International Journal of Engineering Innovation & Research
Volume 7, Issue 2, ISSN: 2277 – 5668

Scale Development to Assess Instructors' Intention to use Technology and E-learning in Libyan Higher Education

Tark Melud ELMALTI[1*], Yasemin Gultepe[2] and Ismael Amara Belag[1]
[1]Kastamonu University, Institute of Science, Kastamonu - TURKEY
[2]Kastamonu University, Faculty of Engineering and Architecture, Kastamonu - TURKEY
*Corresponding author email id: tarkmalty@yahoo.com

Date of publication (dd/mm/yyyy): 10/04/2018

Abstract **– This paper describes the development an instrument to assess faculty intention to use technology and e-learning in Libyan higher education (LHE). In spite of the research that has been conducted to examine the factors that explain faculties' intention to use technology and e-learning, few have developed an instrument to determine these factors. Four independent variables (computer-internet experience, computer self-efficacy, technology-internet quality, and attitudes toward use) intention to use technology and e-learning used as a dependent variable. It is significant to know and assess the variables that influence faculty intention to use technology and e-learning. The final retained 25-item intention to use technology and e-learning instrument was acceptable with sample size 136. Based on the findings, this article proposes guidelines for further investigation by applying statistical analysis on another sample to show the relations by the four independent variables and the dependent variable intention to use.**

Keywords **– Attitudes Toward Using, Computer-Internet Experience, Computer Self-Efficacy, Intention to Use, Technology-Internet Quality.**

I. INTRODUCTION

Newly e-learning systems have been used in teaching and learning in many universities that resulted in changes in education process in those institutions [1]. Moreover, the use of e-learning systems in universities is a result of advancement of IT. As a result of the growth of web application e-learning systems are becoming an important instructional medium in universities [2]. In addition, with the wide spread use of the WWW, many higher education institutions (HEIs) are taking the opportunity to develop e-learning courses [3]. Furthermore, with the progress of IT, e-learning systems are becoming an integral part of the teaching and learning process in HEIs [4].

The role of faculty in the whole e-learning is greatly important. Teachers who play the twin role of being experts in subject matter and technological specialists are the real creators in the teaching-learning system [5]. According to [6], despite the status of e-learning, there is a lack of clear consent on the attitude and ability of academic staff in higher education to participate in these developments. Overall from our point of view, there are a number of factors that influence individuals' intention to use technology and e-learning, the most critical of these factors will be reviewed in the next section.

A. Factors that Influence Intention to use

Several studies focused on intention to use e-learning, [7] reported that, from the direct influences, it is clear that, when teachers perceived technology to be useful and that using technology would increase their productivity, their intention to use will be significantly increased. Furthermore, a positive attitude also has a positive and direct influence on behavioral intention, that is when teachers have positive feelings towards the use of computers, these feelings reinforce their intentions to use technology.

In the same direction, a number of studies have been referred to significant barriers or factors that faces faculty to participate in web-based teaching. One important factor that affects implementing and using e-learning is the individuals' attitude towards using technology and e-learning, So far there is no standardized instrument to measure faculty attitude towards e-learning [8].

According to [9], succeeding of e-learning is affected by a number of factors including users' attitudes towards e-learning as well as their satisfaction with technology during a learning/teaching experience. Users perceive e-learning program to be successful if they provided with easy access to suitable technical infrastructure [10]. The second critical factor that influence using technology and e-learning is computer self-efficacy which is widely accepted important construct in social psychology [11]. However a choice of factors of IT acceptance have been examined in past research, self-efficacy has been recognized as a main key of IT-related ability and the use of IT [12]. The third factor that using technology and e-learning influenced by is computer-internet experience. Studies using Technology Acceptance Model (TAM) have projected that perceptions of ease of use and usefulness of a technology is influenced by the individuals' experience of that technology. That is, Older individuals who had more experience of the technology used learning management (WebCT) more than younger individuals who had less experience. Furthermore, student success in distance learning depends on technical skills in computer process and internet navigation [13]. The fourth factor that affects using technology and e-learning is the technology-internet quality, several researchers indicated that technology-internet quality significantly affect satisfaction in e-learning. Users will be willing to adopt such a tool with few barriers and satisfaction will be improved [14]. Consequently, the higher the quality and reliability in IT, the higher the learning effects will be [15].

B. ICT in Libya

Libyan national policy for Information and Communication Technology (ICT) in education was

launched in 2005 and managed by the Ministry of Education and the Ministry of Vocational Training. The government is determined to provide tools and ICT skills on a large scale to all sectors of the country [16]. Though one of the agents to develop the quality of education through ICT is developing open and distance learning as well as continued education. But implementing of E-learning systems in Libya still in determining years [17], the attempt to inspect e-learning systems still as case study because of the lacking of using ICT, i.e. using of ICT is still not widespread. According to [18], the barriers to implement and use e-learning in Libya includes technological barriers, that is, lack of networks and systems infrastructures, lack of experience in using technology; lack of appropriate internet service. In a comparison between Libyan and African institutions, [19] classified the challenges associated to the implementation and using of e-learning and ICT to three categories: lack of ICT infrastructure, lack of qualified personnel, and resistance to change.

Based on the review of the factors that influence using technology and e-learning covered in previous section, our aim in this paper is to develop an instrument for faculty intention to use technology and e-learning in LHE. [20] Suggested a number of rules and steps should be followed in Scale development. These steps are as the following: (1) Generating an item pool, (2) Determining the format for measurement, (3) Content validity and review by experts, (4) Administration of the items to a development sample, (5)Analysis of the psychometric properties, (6) Optimization of the scale.

So in this paper, we followed the sequence of steps mentioned before in the development of the scale starting from item pool generation to optimization of the scale to assess faculty intention to use technology and e-learning in LHE.

II. METHODS

There are two basic approaches to item development that often used. The first is deductive, or "classification from above." The second method is inductive, or "classification from below" [21].

In this paper we used the deductive development scale, the deductive scale development utilizes a classification schema or typology prior to data collection. This approach requires an understanding of the phenomenon to be investigated and a thorough review of the literature to develop the theoretical definition of the construct under examination. The definition is then used as a guide for the development of items [22].

On the other hand, the inductive approach is so labeled because there is often little theory involved at the outset as one attempts to identify constructs and generate measures from individual responses. Researchers usually develop scales by asking a sample of respondents to provide descriptions of their feelings about their organizations or to describe some aspect of behavior.

Based on the goals of the paper an instructors' questionnaire (ITQ), conducted, there are some elements should be considered when we investigating the technology and e-learning in Libyan higher education, we assumed that, instructors' intention to use technology and e-learning in Libyan higher education is influenced by some factors found against the development and progressing in this field in the country. These factors are, computer-internet experience (CIE), computer self-efficacy (CSE), technology- internet quality (TIQ) and attitudes toward technology and e-learning (ATE).

A. Generating an Item Pool

In the beginning, a pool of items correlated to intention to use e-learning and ICT was generated, sufficient review and investigation of the existing literature, covering faculty intention to use ICT and e-learning. At this phase a list of 29 items were recognized, to ensure the content validity of the scales, a set of items selected must be representative of the concerned domain content [23]. Therefore, validated items adapted from prior studies were used to measure computer and internet experience, computer self-efficacy, technology and internet quality, attitudes toward technology and e-learning, and intention to use technology and e-learning. These items reflect a latent association with concept of using ICT and e-learning. Both positively and negatively worded statements were included in the pool.

B. Determining the Format of the Scale

At this step, different scaling options have been reviewed. Then, the Likert scale was chosen because of its ease of use, common use in intention measurement, higher reliability coefficients with less items, and method of summated ratings [24]. Therefore, we used the following two scales : The first, four-point scale to evaluate computer and internet experience (CIE) given with the numerical values assigned to each point: (1 = Never, 2 = Monthly, 3 = Weekly, and 4 = Daily). For the other four constructs we have used five-point scale to evaluate : computer-internet self-efficacy (CSE), technology-internet quality (TIQ), Attitudes toward technology and e-learning (ATE), and intention to use technology and e-learning (ITE) with the numerical values assigned to each point progressive from 1 to 5.

C. Content Validity

Content validity is defined as the degree to which the elements of an assessment of instrument are relevant to and representative of the targeted construct for a particular assessment purpose [23]. Therefore, as mentioned before, validated items adapted from prior studies were used to measure computer-internet experience, computer self-efficacy, technology-internet quality, attitudes toward technology and e-learning, and intention to use technology and e-learning. The participants indicated their answers with using a four-point and five-point Likert-type scale. We measured demographic information: gender, age, field of work, teaching experience years, and scientific grade.

D. Administration of the Items to a Development Sample

A 29 items questionnaire was conducted in five constructs, each of which contains a number of items, then, the questionnaire was translated to Arabic language and distributed to a sample of 210 faculty member (teachers, teaching assistant) in LHE (Zawia University, and

institutions of the national authority for technical education) in the academic year 2017/2018. Given that, for scale development a large sample would reduce subject variance [20]. [25] Advice a ratio of 5 to 10 subjects per item. [26] Suggest a sample size for analysis $N \geq 50 + 8M$, or $N \geq 104 + M$. where M is the explanatory variables. So, distribution of the questionnaire containing 29 items to a sample size of 210 was measured suitable. Of the 210 surveys, a 64.8% response rate was achieved (136 usable responses). However this was considered as adequate at this instrument.

III. Data Analysis

The reliability alpha coefficient for the scale with 29 items was tested and found 0.82, which indicated that the items in the scale were highly inter correlated and were all measuring the same attribute, i.e. intention to use technology and e-learning. Then we investigated additional optimization of the instrument by examining the reliability coefficient of each construct independently. We found that the 5-item construct1 (CIE) had a reliability coefficient of 0.82, 10-item construct2 (CSE) had a reliability coefficient of 0.88, 4-item construct3 (TIQ) had a reliability coefficient of 0.82, 7-item construct4 (ATE) had a reliability 0.83, and 3-item construct5 (ITE) had a reliability 0.73, indicating high inter-item correlation within all these constructs. According to [27], Cronbach's alpha is reliable if its value is at least 0.7. But, we were concerned in understanding how many constructs or variables underlay the set of 29 items in the scale. Therefore, we performed exploratory factor analysis on the sample.

Before conducting factor extraction, the KMO and BTS are applied to ensure that characteristics of the data set are suitable for factor analysis. Factor loadings along with the KMO and BTS results are provided in Table I.

Table I. KMO and BTS for subscales

Subscale	KMO	BTS	p
CSE	.815	770.200	<.001
ATE	.856	631.953	<.001
CIE	.782	265.11	<.001
TIQ	.753	283.038	<.001
ITE	..600	124.668	<.001

Examining factor analysis using principal components factor extraction and VARIMAX rotation was conducted to identify the factors in our work. Four commonly rules were applied to decide which factors to be retained: (1) minimum eigenvalue of 1; (2) deleting items with factor loadings less than 0.5 on all factors, or greater than 0.5 on two or more factors; (3) a simple factor structure; (4) scree test. Items that did not success these rules were excluded.

Table II shows all factors with their number of items, eigenvalue, explained variance. Scree test in Fig. I show 'deflect' at 6 calling for retaining 5 factors.

Table III shows the factor loading of the items with a loading of 0.40 or greater.

Table II. Identified factors with number of items, eigenvalue, and explained variance.

Factor	Label	Number of items	Eigen-value	Explained variance (%)
1	CSE	8	6.254	21.567
2	ATE	5	4.233	14.596
3	CIE	5	3.140	10.829
4	TIQ	4	2.517	8.678
5	ITE	3	1.936	6.678
				62..35

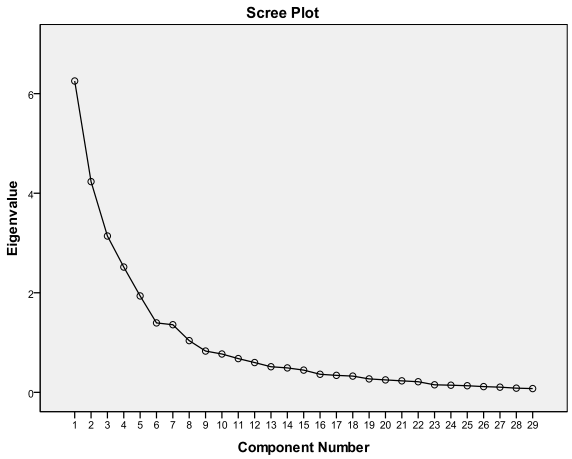

Fig. I. scree plot

IV. Results

The KMO and BTS results indicate the data satisfy the psychometric criteria for performing a factor analysis. The analysis of the responses by the instructors to the 29 items in the instrument are presented, the result show that, 24 items in the suggested five factors were satisfied the rules in step III, 8 items in factor-1 extracted from construct-2 (CSE) with eigenvalue (6.254), explained variance (21.567%), item loadings ranging (from .537 to .882), and 2 items were eliminated (had loading < 0.5), 5 items in factor-2 were extracted from construct-4 (ATE) with eigenvalue (4.233), explained variance (14.596%), item loadings ranging (from 0.844 to 0.920) and 2 items were excluded (had loading < 0.5), 5 items in factor-3 were extracted from construct-1 (CIE) with eigenvalue (3.140), explained variance (10.829%), item loadings ranging (from .683 to .835), 4 items in factor-4 were extracted from construct-3 (TIQ) with eigenvalue (2.517), explained variance (8.678%), item loadings rangings (from .610 to .902), and 3 items in factor-5 were extracted from construct-5 (ITE) with eigenvalue (1.936), explained variance (6.678%) had loadings ranging (from .566 to .856), all the items have been accepted are positively worded.

As mentioned before and seen in Table III, the factor loads related to the 24 items on the subscales range from 0.54 to 0.92. From this point, it is determined these items are qualified sufficiently to be included in the scale. Except for the CSE subscale, one factor with eigenvalues greater than one emerges for each subscale of the instrument. (see Table IV). For the CSE subscale, the scree plot shows a sudden drop following the first factor. This result suggests

the presence of only one factor; in fact, the first factor alone explains more than half of the total variance. Hence, the factor analysis for these items results in a single factor.

Consequently, we could accept the 25 items with total explained variance (62.35%) and identify the 5 factors: Factor-1 involving 8 items that were related to the attributes of computer self-efficacy, factor-2 contains 5 items related to attitudes toward technology and e-learning, factor-3 linking 5 items that related to computer-internet experience, factor-4 involving 4 items that related to technology-internet quality, and factor-5 linking 3 items that related to intention to use technology and e-learning.

Table III. Factor loading

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Computer self-efficacy (CSE)					
CSE1: To use technology-internet including e-learning if I had never use a system like it before, I would feel.	**.882**				
CSE2: To use technology-internet including e-learning if someone helps me get started, I would feel.	**.873**				
CSE3: To use technology-internet including e-learning systems if I can call someone for help if I got stuck, I would feel		.470			
CSE4: To use technology-internet including e-learning if I have just the buit-in help facility for assistance, I would feel.	**.537**				
CSE5: To use technology-internet including e-learning if I have seen someone else using it before trying it myself, I would feel	**.570**				

Table III. Factor loading

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
CSE6: To use technology-internet including e-learning if I have only the software manuals for reference, I would feel.	**.752**				
CSE7: To use technology-internet including e-learning if I had used similar systems for instruction, I would feel.	**.795**				
CSE8: To use technology-internet including e-learning on my own, I would feel	**.860**				
CSE9: To download or install e-learning software/materials on my own, I would feel.	**.710**				
CSE10: To navigate or search for document in any e-learning website, I would feel				.422	
Attitudes toward techno-logy and e-learning (ATE) **ATE1**: Using technology-internet for course instruction is a good idea		**.846**			
ATE2: Using technology-internet for course instruction is beneficial		**.889**			
ATE3: Using technology-internet for course instruction is a positive step toward instruction		**.844**			
ATE4: I prefer face–to–face teaching		-			
ATE5: I believe using technology-internet environm-ent (e-learning systems) is helpful for teaching		**.895**			
ATE6: I feel intimidated by technology-internet environ-ment (e-learning systems)		-			
ATE7: Open universities should adopt more and more courses using technology-internet environment.		**.920**			
Computer-internet exper-ience (CIE)					
CIE1: Frequency of using Word Processing			**.809**		
CIE2: Frequency of using presentation program			**.737**		
CIE3: Frequency of using the internet			**.835**		

Table III. Factor loading

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
CIE4: Frequency of using E-mail			**.683**		
CIE5: Frequency of using Web for information search			**.721**		
Technology-internet quality (TIQ)					
TIQ1: Poor internet access and networking in the University.				**.827**	
TIQ2: Lack of technical support in the University				**.874**	
TIQ3: Inadequate availability of Hardware and Software				**.902**	
TIQ4: Lack of training on e-learning				**.610**	
Intention to use technol-ogy and e-learning (ITE)					
ITE1: I intend to use technology-internet to assist my teaching.					**.566**
ITE2: I intend to use e-learning systems whenever the systems available.					**.856**
ITE3: I thing e-learning should be implemented in classes.					**.855**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Table IV. Eigen Value and Percentage of Variance for Each Factor

factor	Eigen-value	Percentage of variance (%)
CSE	5.077	50.769
ATE	4.028	57.546
CIE	3.017	60.337
TIQ	2.778	69.45
ITE	1.991	66.376

V. Optimization of the Scale

The factor analysis identified 25 items in five groups, as Factor1, Factor2, Factor3, Factor4, and Factor5, the Cronbach's reliability was tested for the 25-item scale and found .805, after that, we investigated extra optimization of the instrument by examining the reliability coefficient of each factor independently.

We found that, the 8-item Factor1 had a reliability coefficient of .893, 5-item Factor2 had reliability coefficient of .937, 5-item Factor3 had reliability coefficient of .822, 4-item Factor4 had reliability

coefficient of .824, and 3-item Factor5 had reliability coefficient of .728. Thus, indicating high inter-item correlation within all the factors and indicating that these factors could be used to involve an instrument to measure instructors' intention to use technology and e-learning.

Table V. Item-total correlation between subscales.

Item	CSE	ATE	CIE	TIQ	ITE
1	.815	.749	.634	.658	.409
2	.769	.787	.500	.806	.794
3	.290	.756	.725	.834	.788
4	.263	.021	.560	.480	
5	.299	.827	.598		
6	.584	.000			
7	.661	.888			
8	.732				
9	.542				
10	.121				

VI. Conclusion and Future Research

In this study a systematic and step-by-step approach is followed for the validity and reliability of the scale, a pool of 29 items reduced to 24 items. Based on the exploratory factor analysis (EFA), the results show the survey items for each dimension successfully measure each variable. The KMO and BTS measures also indicate the data satisfy the psychometric criteria for the EFA. In addition, the reliability alpha coefficient for scales used in research are calculated, the level of an acceptable Cronbach's alpha coefficient is suggested as 0.70 [27]. In the present study, findings suggest that Cronbach's alpha coefficients of the subscales show the internal consistency of the scale, and the item-total correlations of the scale items are quite high. Each of the subscales is statistically and significantly related to intention to use technology and e-learning.

The results of this study demonstrate that this developed instrument is an initial tool to assess intention to use, it is hoped the instrument developed will give confidence to researchers to use it and test it out in concurrence with other psychological variables to develop a better understanding of successful and unsuccessful implementations of e-learning.

The result of such study would inform policy makers and faculty members for planning and curriculum development purposes in Libyan higher education. Finally, with technology use in higher education becoming wide spread globally, a comparison studies could be conduct between countries or cultures to identify the culture variables that influence faculties' intention to use technology and e-learning.

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AUTHORS' PROFILES

Tark Melud A. Elmalti, He received his B.Sc in science, computer department, faculty of science, Tripoli (Alfateh) university, Tripoli, Libya, 1987/1988. He received his M.Sc. degree, computer science, school of computer science and technology, Wuhan university of technology, Wuhan, China, 2002/2003. He is a faculty member since 2004 in computer department, Zwara fac--ulty of technical engineering. Now he is a Ph.D. Student, Department of Genetics and Bioengineering, Institute of Science, Kastamonu University, Turkey.

Yasemin Gültepe She received her B.Sc. in Computer Science Department from Çanakkale Onsekiz Mart University, Çanakkale/Turkey in 2000. She received her M.Sc. degree from Natural and Applied Sciences, Çanakkale Onsekiz Mart University, Çanakkale/Turkey and Ph.D. degree from Natural and Applied Sciences, Ege University, Izmir/Turkey. Her research interests include semantic web, linked data, data management, algorithms and medical informatics. Currently working as a Assist. Dr., Department of Computer Engineering, Engineering and Architecture Faculty, Kastamonu University.

Ismael Amara Belag Received B.Sc in computer science department faculty of science in Zawia University (Libya) in 2000, then in 2001 he joined to work in Libya equation until 2008, in 2006 he received MSc in Information Technology from university of Libya From 2009 he is a staff member in computer department in Zawia University.