Key Success Factors in E-Learning in Medical Education

Emami H, MSc[1]; Aqdasi M, PhD[2]; Asousheh A, PhD[3]

Diroctor, IT and Statistics Center,Shahid Beheshti university (M.C.)

[1]Associate professor, faculty of engineering,Tarbiyat Moddarress university

[2]Assistant professor, faculty of engineering, Tarbiyat Moddarress university

Abstract

Background and purpose: *As in many countries, Medical Education (ME) is offered in three levels including Undergraduate ME, Graduate ME, and Continuing ME. Informtion tehnology development has provided a suitable chance for ME. E-learning in ME is growing more and more. The present study seeks to determine the key success factors (KSF) in E-learning in medical fields.*

Methods: *KSF has been scrutinized in the literature following of which, and due to similarity, a classification with seven groupings was established including institutional factor, technology, interested parties, information knowledge, methods and approaches educational resources, and environmental factors. Through a questionnaire, the data were gatered from the information technology (IT) directors in all medical universities throughout the country. The data collected were subjected to factorial analysis. Data from heads of educational groups were obtained through focus group discussion. Cronbach reliability coefficient was calculated for questionnaire used. Factorial analysis was used to identify meaningful KSF. T-Test, and one-way variance analysis as well as Pearson's correlation were used. The analysis was conducted with SPSS software*

Results: *The results showed no significant differences between age, sex, career, and level of education, and KSF. The preparedness factors were analyzed through group discussions with the heads of the academic departments under the study. By factorial analyses, five factors were found including the departmental interest and potential (27.3%), task performance potential (25.1%), E-teaching development in basic and clinical sciences , and continuing education (20.1%), suitable cultural environment (16.8%), and infrastructures (10.8%). Fisher Exeact Test was used to compare the obtained ratios in 5% curve whose results showed that among the three factors including legal and technocal environment, specialized hardwareand software, and high speed internet, performance interest and potentials showed a significant difference (p=0.002). A p=0.011 was found for the authorities' interest and financial and non-financial rewards. No other significant differences were found anywhere else.*

Conclusion: Our results showed that sex, age, career, work has no relation with KSF which means that if other factors such as technology, organizational and financial preparedness, curriculum content, human resources, teaching methods, standards, literacy, communications systems, trainers and learners, environment and culturewere ready motivated person can experience success in e learning in medicine

Key words: MEDICAL EDUCATION; E-LEARNING; KSF.

Journal of Medicine Eduction Summer & Fall 2008; 12(3 ,4): 81-89

Corresponding author: *Mr Hassan Emami is the IT and statistic center of Shaid Beheshti (M.C.),Teharn, Iran.*
Tel: 98 21 22439925

Introduction

Medical Education (ME) involves its own complexities. ME is influenced by several factors and variables. Students, instructors, the education environmet, methods of education, educational resources, growing educational technology and Information Technology (IT), and timely response to society's needs and demands are all among the factors influencing ME. In the IT era, the proper management and guidance can prepare grounds for up-to-date data for learners on the one hand, and , a qualified, skilled physician as the output of this system on the other hand can enhance more health for the society.

The studies conducted at different medical faculties around the globe have revealed that e-learning is one of the challenges for the future. New paradigms have entered in teaching and learning through e-learning in anything, for anyone, at anytime, and anywhere for life (1) .

The aim of the present study is to scrutinize on the Key Success Factors (KSF) in utilizing e-learning in ME focusing on continuing education.

Information society has effected a constant change in medical knowledge so that every 4-5 years 50% of the medical knowledge, and every 8-10 years, 70% of the same knowledge is considered as "old". Therefore, the knowledge gained in a period of general or specialized academic ME will not suffice for a future career. It is important to study the issue in the information era. IT advances have influenced different fields; however, the impacts have been more visible in medicine which make the importance of the study more important (2). The KSF is important in e-learning in ME.

KSF in e-learning in ME refers to factors that play substancial roles in e-learning. The attention paid by the medical universities goes back to KSF. The International Federation of Medical Education asked the medical universities in 1997 to prepare grounds to integrate e-learning and ME. The

internet has provided opportunities for correspondence among the medical universities and share the educational materials. High capacity computers and IT management are both the most powerful means for medical knowledge processing as well as for opening new frontiers in education process. The principles of ME are being developed and distributed very rapidly; therefore, they are exposed to change and match based on the local needs and demands with new outlooks (3). Presently, many medical universities around the world, the IT is utilized for bettering ME. Though computer simulations and robots are well marketed to familiarize with the clinical skills and have helped the development of ME, the virtual ME, even with the super-modern IT as a model for future learning seems to be difficult, though some students and professors in ME have highly welcomed the development of the IT (4,5). It is because the ME, especially in the clinical field is almost impossible without direct experience with the patients and their diseases in real situations. In basic sciences in ME where group learning is the most prominent teaching method, learning through web, as a complemntry method, can enhance; however, it may help the learners in clinical situations to enhance the skills required. The results of teaching anatomy through the internet and laparoscopy via simulations in some universities are being reported (6). In general, the e-learning methods include the synchronous (online) and asynchronous (offline) teaching methods, computer-based, web-based,and internet-based teaching methods. Numerous factors can affect the success in the aforementioned e-learning methods. A proper (complete and correct) collection of these factors can help remember the important factors when designing such e-learning systems. These include the factors that can guarantee our success. The KSFs which are vital in e-learning have been determined through the studies done by many researchers. In the present study, there have been

attempts to investigate the results of the previous studies in articles, initiative projects, and case studies. In the study on KSF at Pennsylvania State University three key factors were emphasized including the learners, the institute, and general factors. As for the learner factor, obtaining the learning materials, classmates and experienced people had been the key points. The learners demand learning of the knowledge of working with computers (7). For the 'institute', the Pennsylvania State University emphasized on hardware and software needs. They are as the bridges linking the learners, the institute, and other participants as well as establishing e-mails among the learners and instructors, and learners and the institute. The general factors in the same study include the student center, motivations for learning, the subject of transfer, learning activities in the learning environment, and the financial rewards. In Another study by Lindu (2008), the KSFs included organizational and technological preparedness, preparedness in the curriculum content, the learning process, cultural and human resources preparedness as well as preparedness in fianance for initiating the e-learning projects (8). In still another study, done at www.worldwidelearn.com, the KSF indexes were briefly categorized as the learner and instructor preparedness, curriculum development, hardware and software, the necessary skills, technical and logistics support, cultural and organizational preparedness (9). Cook conducted a study on the role of virtual learning in medicine in England. In that study, the KSF in e-learning were categorized as electronic office, resources management, unidirectional and bidirectional communications, integration of the learning materials, and e-records (10). In yet another study, Chiran studied the KSf in e-services in Colombo University. It was found that infrastructure including access to the internet, support, network wideth band, potentials for communications and computer learning were the most important KSfs. Support including technological supports, development of e-mails, and the strategies for preparedness in the language of instruction; the resources, including data banks, easy downloading, and up-to-dating potentials are all among the important KSfs (11). In a study by Mcphearson (2002), the emphasis has been put on issues such as the learners, curricula, IT, and integration (12). In an article entitled " KSF in applying the e-learning effectiveness in passive learners", Anher, et al, emphasize on equal supports, the staff, students' motivations, access to the internet, social supports, different e-learning methods, and face to face learning as the KSFs. Backstrom, et al studied the e-learning in Egypt and considers the infrastructures, e-content preparations, interested parties' acceptance, order, special logic and tolerance as the most important KSFs (13). In the study by Swatman, the e-learning preparedness in Hong Kong was scrutinized in which psychological, social, environmental, and human resources preparedness, as well as the preparedness in finanace, technological skills, preparedness in equipment, and curricula were investigated (14). Wattkins studied the e-learning preparedness at George Washington University in 2005. It was found out that the main KSFs were in three categories as the main goals, financial problems, cash turnover, and technological questions. In an Experimental study among the students by Volery, there are some suggestions for on-line learning success. The obtained results for KSF were based on technology (ease of access, internal design, and level of correspondence), the infrastructure (students' impressions, academic staff's qualifications, and classrooms), and the previous use of technology and the computer knowledge among the students. In Australia, Oliver studies the " Quality Warantees in E-Learning in Higher Education" in which the KSFs included academic staff's specialty in online working including distant learning, technology utilizations in education,

currency, teacher training, and students' preparedness for online learning including technological preparedness, access to technology, and technological literacy (knowledge or science). Technological infrastructures including transfer systems, and hardware and software systems, as well as providing necessary services were also included in this issue. Items such as curriculum development including potentials for re-using of the curriculum were also noted, and for the infrastructureal designs, seven critical factors were considered which include logistics supports, course development, teaching and learning, course infrastructure, student support, supports by the faculty, evaluation, and diagnosis (15). In the study by Slim, et al, there have been eight factors affecting the success in e-learning environment. The classifications for success factors (CSF) which are based on students' observations include teacher characteristics (i.e., their outlook towards technology, its usage and teachning methods), students' characteristics (qualifications in using computers, correspondence with one another, design and content of the curricula for e-learning), technology (including ease of access and infrastructure), and supports (16). In still another study by Badrul Khan on e-learning, some checklists of critical factors are recognized. These factors are classified in eight categories which include organizational factors (the need for evaluations, financial preparedness, and preparedness in infrastructures such as internet data, etc,.., cultural preparedness, and content), managerial factors (including managerial team, the processes for developing task management, maintenance), technical factors (infrastructural design, hardware and software), training factors (i.e., content analysis, audience analysis, analysis of the goals, media analysis, design methods, organization, and teaching strategies), ethical factors (including the impacts of the society and politics, cultural diversities, students' tendencies, geographical

distributions, and diversities; digital divide, etiquette, and legal cases), interface factors (i.e., web and site design, navigation, access, usable tests, logistics, online and offline supports and resources), evaluation factors (e-learning content development processes, evaluation of e-learning environment, e-learning evaluation for planning and organization, and student evaluation. The most important preparedness factors for Khan include organization, educational factors, technology, interface, evaluations, management, logistics supports, ethics, and cultural diversities (17 and 18).

As a summary, the KSF in e-learning includes preparedness in many areas as technology, organizational and financial preparedness, curriculum content, human resources, teaching methods, standards, literacy, communications systems, trainers and learners, environment and culture, strategies and the interested parties. The aforementioned factors have been the most frequent and widespread for KSF.

Methods

The study has been performed in medical universities throughout Iran.The participants included chief information officers at medical universities and heads of clinical and basic science departments.

In the first part the factors extracted from literature review were used to form 54 items. The content validity was approved by expert panel. The Cronbach Reliability Coefficient was calculated as 0.95 which is acceptable. A Likert's type scale with 7 options (1, the most important KSF, and 7 the least important). The participants were asked to clarify their options upon priority from among the 54 items (in 7 fields of organization, technology, the interested parties, literacy, educational resources, methods, and environmental factors). A factorial analysis were performed. The Cronbach reliability

coefficient for the factors was calculated.

For comparing the level of e-learning success indices, the T-Test was used for the binary independent variables such as sex, and for the independent qualitative variables the One-Way ANOVA was used. For the analysis of the dependent, quantitative variables such as age, career record, the Pearson correlation analysis was used.

In the second part, through the FGD method, the preparedness levels of the heads of the departments of the medical universities were examined. A one-day meeting was held with 30 of the heads of the departments from among 70 heads who finally filled out a 15-item questionnaire titled " A survey on the preparedness of the basic and clinical sciences departments" . These heads included the heads of the ENT, cardiology, general surgery, thorax, pediatrics, plastic surgery, anesthesiology, urology, social medicine, health, physical medicine, physical therapy, health education, dentistry, nuclear medicine, radiology, microbiology, and health services management. The content validity was approved by expert panel. the Cronbach's reliability coefficient was calculated as 0.821.

Results

Factorial Analysis.In first part 64 chief information officers filled questionnaires. The following results were obtained: top managers' support for e-learning development (40.3%), having a developed plan in e-learning (30.6%), access to the high speed internet for e-learning (37.1 %), a suitable portal for e-learning (12.9 %), designing a system to reduce academic staff's and students' workload (12.9%), the university chancellor's appreciation of the system (48.4 %), the academic staff's role for e-learning (24.2 %), teacher-student correspondence 37.1 %), having skilled academic staff capable of working with computer (24.2 %), blended e-learning for CME (37.1 %), methods for integrating traditional and online learning meth-

ods (12.9 %), simulations in basic and clinical sciences and CME (25.8 %), presenting text, CDs, e-books, and videos in CME (25.8 %), presence of a suitable infrastructure for IT and communications in the nation for developing e-learning (62.9 %), culturalization for developing e-learning (people's beliefs for e-learning and the acceptance of the degrees offered on teir part) with a frequency of 24.2 %). From among the factors such as organization, technology, the interested parties, literacy, educational resources, methods of education, and the environmental factors, two factors of organization (35.5 %), and the environmental factors (technical, social, and cultural) with a frequency of 27.4 % had the highest frequencies. Through SPSS software the factorial analysis was performed. The Cronbach Reliability Coefficient was found to be 0.951. With data reduction, 13 factors were obtained.

The obtained factors. The first KSF was named the skill and sharing (17.7 %) which included students' motivation for e-learning, the participation of the academic staff for developing e-learning, the educational staff cooperation for developing e-learning, tendency for CME, the academic staff capable of working with computer, the students capable of working with computer and the internet, CME learner skills, the skills of the educational directors in e- learning, and teacher-student correspondence.

The second KSF was named as ' e- resources' (with 11.4 %) including text, CDs, and e-books in clinical sciences, video presentation in basic and clinical sciences, presentation of simulation tools in basic, and clinical sciences, and CME.

The third KSF included the environmental factors (technical and legal) with a frequency of 8.6 %. Developing rules and regulation, instructions, and standards, structural changes in in the organization for e-learning, the presence of suitable IT infrastructure in the country for e-learning, environmental changes in the campus for e-learning (the

passage from the traditional system of learning to the web environment).

The fourth KSF was named as ' e-learning in basic sciences in medicine' with a frequency of 8.6 %. This included distant learning in basic sciences, online and offline learning, as well as blended learning in basic sciences.

The fifth KSF came out to be 'e-learning in clinical sciences' with a frequency of 8.1 %. Distant learning in clinical sciences, non-online learning, online learning, in clinical sciences, and the integration between the traditional and distant learning in different learning periods.

The sixth KSf involved the 'suitable planning' with a frequency of 8.1 %, and covered items such as having a suitable plan in e-learning development, provisions for e-learning, the support of the high ranking directors for e-learning, the presence of a business plan in developing e-learning, as well as informing all about the e-learning in the campus area.

The seventh KSF included the social, economic, and traditional factors with a frequency of 7.3 %. Potentialization of the private sector in initiating the e-learning plans, traditional-online learning integration methods, social factors (such as the acceptance of e-learning in medical sciences), and economic efficiency in e-learning initiation plans.

The eighth KSf was named to be 'network and local systems' with a frequency of 6.7 %. The WAN network for e-learning, localizing the systems without dependency to foreign countries or any specific companies, and designing a system to reduce teacher and student workload.

The ninth KSF was found to be 'specific hardware and software' with a frequency of 5.5 % which included the presence of a suitable portal for e-learning, accessability to necessary software for developing e-learning, having necessary hardware for accessing e-learning, and access to LMS system for e-learning.

The tenth KSf was called ' the appreciation of the high ranking authorities' with a frequency of 5 %. This included items such as the university chancellor's appreciation of e-learning, and the financial and moral rewards for developing e-learning.

The eleventh KSF was the presence of a high speed internet with a frequency of 5 %.

The twelfth KSF was named as ' integration in CME' with a frequency of 4.6 % which covered areas such as online learning and blended learning for CME.

And finally, the thirteenth KSF was named to be ' e-correspondence' with a frequency of 3.7 % which included factors such as e-mail and media application.

The results showed that there existed no significant correlations among age, sex, career , and work with computer and internet with the KSF.

In the second part, 5 factors were found with a rate of 82 % considering data reduction.

Interpretation and naming of the factors.The first preparedness factor was named to be the ' tendency and potentials of the department in e-learning' with a frequency of 27.3 %. Our staff intend to follow e-learning in CME. My opinion is generally positive for online learning. My opinion is positive for online learning in basic sciences. My opinion is generally positive for offline learning in CME. And, my opinion is geerally positive for offline learning in basic sciences.

The second preparedness factor, was named to be 'internal potentials for e-learning' (25.1 %). We are capable to follow CME e-learning-wise. I believe our university is capable of performing CME electronically. I believe we are capable of holding e-learning in basic and paramedical sciences.

The third preparedness factor was named to be ' preparedness in integrated e-learning' (20.1 %). The CME learners are interested for e-learning. I am positive for blended CME e-learning. I am positive for blended e-learning in basic sciences.

The fourth preparedness factor included the cultural environment (16.8 %). I will do whatever I can to en-

hance e-learning in CME, and that our culture permits the presence and development of elearning.

The fifth factor was named to be ' suitable infrastructure (external)' with a frequency of 10.8 %). The country's infrastructure is a hinderance for developing e-learning.

The Common Factors Between the Two Groups of IT Directors and Educational Directors. Our results show that there have been common KSF factors between the IT directors and educational directors for the preparedness in e-learning. These factors are mentioned in Table .

Table . The common factors between the two groups(KSF and preparedness).

The KSF as mentioned by the ICT Directors	Rank	%	The Preparedness of the Educational managers	Rank	%	P_value
Skill and Sharing	1	17.7	Tendency and Potential for Initiation	1	27.3	Fisher exact test
Legal and Technical Environment	3	8.6	Suitable Infrastructure	5	10.8	0.214 ns
Suitable hardware and Software	9	5.5	Suitable hardware and Software			0.002 sig
E-Learning Methods in Basic sciences	4	8.2	Developing E-Learning in Basic and Clinical Sciences	3	20.1	
Social, Cultural, Economic, and Traditional	7	7.3	Cultural Environment	4	16.8	0.248 ns
Authorities' Appreciation and Initiating Financial and Moral Rewards	10	5	Potential to Do the Tasks	2	25.1	0.011 sig

The Fisher Exact Test was used to compare the obtained ratios with 5 % curve level. The results showed that among the three factors of legal and technical environment, specialized hardware and software, and high speed internet for the ICT directors, and the tendency and potencial for implementation for the educational directors, there was a significant difference (p=0.002). As for the appreciation and reward offering of the high ranking officials on the part of the ICT directors, and the potentials for performing the tasks on the part of the educational directors, a significant difference was also found (p=0.011). No significant differences were found in other areas.

Discussion

Our results showed that sex, age, career, work has no relation with KSF which means that if other factors such as technology, organizational and financial preparedness, curriculum content, human resources, teaching methods, standards, literacy, communications systems, trainers and learners, environment and culturewere ready motivated person can experience success in e learning in medicine.

Reference

1) OCLC E-Learning Task Force . Libraries and

the enhancement of E- Learning. Ohio: OCLC Online Computer Library Center. [cited June 25, 2004].Available from:URL: http://www5.oclc.org/downloads/community/elearning.pdf

2) Ruiz JG, MINTZER M, Lepig RM, The Impact of E-Learning in Medical Education. Aca Med 2006 March; 81: 207.

3) Zandi and Abedi. Familiarity with E-Learning as a New Technology and Its Integration in Medicine Curricula.[persaian]. Journal Amowzesh Dar Oloom Pezeshki. 2004; 1:59.

4) Hara N, Kling R. Students' Distress with a Web-based Distance Education Course: An Ethnographic Study of Participants' Experiences. In W. H. Dutton and B. D. Loader. editors. Digital academe: New media in higher education and learning; 2002. p.62-84.

5) Shachaf P, Hara N. Team effectiveness in virtual environments: An ecological approach. In Ferris SP,Godar S, editors. Teaching and learning with virtual teams. Hershey, PA: Idea Group Publishing;2005. p. 81-106.

6) Hoffman H, Murray M, Curlee R and Fritchle A. Anatomic VisualizeR: Teaching and Learning Anatomy with Virtual Reality. In Akay M, Marsh A, editors. Information Technologies in Medicine, Volume I: Medical Simulation and Education. Clifornia: John Wiley and Sons, Inc; 2001. p. 205-18,

7) Masson P.Open Source Software is not a Technology Issue.[online]. 2007 [cited 2008 May 20]. Availale from:URL:http//www.psu.edu

8) Newell LE. E-learning Preparedness Assessment for Crowley Independent School District. www.crowleystar.net/Index. November 21, 2006

9) Smith P, Murphy K, Mahoney S. Towards identifying factors underlying preparedness for online learning: An exploratory study. Distance Education, 24(1). [Cited Nov 19, 2006].Available from: URL:http://taylorandfrancis.metapress.com/media/92ljqkwxukb3m6xhdr02/contributions/0/y/n/1/0yn1rkg45b69gw4w.pdf

10) Cook J. The role of virtual learning environments in UK medical education.[online]. Aug 1, 2003 [cited Nov 19, 2006]. Available from:URL: http://www.ltss.bris.ac.uk/jules/jtap-623.pdf

11) Chiran C. An identification of Critical Success Factors (CSFs) on user perspectives in diffusing e-Information Service in the University of Colombo Library[online]. 2004 [cited Nov 19, 2006]. Available from:URL: www.cmb.ac.lk/academic/institutes/nilis/reports/chaminda.pdf

12) McPherson M. Organisational Critical Success Factors for Managing e-Learning Implementation. in Proceedings of the International Conference on Computers in Education 2002.

13) Beckstrom M, Croasdale H, Riad MS, KamelMM. Assessment of Egypt's eLearning Preparedness[online]. 2005[cited Nov 19,2006]. Available from:URL: http//:www.mohamedelzayat.net/egypt%20readiness%20for%20el-earning.pdf

14) Swatman PM e-Learning Preparedness of Hong Kong Teachers.2007 [cited Nov 19, 2007]. Available from:URL: http://www.unisanet.unisa.edu.au/staff/Homepage.asp?Name=Paula.Swatman

15) Bendel O, Hauske S. E-Learning, digitale Forschungsplattform, Oberentfelden/Aarau. [online]. 2004[cited Nov 19, 2007]. Available from:URL: http://www.alexandria.unisg.ch | 20.08.2005

16-Selim HM. Critical success factors for e-learning acceptance:confirmatory factor models Comput Edu 2007;49: 396–41

16) Khan, B. H.Managing e-learning: Design, delivery, implementation, and evaluation. Hershey, PA: Information Science Publishing; 2005.

17) Khan BH. People, process and product continuum in e-learning: The e-learning P3 model. Edu Tech 2004;44(5): 33-40.

18) Karle H. Basic Medical Education WFME Global Standards For Quality Improvement. WFME Office: University of Copenhagen ; 2003.

19) Sharpe R. The undergraduate experience of blended e-learning: a review of UK literature and practice;)2006(

20) Ruiz GJ, Mintzer MJ, Leipzi RM. The Impact of E-Learning in Medical Education. Acad Med 2006; 81:207

21) ttp://www.worldwidelearn.com/online-courses/teaching-online.htm