CHAPTER THREE
RESEARCH FRAMEWORK AND METHODOLOGY

3.1 Introduction

The previous chapter reviewed the literature related to innovation adoption, specifically the adoption of e-learning. This chapter presents a research framework to determine the relationships between the research variables. These variables are classified as variables relating to (1) characterizing e-learning adoption; (2) factors associated with e-learning adoption, namely technology, organizational and personal factors, institutional forces and (3) impact of e-learning on adult workers. An integrated conceptual framework that describes the relationships between these variables is presented. This chapter will also discuss on the philosophical underpinning of research paradigms research design, research strategy, research population, research sampling and research instrument.

3.2 Research Instrument

This section discusses about the research instrument and its development for data collection on the adult workers' adoption of e-learning through the measurement of the factors: e-learning adoption, technological, organizational, personal and institutional forces factors as well as outcome of e-learning adoption.

3.2.1 Level of Adoption

A review of studies conducted by Govindasamy (2002) Zhang and Zhou (2003) Lee (2006) and Uhomoibhi (2006) indicated that e-learning has many powerful applications that can be adopted by individual. Some of the common applications in e-learning include: e-mail, online library, online testing, online assessment, live audio, live video conferencing, live chat tutorial, online courses material, online grades and online registration (Table 3.1).

Table 3.1 Literature used for level of adoption items

Applications	**Sources**
E-mail	Govindasamy (2002); Zhang and Zhou, (2003); Uhomoibhi (2006); and Lee (2006); Van-Raaij and Schepers, (2008)
Online library	
Online testing	
Online assessment	
Live audio	
Live video conferencing	
Live chat tutorial	
Online courses material	
Online grades	
Online registration	

These interactive applications have been widely adopted for e-learning (Harman & Dorman, 1998; Piotrow *et al.*, 2000). E-learning is arguably one of the most important ICT applications to facilitate learning in geographically dispersed regions (Atkinson, Beniest & Rao 2007). In other words, e-learning has become a general term encompassing the application of computer technologies in education, whether it occurs in face-to-face classrooms or in online learning environments (Abrami *et al.*, 2006).

E-learning has the capacity to enhance learning and expand access to education and training to students around global (Atkinson *et al.*, 2007). Nevertheless, as indicated by the literature review, e-learning applications generally show a linear progression with complexity of technology (Lee, 2006; Uhomoibhi, 2006).

3.2.2 Extent of Usage

In general, the extent of usage refers to the quantity of learning activities that are conducted through the Internet (Duan *et al.*, 2010). The development of information and communication technologies (ICTs) has provided significant opportunities for education suppliers to explore and develop new ways of delivering educational programs.

The proliferation of Internet technologies and applications has altered the characteristics of the traditional learning environment, paving the way for new learning environments. As Chin and Marcolin (2001) suggested, constructs of IT that portray actual usage of the innovation provide a clearer understanding on the adoption of innovations such as e-learning. However, this has been neglected in previous e-learning studies (e.g. Lee, 2006; Wu *et al.*, 2008; Duan *et al.*, 2010).

Four e-learning implementations and adoption sub-stages were investigated in this study. These sub-stages were adapted from prior literature review (e.g. Zaltman *et al.*, 1973; Davis, 1989; Moore & Benbasat, 1991; Rogers, 1995; Fichman & Kemerer, 1997; Thi, 2006; Masri, 2010). The four phases are not using, used sometime, used most of the

time, and used all the time. Figure 3.1 provides a summary of the phases of usage for e-learning applications.

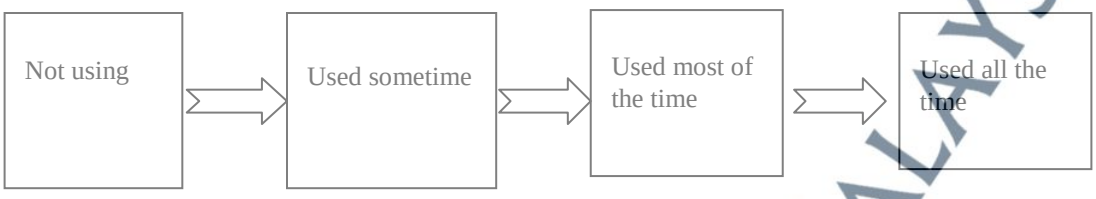

Figure 3.1 E-learning Adoption Phases

A framework to characterize and measure e-learning adoption based on two dimensions presented in a matrix was developed. Table 3.2 shows the level of adoption constitutes types of applications adopted ranging from e-mail to online registration. Extent of usage refers to the various sub-phases of e-learning applications' usage which ranges from "Not using" the application by adult learners to the substitution phase "used all the time" that reflects the maturity of e-learning adoption. These two dimensions are used to characterize e-learning adoption among adult workers.

Table 3.2 Preliminary E-Learning Adoption Matrix

Extent of usage / Level of adoption	Not using	Used sometime	Used most of the time	Used all the time
E-mail				
Online library				
Online testing				
Online assessment				
Live audio				
Live video conferencing				
Live chat tutorial				
Online courses material				
Online grades				
Online registration				

3.2.3 Technological Factors

The literature review in the previous chapter has identified three major characteristics of innovation that influence individual's attitude toward innovation adaption. In general, the results indicate a positive relationship among relative advantage with innovation adoption (e.g. Lu & Liao, 2005; Samarawickrema & Stacey 2007; Hsbollah & Idris 2009), compatibility (e.g. Samarawickrema & Stacey, 2007; Duan *el al.*, 2010). Nevertheless, complexity (e.g. Batty & Ryder, 2000; Romiszowski, 2004; Martins *et al.*, 2004; Samarawickrema & Stacey, 2007; Hsbollah & Idris, 2009; Duan *el al.*, 2010) has been found to posse relationship with innovation adoption.

Technological factors are operationalized in the present study based on Roger's theory (1995) that refers to its attributes that influence innovation adoption. The three technological attributes proposed by Rogers (1995) have been widely used by previous researches to examine the adoption of innovation. In addition, Rogers (1995) technologies are describes to have attributes that have an impact on the decision to adopt, and how to implement and use the innovation. Technological factors identified from the work of previous researchers are presented in Table 3.3.

Table 3.3 Previous Studies Used for Technological Factors

Technology	Sources
Relative advantage Compatibility Complexity	Tornatzky and Klein (1982); Ely, (1990); Stockdill and Morehouse, (1992); Surry, (1997); Sherry, (1998); Wilson, Sherry, Dobrovolny, Batty, and Ryder, (2000); Wilson, Sherry, Dobrovolny, Batty, and Ryder, (2002); Martins *et al.*, 2004; Lu *et al.*, (2005); Samarawickrema and Stacey, (2007); Liao and Lu, (2008); Duan et al (2010);

3.2.3.1 Technological Quality Factors

The DeLone and McLean (2003) model is a common technique used to assess IS success. Adoptions of e-learning systems are considered to be the most important IT projects in universities (Lee, et al., 2009). However, the evaluation of these systems is still facing problems as there is a lack of measurements to evaluate the success of these projects. The DeLone and McLean (2003) model is believed to be one of the most important measurements which can be used to address this issue in the e-learning adoption field. Studies conducted by Holsapple and Lee-Post (2006), Lin (2007), and Lee-Post (2009) are believed to be supportive of this model in the e-learning adoption field. Table 3.4 shows studies that believed to be supportive of IS success adoption. Successful adoption of information technology factors are operationalized in the present study based on DeLone & McLean (2003).

Table 3.4 Previous Studies Used for Technological Quality Factors

Factors	E-learning adoption systems
Information quality System quality Service quality	MacDonald & Thompson (2005), Holsapple & Lee Post (2006), Holsapple & Lee Post (2006), Roca et al. (2006), Roca et al. (2006), Wang et al. (2007), Wang et al. (2007), Liaw (2008), Ozkan & Koseler (2009),Wang & Wang (2009), McGill & Klobas (2009), Ramayah et al. (2010),

3.2.4 Organizational Factors

Top management support was among the factors that have been identified in this study as an important determinant of adoption of technological innovation (Eraut, 2000; Carrow, 2000; Ellinger, 2005; Sabherwal *et. al.*, 2006; Lohman, 2006; Lee *et. al.*, 2006; Al Qirim 2007; Seyal *et. al.*, 2007; Mosbeh & Soliman 2008; Al-Fakhri, 2008; Berg & Chyung, 2008; Huang, 2008; Tarofder *et. al.*, 2010). Top management support is operationalized as the responsible for helping to create a stimulating, nurturing and supportive environment for adoption of innovation (Yap *et. al.*, 1994; Guns, 1996 & Premkumar & Robert, 1999).

Organizational culture is another important factor identified in the literature that contributes to IT adoption in general and to e-learning adoption in practically (Conyers & Kaul, 1990). Organizational culture is operationalized in the present study as the underlying system of shared beliefs, attitudes and values which are reflected in the way the organization operates (Conyers & Kaul, 1990). The items for organizational culture used in the present study were adapted from Deshpande and Farley (1999).

Organizational structure plays a significant role in deciding diffusion of innovation (Damanpour & Gopalakrishan, 1998). Organizational structure is operationalized in the present study as the formal system of task and reporting relationships that controls coordinates and motivates employees to achieve an organization's goals (Glautier & Underdown, 2001). Organizational structure was among the factors that have been identified in the literatures as an important consideration for the

adoption of innovations (Zmud, 1982; Kwon & Zmud, 1987; Damanpour & Gopalakrishan, 1998; Eder & Igbaria, 2001; Gwebu & wang, 2007; Kunzmann *et. al.*, 2009). Organization factors were derived from the work of different authors presented in Table 3.5.

Table 3.5 Literature Used for Organization Factors

Organizational factors	Sources
Top management support Culture Structure	Conyers and Kaul, (1990); Iacovou *et. al.*, (1995); Eraut, (2000); Carrow, (2000); Ellinger, (2005); Sabherwal *et. al.*, (2006); Lohman, (2006); Sabherwal *et. al.*, (2006); McPherson and Nunes, (2006); Gwebu and wang (2007); Berg and Chyung, (2008); Al-Fakhri, (2008); Huang, (2008); Daneshgar *et. al.*, (2008); Kunzmann and Schmidt (2009).

3.2.5 Personal Attributes

The literature review in the previous chapter has identified five major personal characteristics that influence learning. Education Participation Scale (EPS) developed by Boshier and Collins, (1983) was used to determine the motivational orientations of the adult workers in education. The five factors are social contact reflects a desire to develop or improve one's relationship with other people. Social stimulation which reflects a need to find intellectual stimulation as an escape from routine or frustrating situations. Professional advancement that reflects a need to improve occupational status or performance. External expectations reflect the presence of pressure to participate in educational activities from another person or circumstances. Cognitive interest reflects the view of learning as a way of life and the belief in the concept of learning for the sake of learning.

The items for personal attributes used in the present study were adapted from Boshier and Collins, (1983). The personal attributes was operationalised based on Boshier and Collins's (1983) five dimensions which influence the participation of adults on learning due to the need for social contact, social stimulation, professional advancement, external expectations, and cognitive interest. The personal factors are derived from the work of pervious authors are presented in Table 3.6.

Table 3.6 Literature Used for Personal Factors

Personal factors	Sources
Social contact Social stimulation Professional advancement External expectations Cognitive interest	Houle, (1961); Sheffield, (1964); Morstain and Smart, (1974); Boshier and Riddell, (1978); Furst and Steel, (1986); O'Conner, (1987); Peterson, (1981); Romaniuk and Romanuik, (1982); Brady and Fowler, (1988); Knapper and Adair and Mowsesian, 1993; Bynum and Seaman, (1993); Cropley, (2000);

3.2.6 Institutional Forces

The literature review in the previous chapter has identified three major institutional forces (coercive, normative and mimetic) that influence e-learning adoption. Specifically, for coercive force, the respondents were asked the degree to which e-learning was required for their on-the-job training. For normative forces, the respondents were asked to indicate the degree to which others in their social network were using e-learning. For mimetic force, the respondents were asked the degree to which they agreed that individuals who were using e-learning had a high status.

The institutional theory focuses on the pursuit of legitimacy in the eyes of important societal stakeholders and accentuates the significance of the institutional

environment as attitudes and behaviors of social actors (Grewal & Dharwadkar 2002). The theory indicates that in modern societies, social actors are typified as systems of rationally ordered rules and behaviors (Weber, 1946; Teo, Wei, & Benbasa, 2003). Institutional forces were derived from the work of different authors presented in Table 3.7.

Table 3.7 Literature Used for Institutional Forces

Institutional forces	Sources
Coercive Normative Mimetic	DiMaggio & Powell, 1983; Flanagin, 2000; Teo, Wei, & Benbasa, 2003; Scott, 2004; Wang and Cheung 2004; Harcourt, Lam, & Harcourt, 2005; Johnson, Dowd, & Ridgeway, 2006; Jan et al., 2012;

3. 2.7 Outcome of E-Learning on Adult Workers

As this study is focus on adult workers, the literature has indicated two perspectives to examine the outcomes of e-learning adoption in terms of academic study and job performance.

3.2.7.1 Outcome of E-Learning on Adult Workers' Study

In this research, e-learning impact on adult workers' study is operationalised using Bloom's taxonomy. Bloom (1956) developed the taxonomy to help instructors in the assessment of their course material and testing outcomes. He grouped the concept of learning into three domains of behavior namely, cognitive affective and psychomotor.

There are six components under cognitive domain (knowledge, comprehension, application, analysis, synthesis and evaluation).

The cognitive purpose of acquiring knowledge (students can feedback what you told them), the purpose of comprehending (students must be able to explain a concept with their own words), the purpose of applying (students must be able to solve a problem), the purpose of synthesis (students must be able to create new solutions), and the purpose of assessment (students must be able to practice critical thinking). Affective domain which explains individuals deals with things emotionally, such as feelings, values, appreciations, motivations and attitudes. Psychomotor domain which is the area of physical movement, coordination and use of motor skills by individuals.

Bloom's taxonomy has been utilized by authors such as Boyd and Murphrey (2002); Vidakovic, Bevis and Alexander (2003) as an evaluating tool to assess student's performance in traditional courses versus online simulations. Halawi *et al.,* (2009) have also used Bloom's taxonomy scale to assess the effectiveness of e-learning.

Generally, Bloom provided the instrument that researchers use to examine the learning preferred behavior pattern of student after taking the course. In their study, Halawi *et al.,* (2009) used 27 items that measure the e-learning outcomes and the factors that influence outcomes in term of individual. The items for e-learning impact on adult workers' study used in the present study were adapted from Halawi *et al.,* (2009).

3.2.7.2 Outcome of E-Learning on Adult Workers' Performance

This section aimed to examine the relationship between e-learning adoption and the impact on adult workers' job. There are several advantages of e-learning reported by organizations that had adopted e-learning programs for their employees (Davy 1998; Chute *et al.,* 1999; Schriver & Giles 1999; Chute, Thompson & Hancock, 1999; Pollard & Hillage, 2001; Primelearning, 2001). For example, e-learning adoption provides a cost saving and time-effective approach to employee training (Adams, Nelson & Todd, 1992; Rosenberg, 2000; Luor, Hu, & Lu, 2009).

Through e-learning adoption, workers have access to various on-line databases and tools that help them to find solutions for their work related problems (Wang *et al.*, 2007). In order for e-learning adoption to be used effectively in an organization, it needs to measure the effectiveness of the e-learning. Wang *et al.*, (2007) measure the e-learning outcomes and the factors that influence such outcomes in terms of individual and organizational factors. The items for e-learning impact on adult workers' job used in the present study were adapted from Wang *et al.*, (2007).

3.3 Research Design

Research design represents the plan in which the research flow is organized, managed, and accomplished (Shareef, 2009). This study involves quantitative approach. Quantitative research can be used to describe current conditions, investigate relationships, and correlations between variables (Gay, Mills, & Airasian, 2006). According to (Leedy & Ormrod, 2005), "Quantitative research is used to answer questions about relationships among measured variables with the purpose of explaining, predicting, and controlling phenomena". The aim of quantitative research is to determine the relationship between one variable and another in a given population (Gall, Gall, & Borg, 2003).

There are three possible approaches that could be used for this study. The approaches are survey, case study and action research. According to Zikmund (2003), there is no one best research methodology. The approach adopted depends on the research objectives and research questions that the researchers seek to answer. Furthermore, the decision to adopt any research methodology is always a compromise between options and choices (Zikmund, 2003). The choices to be adopted are also frequently influence by the availability of resources and the skills possessed by the researchers themselves.

Moreover, use of a quantitative method enables the researcher to quantitatively assign numerical values to the variables so that an association can be determined through use of different statistical methods (Howitt & Cramer, 2008). However, this study aimed to characterizes e-learning adoption and the extent of usage among adult workers. It also

aims to identify factors associated with the adoption of e-learning by adult workers and to determine the relationship between e-learning adoption and outcome. Therefore, based on the purpose of research questions and the nature of the research objectives, this study can be categorized into a quantitative descriptive survey design rather than qualitative.

The quantitative approach concerns on numerical representation and management of the observations for clarifying and describing the phenomena that the observations mirror. In contrast, the qualitative approach focuses on non-numerical representations and the explanation of observations, with an intention to discover the fundamental meaning and defining the relationships.

Further, the qualitative approach highlights on the research, which contains factors and variables that are not thoroughly measured and examined, but in terms of quantity, explains the huge number of processes and frequency. On contrary, quantitative approach concerns on the measurement and investigation of relationships between variables (Bellenger, Bernhardt, and Goldstucker, 1976; Casebeer and Verhoef, 1997; Zikmund, 2000). The variables and their relationships are considered the main idea in a quantitative approach (Neuman, 2003). A quantitative study is valuable as long as the preparation of the research prior to collecting and analyzing data is exhaustive, because it supports the instrument development for measuring ideas and arrangement for sampling. Also, the quantitative approach develops a deductive research by examining the relationship among variables and present facts for a certain hypotheses (Neuman, 2003). The major differences of the approaches are outlined in Table 3.8.

Table 3.8 Characteristics of Qualitative and Quantitative Paradigms

Qualitative Paradigm	Quantitative Paradigm
1. Qualitative methods preferred, Phenomenological	1. Quantitative methods preferred. Logical-positivistic
2. Concerned with understanding human behavior from the actor's frame of reference.	2. Seeks the facts or causes of social phenomena without advocating subjective interpretation.
3. Phenomenological approach.	3. Logical-positivistic approach.
4. Uncontrolled, naturalistic measurement.	4. Obtrusive, controlled measurement.
5. Subjective; "insider" perspective; close to the data.	5. Objective; "outsider" perspective; distanced from data.
6. Grounded, discovery-oriented, exploratory, expansionist, descriptive, inductive.	6. Ungrounded, verification-oriented, confirmatory, reductionist, inferential, hypothetic-deductive.
7. Process-oriented. Holistic —attempts synthesize.	7. Outcome-oriented. Particularistic — attempts analyze.
8. Validity is critical; "real," "rich," and "deep".	8. Reliability is critical; "hard" and replicable data.

3.4 Choice of Survey Method

Zikmund (2003) reveled that there is no best method as each one has its own strengths and weaknesses. While Cooper & Schindler (2003) believed that it is not difficult to choose the best method if the researcher can evaluate between the advantages and disadvantages for each method. However, Kumar (2005) suggested that choice of survey method depends on three major issues namely the nature of the investigation, the geographical distribution of the respondents and the respondent's characteristics.

According to Lambert and Harrington (1990) the response rate for e-mail ranged from 20 to 30 percent. On the other hand, Mavis and Brocato (1998) found that response rates for email surveys were consistently lower. On the other hand, mail surveys were also shown a low response rate (Kumar, 2005). Previous studies that investigated e-learning adoption in Jordan and using survey questionnaires sent by e-mails and mail

surveys to respondent revealed a low response rate (e.g. Abuloum & Khasawneh, 2006; Abbad & Nahlik; 2009). Therefore, all questionnaires were delivered by hand in order to ensure higher response rate (Karim, et al., 2006; Alzaza, 2012; Qazaq, 2012). Based on the criteria suggested by Sekaran, (2003) survey (by hand) and develop a good questionnaire design are perceived as a better choice to ensure higher response rate.

3.7 Population of the Study

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query (Castillo, 2009). It is for the benefit of the population in which the research is done. However, due to the large sizes of populations, researchers are often not able to test every individual in the population because it is too expensive and time consuming. This is the reason why researchers rely on a sample techniques (Sekaran, 2003). The size of sample depends on the accuracy required, the number of variables in the study and the appropriate statistical tools to be used.

However, the population of the current study involved Jordanian adult workers who enrolled in the distance program at the AOUJ either they are pursuing degree, higher diploma or master. In this study, only adult workers are enable to answer the questionnaire because the questionnaire contains of factors such as organizational, personal and institutional factors. The statistical number of this population according to AOUJ (2013) is 2740 adult workers who are pursuing their basic degree program holding different subject (Faculty of Business Studies, Faculty of Language Studies, Faculty of Computer Studies and Faculty of Education Studies). A sample frame was obtained from

AOUJ which comprised of all adult workers who are pursuing their basic degree program. Table 3.9 shows the distribution of the population of the study from each faculty.

Table 3.9 The Distribution of the Population of the Study from Each Faculty

Subject	N. Students	% of sampling
Degree		
Faculty of Business Studies	857	31.27%
Faculty of Language Studies	511	18.64%
Faculty of Computer Studies	402	14.67%
Faculty of Elementary Education Studies	522	19.05%
Faculty of Education Studies	294	10.72%
Higher Diploma		
Faculty of Education Studies	54	1.97%
Master		
Faculty of Language Studies	33	1.20%
Faculty of Business Studies	30	1.09%
Faculty Education in Educational Technology	37	1.35%
Total	**2740**	**100%**

Source: Arab Open University Jordan, 2013/2014.

3.6 Sample Selection and Sampling Frame

A sampling frame is a list of population elements from which a sample can be drawn. According to Hague and Harris (1993) a sampling frame should meet the following criteria:

1. The frame should contain a list of members of the defined population.
2. The frame should be completed and up-to-date.
3. No element listed more than once.

4. Information given on the frame provides adequate means for stratifying the sample.

In this study, the target population is the adult workers who are working fulltime and learn part-time at the Arab Open University in Jordan (AOUJ). A decision was taken to include all AOUJ adult workers who are pursuing their basic degree programme in selecting the sample. According to Gay et al. (2006), sampling is the process of selecting the participants for a study in such a way that they represent the larger group (population) from which they were selected. It is very important in selecting the sample to determine the adequate sample size which represents an appropriate quantity of the entire population (Bless & Higson, 1995). Zikmund (2003) outlines that the convenience sample according to population are considered as significant issue to the research.

Therefore, the prior studies argued that when the population size is 10,000 and more, the sample would be between 200 and 1000 participants. Besides, Sekaran (2003) presents a table contains the sample size for a given population of size from 10 to 1000000. According to the table, if the population size is 5000 then the sample size must be more than 357. While, if the population size is 6000 then the sample size must be more than 361.

With regards to the guidelines by Sekaran (2003) the population size of this study which is 2740 adult workers who are working fulltime and learn part time at Arab Open University, it is appropriate to select a sample size of not less than 339 adult workers from the target research population (Zikmund, 2003; Sekaran, 2003). As a result, in this

study, it is appropriate to select a sample of not less than 339 adult workers from the target research population. Based on that recommendation, this study managed to employ 600 adult workers from the target population. This research employed a proportionate stratified random sampling method to select the number of adult workers from each faculty at AOUJ. The main advantage with stratified random sampling is how it captures key population characteristics in the sample. Similar to a weighted average, this method of sampling produces characteristics in the sample that are proportional to the overall population. The Stratified random sampling works well for populations with a variety of attributes (Sekaran, 2003). The adult workers were given 15 minutes to complete the questionnaire in their classrooms. All the respondents were given a brief about the study during this process. The data collection was carried out in a period of two months from November 2013 to December 2013.

3.7 Data Collection Procedure

The main objective of this study is to investigate the adoption of e-learning among adult workers in general. Hence, the unit of analysis for this research consists of individual adult workers in Jordan.

To achieve the objectives of this research, a questionnaire was developed to collect data from the respondents to provide answers to the research questions. However, stringent regulations prohibit Arab Open University in Jordan students to respond to any questionnaires, unless with the consent of the Director University. Therefore, a formal request was sent to seek permission from the Director. The questionnaires were

distributed to the adult workers by hand in the classrooms with cooperation from the lecturers and professors during they stay in the classrooms (Karim, et al., 2006). This method provides a great opportunity to meet with a great number of students under the supervision of their lecturer/professor, which gives an opportunity to motivate and encourage them to cooperate. All the respondents were given a briefly explanation about the study and its importance and how to complete the questionnaires in order to ensure higher response rate.

3.7.1 The Sample of the Study

For this study, data was collected using survey questionnaires that were sent to respondents by hand. A total of 600 questionnaires were sent to the sample. A total of 600 questionnaires were returned and 82 questionnaires were excluded as they were unusable due to many uncompleted items in their questionnaires. Thirteen questionnaires were unusable and subsequently removed as the respondents are self-employed, unemployed and pensioner/ retired. The focus of the current study is on the adult workers who are working full time and learn part time. The final responses consisted of 505 questionnaires which represented 84 percent of the total number of questionnaires being distributed.

3.8 Questionnaire Design

When designing the questionnaire of this study, care was taken to ensure that the questionnaire meets the study objectives. The questionnaire encompassed a series of questions presented in the Appendix A. The questionnaire was developed following the systematic process:

a) Reviewing the relevant researches, related literature, and journal articles in order to identifying pertinent variables to the study,
b) Crafting the questionnaire based on the identified variables,
c) Getting an expert opinion by submitting the draft to the supervisor then discussing and revising it according to the supervisor suggestions,
d) Pretesting the questionnaire to ensure that the questionnaire is explicable to the respondents,
e) Undertaking a pilot study,
f) Refining the questionnaire based on the pilot study results,

Gay and Diehl (1992) also suggested that the development of the study instrument followed the general guides whereby the questionnaire design should be concise, attractive and easy to answer. Zikmund (2003) emphasized that an instrument must meet two requirements. Firstly, relevancy of questionnaire utilized to collect the data to achieve the objectives of research. Secondly, accuracy as the questionnaire utilized to collect data characterized by a high degree of validity and reliability.

The following guidelines proposed by Hair et al., (2006) were taken into account while phrasing the questionnaire items.

1- Using simple words and common language.
2- Using brief and direct questions.
3- Avoiding vagueness and be clear about what you asking for
4- Avoiding leading questions to desirable answers and;
5- Avoiding double-barreled questions consist of two or more concerns.

The questionnaire in this present study is divided into four main sections. General and simple questions which were asked before the difficult ones.

- Section A: Comprised a series of questions to elicit the respondent's demographic information.
- Section B: It designed to probe the adoption of e-learning applications. The questions for this section were specifically developed for the purpose of this study, and presented in two matrix table. This matrix is based on two perspectives; level of e-learning applications adoption and extent of their usage. This was used to characterize e-learning adoption and provide an overall view of the nature of e-learning adoption.
- Section C: This section was developed to determine the factors that influence e-learning adoption. Also, this section comprised four major categories which are technological, organizational, institutional forces and personal factors. Technological factors were operationalised with 39 items adapted from Duan *et al.,* (2010) and Wang *et al.,* (2007) with scales reliability between .68 and

.85. These items were measured using a five-point Likert scale with 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5=Strongly Agree. It is important to note that Duan *et al.,* (2010) and Rogers (1995) DOI theory. According to Goldberg and Velicer (2006), using a rating scale of five choices increases the likelihood that the participants will carefully review rating scales and will be less likely to rush through the items.

- Organizational factors were operationalised with 19 items adapted from Yap *et al.,* (1994) Premkumar and Robert (1999) Deshpande and Farley (1999) and Kim and Lee (2008). The items were measured using a five-point Likert scale with 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5=Strongly Agree.
- Personal factors were operationalised with 21 items adapted from Kim and Merriam (2004) and Miller (1967) who had adapted it from Boshier and Collins, (1983). The items were measured using a five-point Likert scale with 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5=Strongly Agree.
- Institutional forces operationalised with 9 items adapted from Jan et al., (2012) with scales reliability between .82 and .91. The items were measured using a five-point Likert scale with 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5=Strongly Agree.
- Section D: This section was developed to measure the impact of e-learning adoption by adult workers. This section consists of two dimensions which are e-learning adoption impact on adult learners in terms of study and job. The impact

of e-learning among adult workers in terms of study were operationalised using 7 items adapted from Halawi *et al.,* (2009) who used Blooms' taxonomy to examine the impact of e-learning on learners. These items were measured using a five-point Likert scale with 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5=Strongly Agree.

- The impact of e-learning on their job outcomes were operationalised using 7 items were adapted from Wang *et al.,* (2007) who had adapted from original IS success model proposed by DeLone and McLean (2003). These items were measured using a five-point Likert scale with 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5=Strongly Agree.

3.9 Questionnaire Translation

The questionnaire was translated into Arabic language using a back translation technique in order to achieve the measurement equivalences in both languages (Brislin, 1970). The questionnaire was sent to two bilingual experts (English/Arabic) in order to ensure that the two versions are harmonized as close as possible. The Arabic version was translated later back into English by another bilingual expert in order to remove or solve any differences. The Arabic questionnaire is depicted in Appendix B.

3.10 Pre-Test

According to Dillman (2000) the research instrument needs to be fine-tuned with a series of tests before it can be sent out to respondents. Churchill (2001) also states that data collection should never begin without an adequate pre-test of the questionnaire. The rationale for this pre-testing stage is to ensure the research instrument is clear and comprehensible for the study sample (Hoinville & Jowell, 1985). The reasons of such pre-testing steps include:

- To find out any ambiguity in the wording
- To avoid typos and errors
- To determine how long it takes to answer the questionnaire
- To check the layout of the questionnaire

In this study, the researcher presented the questionnaire to four academic experts and two adult workers from Arab Open University in Jordan of reviewers to validate the questionnaire. They were asked to give feedback on the following issues: the length of time needed to complete the instrument, the clarity of the statements and instructions, typographical errors and the layout/structure of the instrument.

The suggestions from this pre-testing, four useful feedbacks were obtained. Firstly, a minor change was made to the questionnaire wording of the cover letter. However, no comments were suggested regarding the comprehensibility of the statements and instructions. Secondly, all respondents took approximately 15 minutes to complete

questionnaire. Thirdly, for technology attributes, there were initially 39 items representing 6 different dimensions of technology attributes. The results indicated that the item of relative advantage is similar to compatibility namely "E-learning meets my personal learning needs" and also the item of complexity is similar to system quality namely "E-learning system is easy to use". These items were subsequently deleted from the questionnaire. The items related to technology attributes dimensions were reduced to 39 items instead of 37 items. Finally, to do changes in terms of the items' arrangement, flow and sequencing of the questionnaire. The suggestions were incorporated and a final version of the instrument was ready to be piloted on a larger scale.

3.10.1 Pilot Study

A pilot study is essential in the planning and carrying out of research (Connelly, 2008). The main purpose of pilot testing is to ensure whether the research instrument is valid and reliable. The aim of conducting pilot test in the present study is to ensure the information required are clearly understood by the respondents and to ensure whether the length of the questionnaire can be completed within a set time span. In general, a pilot study uses parallel methods and procedures to the main study (Cohen *et al.*, 2007). The pilot study serves many purposes. Among these as pointed out by Van Teijlingen and Hundley (2001) and Cohen *et al.*, (2007) are:

- checking the clarity of the questionnaire items and instructions
- getting feedback on the validity and reliability of the questionnaire items
- checking the length and complexity of the questionnaire

- trying out the coding and analysis of the data
- assessing the likely success of proposed recruitment approaches
- identifying logistical problems which might occur using the proposed methods

In this study, the researcher piloted the major study in October 2013. According to Hunt, Sparkman, and Wilcox (1982), the sample size for a pilot test is at least 30. On the other hand, Cooper & Schindler (2003), the range from 25 to 100 is a suitable size for pilot test in general. To achieve the pilot sixty adult workers who are working full time and learn part-time at AOUJ were selected to participate in the pilot study, while 49 respondents were returned the questionnaires. Thus, the 49 questionnaires were analyzed using SPSS version 18 to examine the validity and reliability of the instrument using factor analysis and reliability test. The next section will discuss the outcome that obtained from the pilot study.

3.10.2 Exploratory Factor Analysis (EFA)

Factor analysis is a data reduction technique used to reduce a large number of variables to a smaller set of underlying factors that summarize the essential information contained in the variables. This could be done by defining common underlying dimensions which is also known as factors (Hair *et al.*, 2007). Hair et *al.*, (2007) described factor analysis as a method used to reduce a large number of variables by combining the related variables together in a factor. It is a rule of thumb that factor loadings greater than 0.30 (absolute value) are considered significant. Loadings 0.40 are considered more important, and if the loadings are 0.5 or greater, they are considered very significant (Hair *et al.*, 2007).

For exploratory research, the cut-off point for significant factor loading that was chosen is 0.50 as recommended by Nunnally (1978).

The framework of this study consist of 19 research variables, namely relative advantage, compatibility, complexity, system quality, information quality, service quality, top management support, culture, structure, social contact, social stimulation, professional advancement, external expectations, cognitive interest, coercive pressures, normative pressures, mimetic pressures and impact on adult workers in terms of study as well as job.

Factor analysis was conducted on each variable in the study framework. Nine items have found to exhibit correlations of less than 0.5 and were removed. The items omitted were as follow: out of nine items of relative advantage, two items are left out, compatibility originally had six items, one item was omitted, complexity originally had six items, one item was omitted, system quality originally had six items, one item was omitted, information quality originally had six items, one item was omitted; in terms of organizational factors, the organizational structure originally had six items, one item was omitted, organizational culture consisted of eight items, two items were left out.

An examination on the BTS for each variable also indicates that it is significant and KMO of sampling adequacy for each variable is well above 0.6. The result of the factors analysis showed that all items have loading above “0.5”. The results of the factors analysis is shown in Appendix C. Hence, the original number of the questionnaire was 100 items from independent variables and impact of e-learning were reduced to 91 items.

3.10.3 Reliability of the Instrument

Reliability is perceived as the degree by which similar results can be obtained when repeating the same course of action under different circumstances (Crowther & Lancaster, 2009). In other words, reliability is to examine the internal consistency between items using Cronbach's coefficient alpha (Pallant, 2007). Cronbach's coefficient alpha value is the most widely used statistics to determine the reliability of the measurement (Leedy & Ormrod, 2001; Sekaran, 2003; Hair *et al.*, 2007; Pallant, 2007; Saunders *et al.*, 2007; Crowther & Lancaster, 2009).

Table 3.10 shows the value of Cronbach's coefficient alpha ranged from .844 to .968. They are generally considered sufficient for research purposes (Nunally, 1978). According to Sekaran (2003) the reliability of less than .60 is considered to be poor, those in the .70 range is acceptable, those over .80 are good and coefficient of 0.9 and above is considered excellent.

Table 3.10 Reliability Coefficient for Multiple Items in the Pilot Study

Variable	N. of Items	Alpha (a)
Relative advantage	6	.946
Compatibility	5	.928
Complexity	5	.925
System quality	5	.914
Information quality	5	.856
Service quality	5	.912
Top management support	5	.872
Structure	5	.934
Culture	6	.919
Social contact	4	.892
Social stimulation	4	.939
Professional advancement	5	.968
External expectations	4	.844

Cognitive interest	4	.898
Coercive pressures	3	.865
Normative pressures	3	.897
Mimetic pressures	3	.869
Impact in terms of Study	7	.902
Impact in terms of Job	7	.883

3.11 Final Instrument

After performing validity and initial reliability tests, the final version of the instrument was developed for use in actual data collection. Throughout the process of instrument development and testing, the emphasis was on the proper instrument design for the statistical analysis methods to be used. As a result, the sections used in the initial instrument were retained. The final instrument is found in Appendix A.

3.12 Data Screening and Cleaning

To ensure that data have been correctly entered and that the distribution of variables to be analyzed are normal, data screening and cleaning procedures for errors or outliers were conducted. According to Zikmund (2003) an outlier is related to data which has value that lies outside the normal range. Any individual item with a Mahalanobis Distance (D^2) scores greater than Chi-square value ($X^2 = 114.2678$) would be considered as multivariate outliers (Hair *et al.,* 2006). All items in this study were carefully screened in order to identify any errors in data entry by using descriptive statistics. The outcome of the descriptive test which included mean, minimum and maximum values in addition to box plot showed that only three questionnaires have extreme values in most of the responses.

Hence, the three questionnaires were excluded from the final analysis. The final usable questionnaires were 502 of the total number of questionnaires distributed.

Due to the fact that assumption of normality is a prerequisite for many inferential statistical techniques, researcher must consider the issue of normality distribution of the data before further analysis can be conducted. However, Hair, Black, Babin, and Anderson (2006) suggested that with a sample size of 200 or more, there is no worry about the normality distribution of the variables.

The sample of this study consists of 502 respondents; there was no serious concern about the normality distribution of the data for this study to be used for further analysis. Nevertheless, test of normality distribution of the data was still conducted to examine Skewness and Kurtosis of the data distribution. Skewness is a measure of symmetry, or more precisely, the lack of symmetry and a distribution, or data set, is symmetric if it looks the same to the left and right of the center point (Hair *et al.*, 2006).

On the other hand, Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. Data with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near to the mean rather than a sharp peak (Hair *et al.*, 2006).

Hair *et al.*, (2006) described positive kurtosis indicates to the poutiness of distribution while negative value indicates to flatness of distribution. On the other hand, skewness indicates the distribution swing of the scale to both sides - A positive skew if it

is skewed to the left-side, and a negative skew if it is skewed to the right-side. The results of Kurtosis and Skewness for relative advantage are presented in Table 3.11 below, while the rest of results are shown in Appendix D.

Table 3.11 Results of Skewness and Kurtosis for Relative Advantage

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
TRA1	502	-.259	.109	-.667	.218
TRA2	502	-.249	.109	-.763	.218
TRA3	502	-.233	.109	-.759	.218
TRA4	502	-.270	.109	-.692	.218
TRA5	502	-.262	.109	-.754	.218
TRA6	502	-.673	.109	.246	.218
Valid N (listwise)	502				

As the results indicated, there were no values exceeding the acceptable range of skewness suggested by Hair *et al.*, (2006) which is between -2.58 and +2.58 at the 0.01 significance level or between -1.96 and +1.96 at 0.05 of the significance level. As for kurtosis, the normal range is between -3 and +3. Based on the kurtosis and skewness results, there was no serious concern about the normality distribution of the data to be used for further analysis.

3.12.1 Test of Non-Response Bias

Test for non-response bias was undertaken because this type of bias affects the interpretation of the variables and subsequently the overall conclusions resulted from data analysis.

To examine the non-response bias, a test comparing the early and late respondents proposed by Armstrong and Overton (1982) was adopted. To achieve this purpose, the first 50 questionnaires which were received within the first two weeks were classified as early responses, while the last 50 questionnaires received were classified as late responses.

The objective of the test is to examine if there were any significant differences in the major variables between early and late responses. Therefore, t-test was conducted to examine the differences between the two groups. An extract of non-response bias results is shown in Table 3.12 below, while the rest of the results are shown in Appendix E.

Table 3.12 Independent Sample t-Tests

Technological Factors	Levene's Test	Sig.	Significance at 95% level
TRA1	.463	.498	Not Significant
TRA2	.023	.879	Not Significant
TRA3	.240	.626	Not Significant
TRA4	.174	.677	Not Significant
TRA5	.205	.652	Not Significant

TRA6	5.615	.020	Significant
TCom1	.975	.326	Not Significant
TCom2	1.447	.232	Not Significant
TCom3	2.399	.125	Not Significant
TCom4	.078	.780	Not Significant
TCom5	1.840	.178	Not Significant
Tlex1	.034	.853	Not Significant
Tlex2	.595	.443	Not Significant
Tlex3	.384	.537	Not Significant
Tlex4	.365	.547	Not Significant
Tlex5	2.833	.096	Not Significant
SyQ1	.269	.605	Not Significant
SyQ2	.031	.861	Not Significant
SyQ3	.349	.556	Not Significant
SyQ4	1.799	.183	Not Significant
SyQ5	.282	.597	Not Significant
IQ1	1.398	.240	Not Significant
IQ2	.913	.342	Not Significant
IQ3	.445	.506	Not Significant
IQ4	1.810	.182	Not Significant
IQ5	1.401	.239	Not Significant
SeQ1	1.220	.272	Not Significant
SeQ2	1.195	.277	Not Significant
SeQ3	.065	799	Not Significant
SeQ4	.000	.990	Not Significant
SeQ5	.110	.741	Not Significant

The results for test of non-response bias (Appendix E) reveled that the majority of the values were above the significant level of 0.05. Therefore, the results indicated that there was no major concern regarding the issue of non-response bias between the early and late responses for this study.

3.13 Profile of the Respondents

This section describes the background information of the respondents who had participated in this study. Specifically, it provides the demographic information about respondent's gender, age, marital status, employment status, working industry, work experience, monthly income, education level and colleges enrolled. Table 3.13 shows the frequencies and percentage of these variables.

Table 3.13 Personal Background of the Respondents

Gender	**Frequency**	**Percentage (%)**
Male	289	57.6
Female	213	42.4
Total	502	100%
Age	**Frequency**	**Percentage (%)**
18-27	65	12.9
28-37	344	68.5
38-47	75	14.9
Above 48	18	3.6
Total	502	100%
Marital Status	**Frequency**	**Percentage (%)**

Single	193	38.4
Married	309	61.6
Total		100%
Employment Status	**Frequency**	**Percentage (%)**
Full time employment	373	74.3
Part time employment	129	25.7
Total	502	100%
Working Sector	**Frequency**	**Percentage (%)**
Government Sector	204	40.6
Private Sector	298	59.4
Total	502	100%
Work Experience	**Frequency**	**Percentage (%)**
Less than 1 year	86	17.1
1-5 years	108	21.5
6-10 years	245	48.8
More than 10 years	63	12.5
Total	502	100%
Monthly Income	**Frequency**	**Percentage (%)**
Less than 500 JD	309	61.6
501-700 JD	109	21.7
701-1000 JD	75	14.9
Above 1000 JD	9	1.8
Total	502	100%
Currently Pursuing	**Frequency**	**Percentage (%)**
Degree program	407	81.1
Higher diploma	17	3.4
Master program	78	15.5

Total	502	100%
Colleges	**Frequency**	**Percentage (%)**
Business Studies	133	26.5
Language Studies	114	22.7
Computer Studies	97	19.3
Education Studies	158	31.5
Total	502	100%

Table 3.13 above shows that the majority of the respondents were male as they represented 57.6 percent of the sample. The rest were female who represented 42.4 percent of the sample.

In terms of respondent's ages, Table 3.13 indicated that the majority of the respondents were relatively young between the ages of 28-37 years as they represented 68.5 percent of the sample. This is followed by the age group of 38-47 years which represented 14.9 percent of the respondents and the age group of 18-27 years as they represent 12.9 percent of the respondents. The respondents in the age group of 48 and above 18 were represented only 3.6 percent of the total number of respondents.

In terms of marital status, Table 3.13 shows that the majority of the respondents were married as they represented 61.6 percent of the sample. The rest were single who represented 38.4 percent of the sample.

Table 3.13 revealed that more than a half of the respondents had fulltime employment as they represented 74.3 percent of the respondents. Respondents who had part time employment represented 25.7 percent of the respondents.

Table 3.13 revealed that more than half of the respondents (59.4%) were private sector. Less than half of the respondents work at public servants that represented 40.6 percent of the total number of respondents.

Table 3.13 above showed 17.1 percent of the respondents had less than 1 year working experience. This was followed by 21.5 percent of the respondents with work experience between 1-5 years, 48.8 percent of the respondents with 6-10 years work experience and 12.5 percent of the respondents had more than 10 years of work experience.

The distribution of respondent's monthly incomes across the sample is illustrated in the Table 3.13. Slightly more than a half (61.6 percent) earned an income of less than 500JD. While, 21.7 percent of respondents earned an income of between 501-700 JD, this is followed by 14.9 percent who earned an income between 701-1000 JD. Only 1.8 percent of the respondents earned an income above 1000 JD.

Table 3.13 reveals that, slightly more than a half of the respondents (81.1 percent) are pursuing a degree program with 15.5 percent master program and 3.4 higher diploma.

Table 3.13 above illustrates colleges enrolled of the respondents. It can be observed that less than half of the respondents (31.5 percent) who had enrolled education studies. This was followed by 26.5 percent of respondents who had enrolled business studies. Only 22.7 percent of the respondents had enrolled language studies and 19.3 percent had enrolled computer studies.

3.14 Data Analysis

The data collected was analyzed using SPSS software, version 18. Five categories of data analysis are conducted namely, descriptive statistics, factor analysis, clustering of adoption groups, test of differences, correlations and multiple regressions were conducted to provide answers to the research questions.

3.14.1 Descriptive Statistics

To present raw data transformed into a form that will make them easy to understand and interpret. Descriptive statistics (mean, values, and standard deviations) for all variables of interest in this study were presented. Pallant (2007) revealed that descriptive statistic aimed to depict the different attributes of the data, verify any violation of the principal assumptions for the statistical methods and to address particular research questions. In this study, the descriptive statistics were undertaken using central tendency and variation statistics such as means and standard deviations.

3.14.2 Validity

Validity can be defined as the extent to which the instrument measures what it is intended to measure. This means the measurement results should be the same as what they emerge to be about (Gay & Diehl, 1996; Zikmund, 2003; Sounders *et al.*, 2007).

Validity can be classified into three different types namely content validity, construct validity, and concurrent validity. Content validity is known as face validity. It is concerned with the content of the measurement as it should measure what it is supposed to measure. According to Gay and Diehl (1996), content validity cannot be measured by any calculated procedures. It is determined by professional judgment on its accuracy and adequacy of the measurement content.

The second type of validity is construct validity which is the capacity of a measure to verify an understanding of associated hypotheses created from a theoretical foundation on the conception (Zikmund, 2003). Hence, this test concerns mostly about the proposed theoretical construct. Finally, concurrent validity is about the consistency of the results which are attained by the test comparing with other tests conducted at the same time.

3.14.3 Reliability

Babbie (2001) revealed that reliability means regardless of whenever the same procedures are used repeatedly, it should get the same results for the same study. The measurement is considered reliable if it yields the same results when the same technique applied repeatedly on the same respondents over a different period of time. The reliability of the scale can be measured by Cronbach's alpha which is ranged from 0 to 1. According to Nunnaly (1978) the value of 0.7 is the acceptable alpha value for research in general.

In this study, the internal consistency using Cronbach's alpha was computed to ascertain the internal consistency of the measurement items. On the other hand, factor analysis was used to test the reliability and construct validity for this study. The results of the reliability test for each factor were summarized after each factor analysis.

3.14.4 Factor Analysis Assumptions

Factor analysis founded by Karl Pearson, Charles Spearman, and others in the early 20th century (Johnson & Wichern, 2007). Zikmund (2003) describes factor analysis as a kind of data reduction approach employed to discriminate the fundamental dimensions from the original variables. In other words, its main objective is to sum-up a large number of variables into a smaller number of factors.

Several requirements should be satisfied before factor analysis can be applied. First, Hair *et al.*, (2006) highlighted that as a general rule, the minimum is to have at least ten times as many observations as there are variables to be analyzed. This study has 18 variables, and therefore, the minimum sample size needed was 150 observations. This study consists of 502 respondents and the ratio between the variables used in factor analysis and sample size is 1:34. Hence, the first assumption for using factor analysis is being met.

The second test to determine the appropriateness of factor analysis is the type of data used for factor analysis. Hair *et al.*, (2006) highlighted that the data for factor analysis should be a metric measurement. In this study, all the variables for factor analysis had adopted metric scale; hence, factor analysis can be carried out.

The final assumption is the factorability of the correlation matrix. The researcher must ensure that the data matrix has sufficient correlations to justify the applications for factor analysis (Hair, Anderson, Tatham, & Black, 1998). There are two common tests employed to test the correlations among the variables namely Bartlett Test of Sphericity (BTS) and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) which generates an index that range from 0 to 1 (Hair et al., 2006).

For the purpose of factor analysis in this study, the KMO MSA and the BTS were used to determine whether factor analysis is suitable. A small KMO value indicates that factor analysis may not be a good option. Therefore, a KMO value of more than 0.5 is required for factor analysis. On the other hand, Kaiesr (1974) classified MSA values as

meritorious if it is above 0.80, middling if it is in the 0.70s, mediocre if it is in the 0.60s, miserable if in the 0.50 and unacceptable if it is under 0.50. In this study, the MSA value for each variable was first examined and values falling in the unacceptable level will be excluded. Once the individual variables achieved an acceptable range, the overall MSA was evaluated before conducted any further factor analysis can be conducted.

3.14.4.1 Factor Analysis Procedures

After the suitability of variables, factor analysis has been determined, factor analysis was conducted according to the following stages. First, determining the factor loading in order to obtain the initial factors. In this stage, the following requirements should be fulfilled: Factor loading should be 0.5 or more, there is no cross loading between the variables and each component should have more than one variable. In order to extract the number of factors or dimensions, three major principles are used namely; latent root criterion, scree plot and percentage of variance explained. Second, Varimax rotation was used so guarantee that all the correlated variables are presented in the same factor. Finally, new factors are labeled based on their components to give meaning to the factor.

3.14.5 Identify Adoption Groups

A visual approach was employed to identify the various types of e-learning adoption pattern. This approach was adopted because the measure 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) to provide a rich source of information by combining these two dimensions.

3.14.6 Test for Difference

Chi-square test is conducted to examine if there are any significant differences between the early and the late responses in terms of their demographic profiles. A chi-square test is used to determine if two categorical variables are related (Pallant, 2001). Demographic variables which were not in a categorical format in the questionnaire (that are age and working experience) were converted into categorical variables. Before the test was carried out, it was ascertained that we have not violated the assumption for chi-square test that is, minimum expected cell frequency in any cell should be five or more for two-by-two tables (Pallant, 2001). As suggested by Pallant, in the case where two-by-two table violates this assumption, Fisher's exact probability test was considered.

T-test was used to see if there is a statistically significant difference in the mean scores for two groups. The assumption of homogeneity of variance was first examined through Levene's test for equality of variance. In the case where the assumptions of equal variances were violated, the t-value reported for equal variances not assumed was used.

One way analysis of variance (ANOVA) was used to examine whether there exist any differences with more than two categories. As ANOVA test assumed equal variances, the Levene's test for homogeneity of variance was first examined in order to ensure that the assumptions of homogeneity of variance have not been violated.

3.14.7 Correlation Analysis

Correlation analysis was conducted to describe the relationship between variables (Hair *et al.*, 2007). In this study, Pearson's correlation was used to examine relationships between two variables as well as to describe the strength and the direction of the relationship between two variables. The correlation coefficients will range from – 1.00 to + 1.00. The farther away the correlation is from zero, the stronger is the relationship.

Zikmund (2003) highlighted that a value between 0.01 and 0.10 is considered a very weak correlation, 0.10 to 0.29 is considered weak. Medium correlation is depicted when the value is between 0.30 and 0.59, while strong correlation is when the range is from 0.60 to 1.00. However, the correlation value of 0 indicates no relationship between the variables.

In this study, the relationships between impacts of e-learning variables and e-learning adoption using correlational analysis were conducted. In addition, the relationships between each dimension of e-learning adoption were examined using this analysis.

3.14.8 Logistic Regression Analysis

According to Pallant (2007), logistic regression is an extension of correlation and is used to explore the predictive ability of a set of independent variables on dependent variable. To provide answers to one of the research questions in this study, logistic regression analyses were conducted.

Before proceeding with the analysis, basic assumptions of the linearity (represents the degree to which the change in the dependent variable is associated with the independent variable), normality of the error terms distribution and homoscedasticity (constant variance of the error terms) were first examined.

Since logistic regression is very sensitive to outliers, i.e., standardized residual values about 3.3 (or less than -3.3) (Pallant, 2001), it was detected by case-wise diagnostics in the regression analysis. To minimize the effect of outliers, they were deleted from the data set. Before the regression results were considered valid, the degree of multicollinearity and its effect on the results were examined. Variance inflation factor (VIF) and the condition indices for all the variables were examined. According to Hair *et al.*, (1998), the VIF should be close to 1.00 to indicate little or no multicollinearity. They further suggested the cutoff value of 1.00 as an acceptable VIF.

Although path analysis has been used in past studies (Behrman & Perrault, 1982; Dubinsky & Hartley, 1986), this method of analysis was not utilized in the present study. This is because logistic regression was adequate for use in this study as the main

objective of this study was to investigate the antecedents of adoption of e-learning and not to establish the pattern of causation of the model.

3.15 Summary

Chapter three discussed the research methodology adopted for this study. This chapter presented the rational of the research design. Also, the research population and respondents were explained. This was followed by data collection procedures and the development of the instrument. Finally, data analysis techniques used to analyze the data were discussed. The next chapter discusses the results from the output of data analysis.