among the groups and impact measures.

4.10.3 Comparisons of E-Learning Impact by Adoption Groups

Levene test of homogeneity of variances was conducted first to check for equality of variance among the groups. The results of Levene test are shown in Table 4.39.

Table 4.39 Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Academic performance	8.531	2	499	.000
Job performance	7.231	2	499	.001

Levene tests of homogeneity of variances indicate that the p-value is smaller than 0.05 for performance measure.

Table 4.40: *Comparison of E-Learning Impacts by Adoption Groups*

Impact Measures	**Low Adopters**	**Moderate Adopters**	**High Adopters**	**F**	**Sig**
Academic performance	3.56	3.91	3.82	8.633	.000
Job performance	3.68	3.90	4.01	5.910	.003

Based on post hoc (Table 4.40), it is noticed that significant differences academic performance measure are observed between the high-adopters (mean = 3.82) compared with the rest of the lower adoption groups (low adopters: means = 3.56; moderate adopters: means = 3.91). The results indicate that adult workers which have adopted e-learning extensively have been able to achieve better overall academic performance compared to other lower adoption groups. Nevertheless, no significant differences in terms of academic performance were observed among the lower adoption groups. On the other hand, significant differences were being observed for job performance gained

between the moderate adopters (mean = 3.90) and low adopters (mean = 3.68), and between high adopters (mean = 4.01) and low adopters (mean = 3.68).

4.10.4 Adoption Level and E-Learning Impacts

In order to seek a greater insight into meaning on the above statistical results, graphical comparisons of e-learning impact are made among the three-adoption groups as plotted in Figure 4.19 below. The objective is to determine whether there are any distinct trends between the impact measures and the various adoption groups.

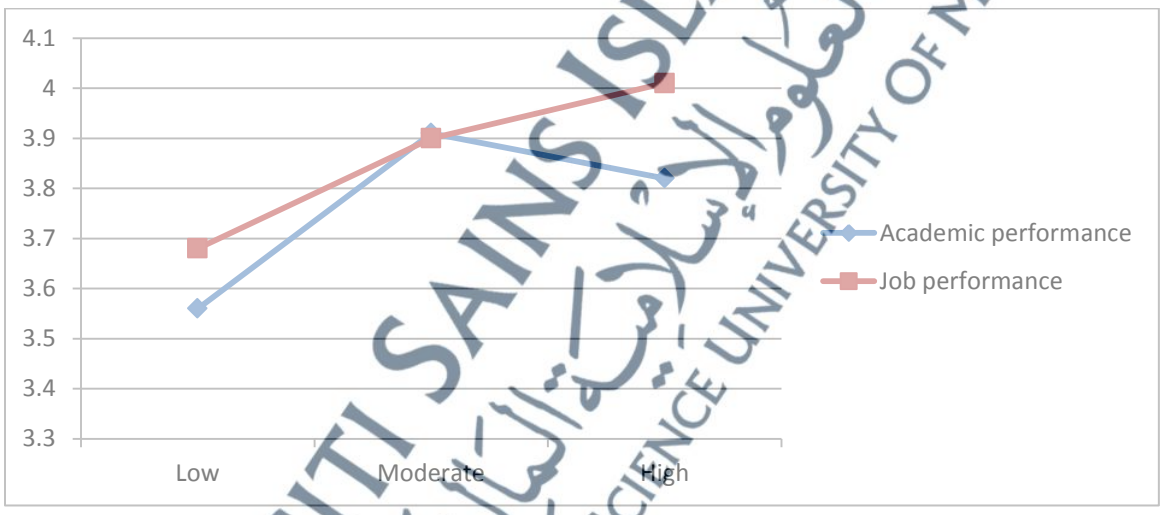

Figure 4.19 Comparisions of E-Learning Impacts

In Figure 4.19, performance declined initially but indicated an increasing trend at latter stage. It also observed that the job performance generally show an increasing trend when the extent of e-learning adoption increased. This reinforced the suggestion that job performance values gained by adult workers increased as adoption progressed. A similar

trend was also being observed for the academic performance which showed increasing trend as e-learning adoption increased.

4.11 Summary

This chapter presented the results of data analysis used for the purpose of this study. Descriptive statistics were conducted to show the study respondents and the major variables. Also, this chapter has idintfied the relationship between the extent of e-learning adoption and its impacts on adult workers. The three adoption groups were subjected to correlation and logistic regressions to determine the relationship between the independent and dependent variables. The analysis shows that the adult workers which have adopted and integrated their e-learning applications have performed better than the adult workers which do not adopt e-learning application extensively. Similarly, adult workers that are being categorised as high-adopters and moderate-adopter of e-learning applications has gained better study perfotmnce as comperd to adult workers which are low-adopters of e-learning applications. The findings in this chapter will be discussed and concluded in the next chapter with recommendations based on these findings.