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E-LEARNING ADOPTION AMONG ADULT WORKERS IN JORDAN

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ABSTRACT

The purpose of this study is to investigate e-learning adoption among adult workers in Jordan. More specifically, the objectives of the study are twofold: (a) To determine the extent of e-learning uptake among working adults in Jordan. (b) To identify the technological, organizational and personal factors that influences the uptake of e-learning among working adults in Jordan. For purpose, an integrated theoretical framework for assessing e-learning adoption, beyond initial adoption was developed. The data were collected from adult workers in Arab Open University in Jordan were used to determine the relationships between technological, organizational, and personal factors and adoption of e-learning. It is found that higher explicitness and accumulation of technology can help the transfer of technological knowledge within the organization and can raise the capability to adopt innovative technologies.

Keywords: *E-Learning; Online Learning; Learning; K-Means Cluster; Hierarchical Cluster*

INTRODUCTION

There is an increasing demand around the world for learning. However, many people live in locations which education or training they want to undertake is not available. Under such conditions, they will be forced to leave their home and work, in order to attend classes (Dodd, Kirby, Seifert & Sharpe, 2009). Another category of people who need to pursue learning on a continuous basis is the working population. As they are working on a full-time basis, they require a flexible educational system that caters their learning needs, at the same time considering their personal commitments such as family responsibilities. In fact, such group of workers faced with decision between learning, leaving their homes and their jobs to gain access to education. These working adults may learn for their career enhancement as they are motivated by being promoted and being paid higher salary based on additional academic qualifications they have obtained (Asaari & Karia, 2005).

In the era of knowledge and technological advancement, educational institutions all over the world are seeking to fill the needs for education particularly, the working adults. One of the significant solutions is by taking advantage of the various communication technologies available today. The rapid growth of information technologies has influenced the way in which education is being delivered (Dodd et al., 2009). Due to the exponential growth of information and communication technology, electronic learning or e-learning has emerged as the new paradigm in modern education (Olaniran, 2006).

In general, the advantages of e-learning include freeing interactions between learners and instructors, or between learners and learners, from limitations of time and space through the asynchronous and synchronous learning network model (Olaniran, 2006). The new technology offers great benefit to

those who work full time in any organisations and have the desire to further their study. In the past, those who want to study may have to leave their jobs because they have to attend classes. With the advent of e-learning, not only individuals can keep their jobs but also further their study at any institutions that offer education with the use of ICT tools.

E-learning is not only useful for such group of individuals; it is also beneficial for the educational institutions that offer such services where adults are working. The benefits of e-learning include provide learning opportunities to all at a reduced cost and increased access to learning for disadvantage groups due to geographical barriers (Jihad & Sondos, 2006). Furthermore, the participants of e-learning will not be constrained by locations, but also time constraint because learning is determined by their own pace. In addition, e-learning has the potential to provide a high quality education and training, producing competitive workforce and increases the level of literacy among citizens (Engelbrecht, 2003). Alexander (2001) summed up the benefits of e-learning in terms of improving the quality of learning, improving access to education and training, reducing the costs of education and improving the cost-effectiveness of education.

The significance of identifying the factors that influence the e-learning adoption become more urgent as it helps government and educational institutions to improve existing practices on teaching and learning. E-learning helps to create a flexible and interactive e-learning environment. Past studies have identified several factors that influenced the e-learning environment in general (Papp, 2000; Selim, 2007; Ndubisi, 2004; & Chang & Tung, 2008). Some of these factors are related to the technological factors, organisational environment and to the individual's behaviour and culture. Johnson et al. (2009) highlighted that organisations played a key role in promoting continuous learning through e-learning. He added that it is imperative to understand the drivers and inhibitors of e-learning as this subject is relatively new compared with the conventional classroom learning. Furthermore, Nedelko (2008) emphasised the importance of personal characteristics of participants on the uptake of e-learning.

It was argued that e-learning and participants' success in e-learning process depends on multiple interdependent factors other than the technology and/or organisational factors such as course materials, and participants' personal characteristics (Wools et al., 2002; & Lee et al., 2007). However, most of the previous studies in the context of e-learning adoption focused on technological factors (e.g. Wang & Liu, 2003; & Roffe, 2002), or at the best technological and organisational factors (Macpherson et al., 2005), while the participants' personal attributes and their interest in enrolment in e-learning process was neglected in literature (e.g. Gonc, 2006; Bose, 2003; Nedelko, 2008; Wools et al., 2002; Learning Online, 2008). As such, it becomes important to identify the personal factors that drive adult's.

workers to engage in e-learning programmes in Jordan, taking into consideration the technological and organisational factors as well.In fact, e-learning in Arab region including Jordan is a new method for learning and teaching. As mentioned previously, Jordan was the first county to adopt e-learning in year 2002 (MoED, 2009). In this context, Arab Open University (AOU) was the first Jordanian university to adopt distance learning on a widespread basis and plays a critical role in e-learning development nationally. AOU is the only university in Jordan that provides distance learning programs (Dirani & Yoon, 2009; personal communication, 2011). Therefore, Jordan universities face many problems in delivering their educational programs. These problems are mainly related to the costs, availability of facilities and shortage of professors (Dirani & Yoon, 2009; & Abbad et al., 2009). However, Jamlan (1995) highlighted that most universities in the Arab countries create their own policies and make decisions about specialization and curriculum depended on requires of the host country without cross-national or institutional comparisons.

In summary, this research attempts to examine the uptake e-learning, the factors that influence adult workers to participate. This research hopes to bridge the gap mainly the limited studies conducted in the uptake of e-learning among working adults in Jordan.

REVIEW OF THE LITERATURE ON E-LEARNING ADOPTION

The literature review highlighted that developing countries face a numerous challenges regarding the adoption of e-learning such as a luck of vital e-learning components, technological infrastructure, negative perceptions of online degrees and learning, skills and unstable socio-political environments (Dirani and Yoon, 2009; Rennie and Mason, 2007; Enuku and Ojogwu, 2006). However, lack of researches on e-learning adoption in developing countries remains the main challenge in this regard. That is because e-learning is still young, whereas in the developed countries there is far more research on e-learning (Andersson and Gronlund, 2009; Rajesh, 2003; Heeks, 2002; Dhanarajan, 2001). Consequently, developing countries should get better understanding regarding these challenges in order to quickly adopt and implementing e-learning in their countries (Andersson and Gronlund, 2009).

Andersson and Gronlund (2009) carried out a study on challenges for e-learning with a particular focus on developing countries in order for understanding how to implement and adopt e-learning in developing countries. A comprehensive literature review including 60 papers on e-learning challenges was undertaken. In their study they found 30 specific challenges which were divided into four categories. These categories are: technology, individuals, context and courses. The overall conclusion is that these challenges are equally valid for both developed and developing countries. However, Andersson and Gronlund's (2009) findings revealed that developing countries focus on access to technology and context for adoption of e-learning and individuals' characteristics was neglected, whereas in developed countries more researchers concern individuals' characteristics for adoption of e-learning.

Based on the study by Andersson and Gronlund (2009) it is obvious from the comparison above that developed countries paid attention to the individual in implementing e-learning, whereas the developing countries concerned with the technology factors.

It was stressed by Moussa and Moussa (2009) in several developing countries including Arabic countries, the current situation of education generally and especially of e-learning is quite poor because numerous factors. Some of the most essential factors are as follows: increasing number of commercialized universities and schools, lack of measures for quality assurance of e-learning and education, lack of accreditation by internationally acknowledged organisations, poor usage of modern technologies in and outside classrooms due to lack of financial and technological resources, little effort to update existing curricula giving higher priority to quantity against quality of material taught, neglecting interactive teaching and teamwork in class rooms and dependence on memorization instead of critically thinking, logically analyzing, objectively criticizing and creatively proposing by the students at universities and especially at schools.

In general, numerous studies have been undertaken on the practical of e-learning adoption such as implementation issues (Newton and Ellis, 2005; Xu and Wang, 2006), e-learning readiness (Smith et al., 2003), e-learning evaluation (Piccoli et al., 2001; Bernard et al., 2004; Papastergiou, 2006; Wang et al., 2007), quality standard (Frydenberg, 2002; Roffe, 2002; Julien, 2005), e-learning infrastructure (Davis, 2004; Fahy 2004; McGreal and Elliott, 2004; Jones and McCann, 2005), and most researches seem to focus on technological, design and delivery issues (Volery and Lord, 2000; Soong et al., 2001; Testa and de Freitas, 2003). Moreover, Chu and Chu (2010) stated that numerous studies which concerned with e-learning have also focused on business area as well. Ho and Kuo (2010) and Liao and Lu (2008) reported that numerous prior studies on e-learning are concerned with learning performance and effectiveness. Thus, it can be stated that few theoretical researchers undertaken for e-learning in both higher education and workplace learning (Chu and Chu, 2010; and Daneshgar et al., 2008). Further, McPherson and Nunes (2006) emphasized that few studies have discussed institutional and organisational aspects of e-learning adoption and implementation, which is vital to the process at all levels. A study done by Ho and Kuo (2010) recommended direction for future studies to investigate that the impact of the adult workers' structural variables. Studies that have been conducted with aim of identifying the antecedence factors associated with e-learning adoption has been limited

in general especially in the context of adult worker adoption in the developing countries (Dirani and Yoon, 2009).

Therefore, this research aims to examine e-learning adoption among adult workers' who are working full time and learning part time in Jordan. For example, a study by Dirani and Yoon (2009) aimed to investigate the factors that affect on Open Distance Learning (ODL) quality in the Arab Open University in Jordan (AOUJ). The study used a qualitative approach, which included five lengthy semi-structured interviews with the program director, two instructors, and three students. The findings revealed that three significant conclusions can be drawn from the study about e-learning in the Arab region: (1) the existence of adverse conditions, (2) the presence of strong instructional practices, and (3) the need to improve administrative support.

Tyan (2004) pointed out the challenges of the diffusion process of e-learning in corporate Taiwan. That is, a number of factors affect the implementation of corporate e-learning, such as maturity of e-learning, corporate readiness, the cost of ownership, government support, and employees' personal characteristics (such as attitudes, personality, background, gender, age. The findings of his study indicates that both situational factors such as technological infrastructure, politics, policies, organisational culture and personal factors such as age, gender, personality, values, prior experiences, attitudes, skills, knowledge are considered critical elements in obtaining successful e-learning outcome.

This study varies from other studies in a sense it aims to adopt e-learning among adult's worker in Jordan. Further, the literature review of this study identifies the three major factors that uptake on e-learning among adult workers. These factors are: technological factors such as relative advantage, compatibility, complexity, trialability and observability, organisational factors such as top management support, culture and structure and personal factors such as social contact, social stimulation, professional advancement, external expectations and cognitive interest that are associated with such uptake.

THEORETICAL FOUNDATION

Numerous theories have been developed to explain organisation and individual's adoption of innovations. Among these are Fishbein and Ajzen's (1975) theory of reasoned action (TRA); Ajzen's (1985) theory of planned behavior (TPB); Davis's (1989) technology acceptance model (TAM); Roger's (1995) theory of diffusion of innovation (DOI).

Based on the two above theories (TRA and TPB), several models have been proposed in order to explain an individual acceptance and adoption of innovations. Davis (1989) created TAM model based on TRA by Ajzen and Fishbein (1975) in order to explain diffusion and adoption of computer utilization behaviour (see figure 2.3). TAM is well recognized and widely used of technology acceptance and technology adoption in the information systems field (Gefen and Straub, 1997). As suggested by TAM model, two basic factors were created to explain diffusion and adoption, these factors involved in explaining the variance in user's intention or behaviour of intention. The two key factors in TAM model are Perceived Ease of Use (PEU) and Perceived Usefulness (PU). Davis (1989) defines PEU as the degree to which an individual believes the given Information System would be free the intensity of their job. While PU can be defined as the degree to which an individual believes using the information system would improve her or his job performance.

TAM has been used in prior studies in the adoption of virtual learning environment (Raaij and Schepers, 2008), Blackboard system (Liaw, 2008) and the WebCT (Ngai, Poon, and Chan, 2007). Specifically, TAM was also expanded and developed to include the attitude toward using Information Technology (IT) including computer utilization behaviours (Duan et al., 2010; Nichols and Levy 2009; McFarland and Hamilton, 2006; Roca et al., 2006; Noyes and Garland, 2006).

Moreover, the acceptance of technology model was also utilized to examine the part of perceived resources such as in online learning adoption (Lee, 2008), the impact of system attributes on e-learning utilize (Pituch and Lee, 2006), the influence of media richness and flow on e-learning technology acceptance (Liu, Liao, and Pratt, 2009), and factors influencing engineers' acceptance of asynchronous e-learning systems in high tech companies (Ong, Lai, and Wang, 2004). Based on the theory of reasoned action, technology acceptance model looks at how ease of use and perceived benefits influence technology acceptance.

Beside TAM model, Venkatesh and Davis (2000) created TAM2 model extension into the original TAM model developed by (Davis, 1989). As suggested by TAM and TAM2 models, an individual's uptake to use a system is determined by two major factors. The key factors perceived usefulness and perceived ease of use. In order to better perceive the determinants of perceived usefulness, TAM2 model incorporates two additional theoretical constructs: social influence processes and cognitive instrumental processes. Three social forces influence perceived usefulness: subjective norm, image, and voluntariness. Four cognitive factors influence perceived usefulness: job relevance, output quality, result demonstrability, and perceived ease of use.

Based on the above review of literature, TAM and TAM2 model is broadly applied to IT acceptance, specifically to explain computer usage behaviour. This study argues that e-learning represents innovation adoption in educational services including e-learning adoption among adult workers, rather than just an IT technology.

The theory of adoption and Diffusion of Innovation (DOI) was developed by Rogers (1995) to explain diffusion of innovation and adoption of new technology such as e-learning adoption at individual levels. Rogers (1995) defined diffusion as the procedure by which an innovation is communicated through certain channels over time among the members of a social system. Further, an innovation is a new idea, object, or practice that is described as new idea by the relevant unit of adoption. The novelty of the idea for the individual determines his or her reaction to it. In other words, an innovation is regarded as new idea, practice or material artefact as perceived to be new by an individual or other unit of adoption (Zaltman et al., 1973).

Rogers (1995) identifies the rate adoption as the relative rapidly with which an innovation is adopted by members of a social system. Rogers's theory suggested that the adoption of an innovation is effected through a number of factors, these factors are as follows: the individual's perception of the attributes of the innovation, the nature of the communication channels diffusing the innovation, the nature of the social system, and the extent of change agents' efforts in diffusing the innovation. The adoption phase includes sub-phases of knowledge, learning and persuasion, and decision; these phases drive to the factual adoption decision. The implementation phase is described the events, actions, and decision involved in making an innovation to use.

Although adoption often includes usage, and has even been used to cover the entire process, usage is commonly referred to as implementation (Prescott and Conger, 1995). Scheirer (1983) described implementation such as synonymous with procedure and usage evaluation. However, he has highlighted the innovation implementation as a neglected area in a quickly growing literature on innovation research.

According to Rogers (1995), the model of diffusion of innovation can be categorized as knowledge, persuasion, decision, implementation, and confirmation. Knowledge as learning of being (awareness-knowledge) and acquire an understanding of how it functions. In the persuasion stage as the development of a positive or negative attitude toward using the innovation through seeking information that reduces uncertainty about the expected consequences of the innovation. Adoption or rejection of the new idea is the decision stage. Confirmation stage as the feedback on the basis experiences can lead to reconfirm or reverse the adoption decision.

In his study, Rogers (1995) examined the attributes that affecting the adoption and diffusion of innovations. These attributes are: relative advantage, compatibility, complexity, trialability and observability. Engel, Blackwell, and Miniard (1995) and Hansen and Salter (2001) argued that the

Rogers' diffusion of innovations model is the most important model for adoption and adaption and widely tested model and well suited as a research framework.

E-learning is an innovation method of learning to numerous people; it was suitable to consider utilizing theory of diffusion of innovation in the study of e-learning adoption (Liao and Lu, 2008; Duan et al., 2010) and how potential adopters' perceptions of the innovation characteristics impact their adoption. According to Moore and Benbasat (1991) one of the important models which can explain and describe innovation characteristics is that from Rogers (1995).

By comparing DOI model with TAM model, it could be infer that in spite of its popularity and considerable empirical support, a common criticism about TAM its parsimony when compare it with DOI model (Hu, Clark, and Ma, 2003). Previous authors highlighted similarity between the TAM model and DOI model by comparing the factors utilized in the two models. They have found that relative advantage in Rogers's model is similar to the perceived usefulness in TAM, and the complexity construct is similar to the perceived ease of use (Premkumar, Ramamurthy, and Liu, 2008; Moore and Benbasat, 1991). Nevertheless, compatibility, trialability and observability constructs in Rogers's model have been not studied by TAM. As such, Rogers's model will be used in this research over the TAM model as it is more suitable in understanding the characteristics of adoption that impede or facilitate diffusion of innovation in an organisation (Rogers, 1983).

E-learning is an innovation and pedagogical service utilizing emerging ICT. Although e-learning provision would be different in platforms terms, application contexts and technologies, the major innovation attributes remain the same. Therefore, Rogers's model will be employed in this context to study the perceived innovation characteristic and its influence on e-learning adoption among adult workers. Eventually, Rogers (1995) focuses on a narrower view of innovators and on individual adoption. In addition, comparing previous widely used models, Roger's theory (1985) diffusion of innovation (DOI) has some attributes or characteristics that can be applied in this study.

This study is based on individual adoption innovation decision, in adopting a particular technology. The intention is on the adoption of e-learning among individuals (adult workers) that are being determined by e-learning technology itself. It was argued that e-learning degree adoption is not only an IT acceptance, but also an adoption of new innovative educational services which are materially different from traditional ones. Summary of previous discussed four models is shown in Table (1).

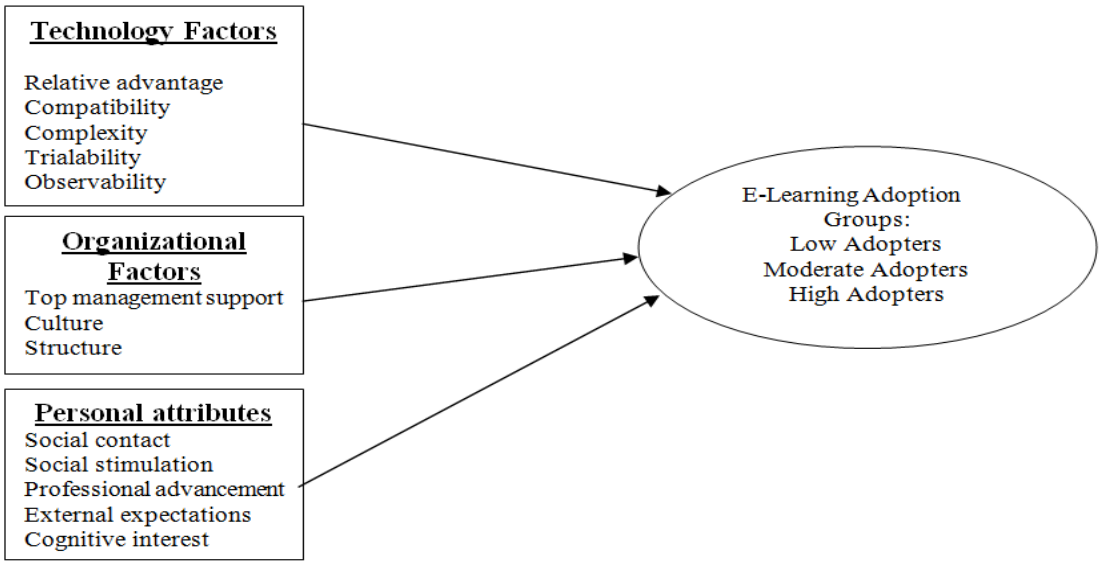
Table 1

Summary of Models in Adoption

Theories (Author)	**Factors**	**Usage**	**Selected Articles using the Theory**
Diffusion of innovation (DOI) (Rogers, 1995)	Relative Advantage Compatibility Complexity Trialability Observability	Acceptance of any new innovation Such as e-initiative, computer, internet	Duan et al., 2010; Liao and Lu 2008; Hsbollah and Idris, 2009; Samarawickrema and Stacey, 2007; Wu, 2008; Martins et al,. (2004)
Technology Acceptance Model (TAM) (Davis, 1989)	Perceived Usefulness (PU) Perceived Easy Of	Acceptance of innovation of technology such as mobile, e-initiative, PDA, e-vommerce, internet banking	Nichols and Levy, 2009; Lee, 2010; van Raaij and Schepers, 2008; Liaw, 2008; Ngai, Poon, and Chan, 2007; Nichols and Levy, 2009; McFarland and Hamilton, 2006; Lee, 2008; Liu, Liao,

	Use (PEOU)		and Pratt, 2009
Theory of Planned Behaviours (TPB) Ajzen's (1985)	Attitude toward Using (A) Subjective Norm (SN) Perceived Behavioral Control (BC)	Improved the predictability of intention in various health-related fields such as condom use, leisure, exercise, diet	Nichols and Levy, 2009; Lee, 2010
Theory of Reasoned Action (TRA) Fishbein and Ajzen's (1975)	Attitude Toward Behavior (A) Subjective Norm (SN)	Most use in medical innovation such as dieting, condom, limiting sun exposure	Nichols and Levy, 2009; Lee, 2010

As the main goal of this research is to identify the factors that influence the uptake of e-learning among adult workers in Jordan, this study will adopt Rogers's DOI theory which focuses consideration the influence of the both organizational as well as technological factors. However, the literature review identified that understanding of the motivation which drives adults to commit to, and complete, higher education through distance learning is an important requirement for the design and the delivery of adult programmes (Abdullah et al., 2008). Therefore, beside the organizational and the technological factors, the personal factors will be other factors that will be used in this study.



OPERATIONALIZATION OF VARIABLES

In this research, the proposed framework comprise of two parts. The first part is the e-learning's antecedent's factors which are the technological, organisational, and personal factors. The second part is the e-learning adoption among adult workers in Jordan which is operationalized in general as the adult worker's uptake and use of the various available functions and services provided by the Arab Open University in Jordan. Table 2 below shows the items of the variables used in this study.

Table 2. Research variables

Variables	Number of Items	Items Source
e-learning adoption	4	Rogers (1995)
technological attributes	32	Duan et al. (2010)
Organizational factors	9	Yap et al. 1994; Deshpande and Farley's 1999; Zmud 1982
Personal Attributes	21	Kim and Merriam (2004)

DATA COLLECTION AND DATA ANALYSIS

In this study, the target population is the adult workers who are working fulltime and learning part-time at the Open Arab University in Jordan (OAUJ). For the purpose of this study, a decision was taken to include all OAUJ students in the sample and was used E-mail. . A total of 335 responses were received representing 44.4% response rate. Statistical Package for Social Science (SPSS) was used to determine the causal relationship among the variables as proposed in the framework.

The reliability of the scale can be measured by Cronbach's alpha which is ranged from 0 to 1. According to Hair et al. (2007), 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.

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. . During factor analysis, variables were retained according to the following criteria: (1) factor loading greater than 0.5 and (2) no cross-loading of variables (king and 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 more factors (king and Teo, 1996).

A principal component analysis with varimax rotation was executed to examine the factor structure of e-learning adoption antecedent measures. Five technological factors with the eigenvalue above 1.0 arose and they were generally consistent with the constructs proposed, representing the themes of complexity, compatibility, relative advantage, observability and trialability. Six different factors with the variables in each factor were identified. From factor analysis, twenty nine items were retained by the six factors which explained about 73.015 percent of the variance. In order to provide meanings to each factor, these factors were labeled based on the meanings of the variables in each factor.

Factor 1 had five variables related to complexity. This factor was labeled as complexiy. Factor 2 consists of six variables related to compatibility; therefore, this factor was labeled as compatibility. Factor 3 had five variables related to relative advantage. Hence, this factor was labeled as relative advantage. Factor 4 had five variables related to observability, so this factor was labeled as observability. Factor 5 had four variables and all of them were related to trialability, hence, it was labeled as trialability. Factor 6 had three variables related to flexibility. Hence, this factor was labeled as flexibility. The results indicated that the new factors were similar to the original dimensions in this phase except the relative advantage where its items loaded on two factors which named as relative advantage and flexibility.

Three organisational factors with the eigenvalue above 1.0 arose and they were generally consistent with the constructs proposed, representing the themes of top management support, organisational structure, and organisational culture. Three factors were extracted which explained about 65.813 percent of the variance. The eigenvalues for each factor in the scree plot provided support for the extraction results using latent root criterion. 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 five variables related to organisational top management support; therefore, this factor was labeled as top management support. Factor two had six variables related to organisational culture, so this factor was labeled as organisational culture. Factor three consists of five variables all related to organisational structure; therefore, this factor was labeled as organisational structure.

Five personal factors with the eigenvalue above 1.0 arose and they were generally consistent with the constructs proposed, representing the themes of professional advancement, social contact, external expectations, social stimulation, and cognitive interest. Five factors were extracted which explained about 75.459 percent of the variance. The eigenvalues for each factor in the scree plot provided support for the extraction results using latent root criterion. 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 five components related to professional advancement. Hence, this factor was labeled professional advancement. Factor 2 had four components related to social contact. This factor was labeled as social contact. Factor 3 consisted of four variables related to external expectations. Consequently, this factor was labeled as external expectations. Factor 4 had four components related to social stimulation. This factor was labeled as social stimulation. Factor 5 has four variables related to cognitive interest. Thus, this factor was labeled as cognitive interest.

Testing for reliability could be achieved by calculating the Cronbach alpha. All the constructs were found to have adequate alpha value (>0.7) (Table 3).

Table 3. Comparing original dimensions to final dimension after factor analysis

Original dimension	**Dimension derived after factor analysis**	**N. Items**	**Alpha (a)**
Technology Factors			
Complexity		6	.905
Compatibility		6	.892
Relative advantage	Relative advantage	5	.924
	Flexibility	3	.905
Observability		5	.885
Trialability		4	.894

Organisational Factors			
Top management support	Top management support	5	0.922
Culture	Culture	5	0.875
Structure	Structure	6	0.885
Personal Factors			
Professional advancement	Professional advancement	5	.924
Social contact	Social contact	4	.917
External expectations	External expectations	4	.881
Social stimulation	Social stimulation	4	.889
Cognitive interest	Cognitive interest	4	.834

5.1 K-Means and Hierarchical Cluster

Everitt et al. (2001) hierarchical clustering is a one of the most significant and straightforward approaches for merges similar groups of points. It should be either divisive or agglomerative. Agglomerative hierarchical clustering begins with every case being a cluster unto itself. To achieve the method of hierarchical clusters, the researcher should specify how distance or similarity is defined, how many clusters are needed and how clusters are aggregated (or divided). In addition, Corter (1996) argued that the hierarchical clustering generates all possible clusters of sizes (1-k), but this method is utilized only for relatively small samples.

In hierarchical clustering, the clusters are nested rather than being mutually exclusive, as is the usual case, that is, in hierarchical clustering; larger clusters created at later stages may contain smaller clusters created at earlier stages of agglomeration (Sharma 1996). Hierarchical clustering which allows users to select a definition of distance, then select a linking method of forming clusters, then determine how many clusters best suit the data (Sharma 1996). Large datasets are possible with K-means clustering, unlike hierarchical clustering, because K-means clustering does not require prior computation of a proximity matrix of the distance/similarity of every case with every other case (Hair et al, 2007).

Looking at the results shown in the table (4.) below, the researcher has decided to use K-means analysis rather than hierarchical one due to many reasons. Initially, the results which have been gotten by using hierarchical analysis were inconsistent and not systematically analyzed. For example, hierarchical analysis has considered the low applications' adopters as moderate applications' adopters and vice-versa. In addition, the adopters who adopted all of the applications (10 out of 10) and who adopted of the applications (9 out of 10) have been considered as moderate adopters rather than high applications' adopters. In a diverse way, the data obtained by using k-means analysis were more accurate and systematic as proven in the results of this study. K-means clustering method is much less computer-intensive and is hence often prefer to choose k-means when datasets are large (Sharma 1996). Therefore, the researcher has decided to use k-means analysis in order to get more consistent and systematic data, the k-means is appropriate for this study.

Table 4 Results of Hierarchical and K-means

No, of Sample	Email	Registration	Library	Grades	Video	Chat	Audio	Course	Assessment	Test	K-means	Hierarchical
30	1	3	3	2	2	1	1	2	1	2	1	2
37	1	3	3	2	2	1	1	2	1	2	1	2
64	2	3	3	2	2	2	1	2	2	2	1	2
100	1	3	3	2	2	1	1	3	1	2	1	2
145	1	3	3	3	2	1	1	1	1	3	1	2
149	2	3	3	2	2	2	1	2	2	2	1	2
162	1	3	3	2	1	1	1	2	1	2	1	2
186	1	3	3	2	2	1	1	2	1	2	1	2
239	1	3	3	2	2	1	1	2	1	2	1	2
310	1	3	3	2	2	1	1	2	1	2	1	2
332	1	3	3	1	2	1	1	2	1	4	1	2
58	1	4	4	2	4	1	2	3	2	2	2	1
121	1	4	4	2	4	1	2	4	2	2	2	1
123	1	4	4	2	4	1	2	4	2	2	2	1
166	1	4	4	2	4	1	2	3	2	2	2	1
173	1	4	4	2	4	1	2	3	2	2	2	1
241	1	4	4	2	4	1	2	3	2	2	2	1
278	1	4	4	2	4	1	2	4	2	2	2	1
318	1	4	4	2	4	1	2	4	2	2	2	1
47	3	3	4	3	4	3	3	4	3	4	3	2
69	2	3	3	2	3	2	3	3	2	3	3	2
88	1	4	4	1	3	1	4	2	4	2	3	2
89	2	3	3	2	2	2	3	2	3	2	3	2
117	3	4	4	2	4	3	3	3	3	3	3	2
139	3	3	3	2	4	3	3	3	3	3	3	2
178	3	3	4	3	4	3	3	4	3	4	3	2
184	1	4	4	1	3	1	4	2	4	2	3	2
198	2	3	3	2	3	3	3	3	3	3	3	2
228	1	4	4	1	3	1	4	2	4	2	3	2
258	3	3	3	1	3	3	3	3	3	3	3	2
268	2	3	4	2	3	2	3	3	3	3	3	2
276	2	3	4	2	3	2	3	3	3	3	3	2
296	3	3	3	1	3	3	3	3	3	3	3	2
311	3	3	3	2	4	3	3	3	3	3	3	2

The study was aimed to exploratory study in the field of innovation diffusion. K-means method was used in this study to identify the different types of e-learning adoption patterns. Hair et al, (2007) stressed that the most important basis for k-means cluster is used Euclidean distance which is the most common distance measure. Nevertheless, the researcher should specify in advance the desired number of clusters, K. Initial cluster centers are chosen in a first pass of the data, and then each additional iteration group's observations based on nearest Euclidean distance to the mean of the cluster. Cluster

centers change at each pass. The process continues until cluster means do not shift more than a given cut-off value or the iteration limit is reached (Corter 1996).

The determination of the appropriate K of clusters is a critical issue in cluster analysis. The researcher is a need to determine a natural K of clusters (2, 3 and 4) that are interpretable in terms of the research question of this study. Therefore, the K three-cluster solution was chosen for the results of this study due to it provides to group the respondents into different adoption groups such as low adopters, moderate adopters and high adopters. These three groups of adopters were more meaning full because it looks at three perspectves of their adoption.

Table (5) below, indicated the number of cases in each cluster, the first group consisted of 125 adult workers which presented 37.3%, and this group considered as low adopters. Second group consisted of 173 adult workers which presented 51.6%, and this group considered as moderate adopters. Third group consisted of 37 adult workers which presented 11%, and this group considered as high adopters.

Table 5 Number of Cases in each Cluster

Cluster	1	125
	2	173
	3	37
Valid		335
Missing		000

Table 6 Initial Cluster Centers

	Cluster		
	1	2	3
E-mail	4	3	3
Online registration	2	3	3
Online library	1	4	2
Grades	1	4	2
Live video	1	4	2
Live chat	1	4	2
Live audio	1	2	4
Online course	1	2	4
Online assessment	1	1	3
Online test	1	1	4

Table 7 above revealed the initial cluster centers, which comprise of three clusters as desired, and gives the average value of each application in each cluster. It can be observed that the first cluster has the lowest averages with each application. The second cluster indicates a highest value, while cluster three reports the moderate average value.

Table 7 Final Cluster Centers

	Cluster		
	1	2	3
E-mail	3	3	3
Online registration	3	3	3
Online library	2	3	3
Grades	2	3	3
Live video	2	3	3
Live chat	1	3	2
Live audio	1	2	3
Online course	1	2	3
Online assessment	1	1	3
Online test	1	1	3

Table 4.48 above shows the final cluster centers, it gives the mean averages of each application in each cluster, which enables a descriptive name to be given to each cluster based on their dominant averages.

Binary Logistic Regression

In this section, the binary 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 13 predictor variables refer. 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 8 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 8 Model Fitting Information

	-2 Log Likelihood	**Chi-Square**	**Df**	**Sig.**
Intercept Only	638.142			
Final	511.194	126.948	26	.000

In addition, Table 9 below shows that Nagelkerke R square value of 0.371 for the overall model. The results indicate the model could explain approximately 38% 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 – 1.

Table 9 *Pseudo R-Square*

Cox and Snell	.315
Nagelkerke	.371

Table 10 Binary Logistic Regression Model

	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	-.612	**.045**	-.112	.705	.501	**.001**
Flexibility	-.224	.398	.099	.700	.323	**.036**
Compatibility	-1.002	**.001**	-.346	.247	.656	**.000**
Complexity	-.467	.170	.032	.921	.500	**.018**
Trialability	-.607	.077	-.306	.322	.300	.183
Observability	-.286	.426	.088	.783	.374	.133
Management	.965	**.013**	.025	.944	-.940	**.000**
Structure	-.616	**.031**	-.355	.173	.261	.143
Culture	-1.131	**.002**	-1.061	**.002**	.070	.771
Social contact	-.464	.130	-.136	.639	.328	**.043**

Professional advancement	.116	.618	.514	**.021**	.398	**.010**
Social stimulation	-.311	.350	-.670	**.036**	-.359	.069
External expectations	-.274	.324	.076	.775	.350	**.040**
Cognitive interest	.456	.245	.051	.887	-.405	.096

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.

The summary of the results from the binary logistics regressions were shown in table 10. Eleven predictor variables, namely relative advantage, flexibility, compatibility, complexity, top management support, culture, structure, social contact, professional advancement, social stimulation and external expectations were found to be significantly associated with e-learning adoption with various groups of adoption.

DISCUSSION

In this section discusses the result that emerged from the data analysis. Attempts will be made to explore how the result related to the findings from previous studies. The approaches adopted in this section are that the discussion will reiterate the highlights if the results are as expected, and if the results are unexpected, the discussion will be an attempt to reconcile. The results obtained from interpreting the adoption level and matrix will be discussed and followed by discussion on factors associated with e-learning adoption.

Characterizing E-learning Adoption

This study has developed a framework to characterised and measure e-learning adoption on a two-dimensional matrix representing level of adoption and extent of usage. The level of adoption was represented by teen types of e-learning application. The extent of usage was measured using four category scale represented by not using, use sometime, use most of the time and use all the time with e-learning applications.

Previous studies have approach to examine the e-learning adoption by two perspectives which are “adopted or net adopted”. Also, these studies were focused just in one perspective in order to examine the e-learning adoption (e.g. Duan et al. 2010; Hung et al. 2009). While, this study has aimed to examine adoption by focusing on both the range of e-learning applications adopted and the extent of usage of each one in order to provide a comprehensive picture of the adoption of e-learning among adult workers in Jordan.

In order to capture information on the extent of usage for each e-learning application, a K-mean clustering has been conducted for this study. Depend on a study sample of 335 responding adult workers; the K-mean has successfully identified diverse e-learning applications’ adoption groups among adult workers in Jordan. These groups were considered as low adopters, moderate adopters and high adopters. The important of K-mean lies in its flexibility, without being restricted by the measurement scale when identifying adoption patterns. Also, this method enables various adoption patterns to be identified the two-dimensional.

The first group is the low adopters presented about 37.3% of the study sample. In this group, the choice of application being adopted by these adult workers is limited. Adult workers have mainly adopted e-learning adoption such as e-mail, registration, online library, grades and video. The findings of this study suggest that, these applications methods are more widely used by adult workers than

others applications. Also, as discussed in the literature review (chapter two) many students including adult workers have a lack of experience with using the new technology especially in Jordan due to e-learning adoption is still innovation method of learning to numerous students (Abbad and Nahlik, 2009).

The next group is the moderate adopters presented about 51.6%, of the study sample. The adult workers have mainly adopted e-learning adoption such as e-mail, registration, online library, grades, video, online chat, audio and online course. This group of adopters is similar to the adoption stage (Hung et al. 2009). Moderate adopters have taken the first step to adopt more advanced internet technologies, and have partially integrated e-learning applications both internally and across-worker. However, full integration of e-learning applications has not been implemented. Rogers (1995) stated, "after being adopted by only a few people in a system, the innovation may ultimately be rejected, so that its rate of adoption level off and, through discontinuance, nose-dives". This made it worthwhile to analyze the rate of discontinuation of e-learning applications in this research study.

The third group is the high adopters which presented about 11% of the study sample. This group has placed a strong emphasis on the nine out of ten or ten out of ten applications adopted by other lower adoption groups. The adult workers have mainly adopted e-learning adoption such as e-mail, registration, online library, grades, video, online chat, audio, online course, online assessment and online test. Third group of this study is that adult workers are more likely to adopt e-learning applications than lower and moderate adopters, due to Adult workers who are frequent and/or heavy users of the Internet are more likely to use e-learning systems, adult workers who are confident in their ability to master an e-learning system, without help, are more likely to become users, adult workers are reassured by the availability of back-up technical support and adult workers believe that an e-learning system will be more useful to them if it is easy to use.

In terms of extent of usage, we could observe the extent to which adult workers migrate from traditional methods of conducting learning to adopt internet technologies. As proposed by Chin and Marcolin (2001), actual usage of the innovations provides a clearer understanding on innovation diffusion but has been neglected in previous innovation adoption studies. In this study, the adoption is described as triggering usage of applications on a limited basis leading to the final stage whereby an application would be substituted for an existing traditional business transaction method.

Findings from present study showed that most of the e-learning applications provided by the Arab Open University in Jordan (AOUJ) to Adult workers are mainly used on most of the time. This trend suggests that the outcomes of adoption depend how adopters have accumulated knowledge and experience in using these applications. When adult workers have adopted e-learning applications on a most of the time, positive feedback would reinforce their usability, and would set the stage for subsequent usage of the application, and application from other levels.

For the low adopters, they mainly adopt applications that indicate their web presence, mainly on a use most of the time and use sometime. Numerous adult workers from this group have substituted e-learning applications for traditional methods of conducting learning.

Moderate adopters, however, they are using a majority of applications indicating their web presence on a use most of the time. A number of adult workers from this group have substituted e-learning applications for traditional methods of conducting learning. Compared to the moderate adopters, high adopters are using the e-learning applications adopted on a use most of the time, while very few adult workers from high adopters have substituted e-learning applications for traditional methods of conducting learning. The findings from the matrix also reveal a number of adult workers which have adopt e-learning applications ranging from e-mail to online audio, solely on use most of the time.

FACTORS 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 adopter. The study found that the relative advantage, compatibility, flexibility and complexity 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, compatibility, flexibility and complexity are significantly related to adult workers' adoption to use e-learning. The result supported findings from prior studies of the significant of relative advantage, compatibility, flexibility and complexity on e-learning adoption among adult workers (Liao and Lu, 2008; Hung et al., 2009).

In addition, the findings indicated that organizational structure, organizational culture and top management support were 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, four factors of personal were significantly impact on e-learning adoption among adult workers, namely social contact, professional advancement, social stimulation and external expectations. These findings support previous studies in the literature (Miller, 1992; Kim and Merriam, 2004). The figure (4.10) showed the summery of the significant of factors that assessed with e-learning adoption's group.

CONCLUSION

Unlike previous studies that described adoption based mainly on one dimension, i.e. level of adoption, this study has given due consideration to both the level of adoption and the extent of usage for each application. More importantly, a framework was developed which also allowed current status of e-learning applications to be taken into account, thus providing a more comprehensive picture of the nature of e-learning adoption by the adult workers.

The finding suggested that the types of application adopted, and the extent of usage, measured in terms of not using, use some time, using e-learning application most of the time, and using e-learning application all the time, could be used to characterize e-learning adoption. More important, both dimensions could form the basis for classifying adult workers in future studies, whereby causal models could be built to examine the relationships between variables such as factors associated with adoption and impact on adult workers.

In this case, K-means clustering method analysis is used as the most popular method and the most suitable for the purpose of this study. Hence, this K-means provided a richer source of information that reflected the nature of e-learning adoption, where adoption behaviour was discussed on the basis of level of adoption and extent of usage. The profile generated for all adult workers based on the above dimensions could increase our knowledge about what applications has been adopted, and the extent they been used by Learning Management System. As far as the author can establish this are the fewest studies of e-learning adoption which has utilised the statistical technique of cluster analysis to classify, or group, learners which were the basis of the study.

The finding suggested that the types of application adopted, and the extent of usage, measured in terms of not using, use some time, using e-learning application most of the time, and using e-learning application all the time, could be used to characterize e-learning adoption. More important, both dimensions could form the basis for classifying adult workers in future studies, whereby causal models could be built to examine the relationships between variables such as factors associated with adoption and impact on adult workers.

This study also found factors such as relative advantage, flexibility, compatibility, complexity, top management support, culture, structure, social contact, professional advancement, social stimulation and external expectations were significantly linked to adult workers e-learning adoption initiative, suggesting researchers will need to give renewed thought to the roles played by each individual external party, including adult workers, when researching technology adoption. More importantly, the analysis of factors associated with e-learning adoption showed that causal models can be built and tested.

The second implication for theory concerned the assumption made in past studies, which examined factors that drive adoption, mainly between binary groups, e.g. non-adopters versus adopters.

This study identified three adoption groups, and has provided evidence that apart from some common factors that were associated with all adoption groups, some group had distinct factors to drive their adoption of e-learning. In other words, certain factors were perceived to be more important for a particular adoption group.

The findings suggested that relative advantage characteristics needed to be given greater emphasis in researching e-learning adoption among adult workers. In particular, , the adopter tends to utilize e-learning as a tool for increasing learners satisfaction and improving service quality in order to help the workers gain relative advantage ultimately increase operation performance. The variable relative advantage discussed in this research showed a positive result concluding that the more benefits seen to be gained from adopting e-learning, the more willingness the adult workers would have to adopt e-learning.

The Arab Open University in Jordan (AOUJ) should enhance the quality of e-learning and at the same time consider relative advantages and trialability, when introducing new technologies. Consistent with Wild et al. (2002), it is agreed that combining the characteristics of effective traditional learning with those of effective online learning will provide a rich and varied presentation environment that will satisfy individual need of users. In addition, it can also be enhanced by educating the lecturers and also students including adult workers about the importance and advantages of using e-learning in teaching and learning processes. In addition, the e-learning adoption profile described in this study provided an overview of e-learning adoption among adult workers.

This is an empirical study and the research model provides a way of viewing the real world, but at the same time simplifying things. In the complex world of adult workers, there are potentially other factors that could influence the adoption of e-learning and implications for adult workers. However, for the purpose of this study, these factors are controlled. In other worlds, the adoptions, and the links between e-learning adoptions, are hypothesized to exist. These causal relationships cannot be established based upon a cross-sectional study approach. Hence, the findings derived from this study may have limited ability to be applied to other university that have adopted e-leaning. This will help to further improve our knowledge and understanding of the factors which influence e-government adoption.

The Jordanian government may have to concentrate on achieving high quality low level informative services before moving to more advanced levels. This will give the government the time to focus on simple e-learning adoption that are more responsive to their needs and at the same time establish a positive online relationship with workers, while at the same time working on increasing the number of internet users in Jordan before paving the way to more advanced levels of e-learning adoption.

The participant was drawn from a single university in Jordan. Therefore, the findings derived from this study may have limited ability to be applied to other university. In order to have a complete picture of e-learning adoption, future research should also be conducted on other sectors such as hotel, hospital, and communication sectors. Finding from other organizations would be useful in providing a comparison of the nature of e-learning adoption between other organizations.

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