Ranking Different Factors which Affect e-Learning Outcomes

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***Abstract*—E-Learning as a new platform of training has attracted a lot of attention from researchers and practitioners in recent years. Many researchers tried to assess different factors which influence E-Learning outcomes. This study aims to examine seven most important factors which exist in the literature (including content, support, ease of use, reliability, computer self-efficacy, expert and culture) using an empirical approach. Participants are 247 students who are using technology-based education in Iran. Regression results showed that five variable including supports, ease of use, reliability, computer self-efficacy and culture, have a significant influence on E-Learning outcomes but two other variables including content and expert don't show a significant effect. Also results of principle component analysis and latent moderated structuring (LMS) method reveal that "technical support" is the most important variable which affects web-based education.**

***Index Terms*—E-Learning, LMS technique, outcomes, ranking.**

I. Introduction

In recent years, a lot of attention has devoted to technology-based learning and this type of education has a remarkable growth [1]. Researchers believe that the world is going toward online-learning rapidly to make education accessible to all [2] and the number of E-Learning students is increasing dramatically [3]. The most important advantage of using E-Learning is that it increases flexibility, through resources that facilitate learning anytime and anywhere [4]. Building on the capabilities of the Internet, organizations and educational institutions have moved rapidly to utilize this new technology for instructional purposes. The aim of E-Learning is to attain learning objectives [5]. Many researchers have studied several aspects of E-learning and many different approaches were adopted [6]. Recent researches have shown that nearly $40 billion is spent annually on technology based training [7]. E-Learning is seen as a good opportunity for universities and organizations to reduce the cost of training and increase its quality [8] but it needs to be well prepared because of its high investment costs [9]. Also it is essential to determine variables which can affect its outcomes. Research into technology-based educating is an emerging field and some studies have already investigated the factors underlying the success or failure of E-Learning [3].

The aim of this research is to demonstrate the effect of some major factors which exist in the literature on the outcomes of technology-based training and determine the degree of importance of each factor. By means of regression analysis we investigated the role of seven important factors in E-Learning outcomes. We also determine the importance of each factor in comparison with other factors by means of principal component analysis and LMS technique.

Based on aforementioned statements, the following two main questions of this research are considered:

- Which variables have a significant effect on E-Learning outcomes?
- How much is the effect of each variable on E-Learning outcomes?

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II. Research Background

Based on reviewing the literature and experts' opinions, 7 major variables including: "Content of the course, technical support, ease of use, reliability of system, E-Learning specialist, culture and Computer self-efficacy (CSE)" which can affect E-Learning outcomes, have been recognized. In this section some previous researches concerning these variables are mentioned. Note that, E-Learning outcomes are measured by student perception and satisfaction.

A. Content

Content is core component of E-Leaning. Some researchers have shown that teaching material and design of learning content are two important variables influencing learners' acceptance of E-learning [10]. It is essential to note that there is a major difference between E-Learning content and transforming of traditional content into a digital representation. Unfortunately many E-learning projects have just imported existing training material into a didactical environment without ever truly justifying its suitability for learning process [11]. The role of content in E-learning is important in extent to which there are some systems for managing learning content called LCMS [12].

B. Technical Support

If technology is used appropriately it has a great potential to enhance E-learning performance. Many online learners drop out of course because of lack of student support and one important factor in their wish list is 24/7 technical support [13]. Also Muilenburg and Berge (2005) assert that lack of technical support is a barrier to online educators [14]. Therefore E-Learning decision makers have to find ways to support learners with the goal of preventing or reducing technology barriers [15].

C. Ease of Use

Technology acceptance model (TAM) which is developed

by Davis in 1989 suggests that a number of factors influence users' decision about how and when they will use a new technology: perceived usefulness and perceived ease of use [16]. In fact the second factor (i.e. perceived ease of use) poses that higher technology ease of use can lead to higher acceptance of technology by users [17]. Because of the focal role of technology in E-learning, those programs that are perceived to be easy to use will lead to higher learning performance [8].

D. Reliability

Technology refers to the set of tools which are used to learning material delivery to the learners [18]. Because of the central role of the technology in E-Learning, it is vital that it can support the whole expectations of learners.

Webster and Hackley assert that technology reliability is an important determinant of the E-Learning effectiveness, especially the effective reaction of learner to this kind of learning experience [19]. Thus a low reliability of the technology can lead to negative learners' perception of the environment and decrease E-Learning outcomes [7].

E. Expert

E-learning is a professional system thus it is required to exist an expert to design it. Toon et al. believes that subject matter expert is one of the most important people for designing and developing E-learning courses [20]. By improving teachers' knowledge about E-learning, they will be able to play the role of expert [21] but in initial stages of implementing, the course has to be designed by a professional. Also existence of an IT expert can help students and teachers to get technological support more easily.

F. Culture

Culture refers to a set of shared values, attitudes, goals and practices that characterizes an organization, institution or group. The role of culture in E-learning is very critical and it is one of the primary variables influencing effectiveness of E-learning [22]. In fact students' acceptance is a key element in technology based education and it dramatically depends on their culture [23]. Designing an E-learning system is a difficult responsibility and the way this is done depends on the learning culture in each country [24].

G. Computer Self-Efficacy

Self-efficacy refers to an individual's perception of his/her ability to plan and take action to accomplish a particular task. Computer self-efficacy (CSE) is one's belief that he/she can use computers in diverse situations. Evidence shows that individuals' motivation and effectiveness depend on their beliefs more than what is objectively true [25]. Because of the central role of computer in E-Learning, an effective performance of learners will depend on their confidence and perception to utilize this tool effectively. Bandura (1997) also argues that individuals with high CSE will succeed more than others because they know how to use computer and will not have to spend any time on how to use it.

III. Method and Sample

Case studies and empirical researches are appropriate ways for IT researches [26]. This research is an empirical study in Tehran high schools. To recognize variables which affect E-Learning outcomes and identify research variables, 9 interviews were conducted of E-Learning professionals in the IT sector of Training Bureau in Tehran. Based on an extensive review of interview transcripts and reviewing literature, 7 variables were recognized. An initial set of questions was developed to measure each variable. 2 academic experts viewed each item on the questionnaire for its content, scope and purpose (content validity). The questionnaire was developed based on a five-point Likert scale. Table 1 shows the results of reliability and validity analysis of the questionnaire.

4 high schools surveyed in this study were using technology based training called "Intelligent high schools". 258 questionnaires were collected but 11 questionnaires were omitted by outlier test in SPSS.

As it is clear in table 1, all measuring criteria have desirable reliability coefficient (Cronbach's alpha). Likewise factor analysis results show the validity of the questionnaire.

TABLE I. Reliability and Factor Analysis Results

	Reliability Analysis		Factor Analysis	
Variable	No. of questions	Cronbach's Alpha	Extraction	Eigen value
Content	5	0.783	0.583	2.687
Support	6	0.775	0.718	2.842
Ease of use	5	0.784	0.692	2.229
Reliability	3	0.755	0.515	1.604
CSE	3	0.970	0.622	1.613
Expert	2	0.878	0.579	1.314
Culture	2	0.812	0.512	1.260
Outcomes	5	0.725	0.580	2.411

IV. Results

Table 2 presents the result of regression analysis. This table shows that in 95% significance level, "content" and "expert" variables don't show a significant relationship with performance but all other variables have a positive and significant effect on E-Learning outcomes.

TABLE II. Regression Results

	B	t-test		R square	F-test	
Model		statistic	Sig.		statistic	Sig.
(Constant)	0.872	4.510	0.000	0.504	34.691	0.000
Content	- 0.24	1.441	0.659			
Support	0.262	3.490	0.001			
Ease of Use	0.205	2.616	0.009			
Reliability	0.158	3.034	0.003			
CSE	0.206	3.597	0.000			
Expert	0.070	1.441	0.151			
Culture	0.208	3.802	0.000			

A. Effect of Each Variable on Performance

For determining the importance degree of all research's indicators, weight of each criterion was calculated regarding to respondents' answers analyzed by SPSS software and

Principal Component Analysis (PCA) statistical method. Weights of these criteria are exhibited in table 3. Also, in order to confirm the results of PCA method, latent moderated structuring (LMS) technique is run by MPLUS3 software. As shown in table 3, both PCA and LMS technique reveal that "support" is the most important criterion which influences E-Learning outcomes.

TABLE III. COMPARING RANKING BY PCA AND LMS TECHNIQUE

Principle Component Analysis			Latent Moderated Structuring		
Ranking	Factors	Effects	Ranking	Factors	Effects(%)
1	Support	0.838	1	Support	25.8
2	Ease of use	0.835	2	Ease of use	23.05
3	CSE	0.806	3	CSE	19.28
4	Culture	0.748	4	Culture	18.18
5	Reliability	0.648	5	Reliability	13.68

V. DISCUSSION AND CONCLUSION

A. Figures and Tables

Many researchers try to evaluate the role of different variables in E-Learning outcomes (for instance: [8]; [26] and [27]). In this research, based on literature review and interviewees' attitudes, we tried to evaluate the role of seven important variables (including content, support, ease of use, reliability, computer self-efficacy, expert and culture) in E-Learning outcomes. Results of regression analysis validate the influence of 5 variables but "content" and "expert" variables don't show a significant relationship. Based on our interviewees' attitudes, there is a good trend in Iran toward creating e-Learning content. Thus the result of regression analysis is consistent with interviewees' attitudes. Results of principle component analysis (PCA) revealed that technical support is the most important variable. This result is consistent with Frankola (2001) which claimed that one of the most important reasons for e-learners drop out is lack of technical support. Also, Darab and Montazer (2010) proved that one of the most important difficulties in using E-Learning in Iran is technical infrastructure. Therefore it is logical that technical support is the most important variable for students.

This study provides insights for universities and institutions to strengthen their E-Learning courses and further improve learner satisfaction through promoting E-Learning outcomes. An unsatisfactory perception will hamper students' motivation to continue their online education. These seven factors cannot be neglected when using a successful E-Learning environment.

B. Limitations and Future Research Directions

Although this research represents a careful and systemic effort to incorporate elements of E-Learning, it has some limitations that should be taken into consideration. Firstly, this study is conducted in Iranian high schools' environment and probably it may show different results in other environments and countries (especially developed countries). Secondly, limitations of time and resources may influence the research's results. Finally other variables (for instance: motivation) should have been considered in this study.

We used some traditional statistical methods (PCA and regression analysis) to evaluate our data. In the future, other statistical methods such as SEM (e.g., LISREL, EQS, PLS), or neural network may be employed to explore cause/effect relationship among variables.

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