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# Readiness for Electronic Learning and Ranking of Related Factors Using the Fuzzy PROMETHEE: A Study at Kerman University of Medical Sciences, Iran

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## Abstract

**Background:** Electronic learning (e-learning), as a tool for the acquisition of knowledge, is rapidly expanding and evolving, but in order to employ such a project, identify its strengths and weaknesses, and make the right decision, organizations and institutions should carefully analyze the degree of their readiness.
**Objectives:** Therefore, the present study aimed at evaluating the readiness of Kerman University of Medical Sciences for e-learning implementation from the viewpoint of faculty members and ranking the identified factors.
**Methods:** The present survey was conducted on 402 faculty members at Kerman University of Medical Sciences as the statistical population; however, a total of 196 subjects were selected using Morgan table and stratified random sampling. Data were collected by a questionnaire measuring the readiness of university based on four factors. The viewpoint of eight experts as well as fuzzy preference ranking organization method for enrichment evaluation (PROMETHEE) was used to rank the factors.
**Results:** All the studied factors, except human resources, had good status and overall readiness of Kerman University of Medical Sciences was at a good level. In addition, ranking of the factors revealed that human resources were the most important factor to assess readiness for e-learning implementation at Kerman University of Medical Sciences.
**Conclusions:** According to the viewpoint of faculty members, Kerman University of Medical Sciences is ready for e-learning implementation and no significant difference was found between the academic rank and academic department of faculty members and their attitudes toward e-learning.

*Keywords:* E-Learning, Readiness for E-Learning, Faculty Members, Fuzzy PROMETHEE

## 1. Background

Technology advents in recent years have shown new applications of electronic learning (e-learning), so that its utilization in education has provided opportunities for the employment of new learning methods and effective teaching styles (1). Meanwhile, e-learning is one of the most widely used terms entered education arena through information technology (IT), and many educational centers, especially universities, utilize it as part of their long-term programs and mainly invested heavily in it (2).

Generally, e-learning refers to the use of network technology (e g, the internet) to design, deliver lessons, and implement learning environments for the realization and continuation of learning (3). In the definition provided by Romiszowski (4), which seems more comprehensive than other ones, e-learning consists of four dimensions. According to his definition, e-learning can be an individual or group activity. In addition, it has continuous (synchronous communication) (synchronous and real-time communication with people) and discrete (non-synchronous communication) (using educational CDs provided previously or delivered through educational materials called on the internet) dimensions (4). In fact, e-learning consists of two broad sets of IT and education and research (5).

Education, especially medical education, faced increasingly utilization of e-learning tools in recent years. Global e-learning market reached US$107 billion in 2015, according to reports; while it was US$32.1 billion in 2010. It also had an average annual growth rate of 9.2% over the past five years and it is expected that e-learning to grow in Asia at an annual rate of 25% - 30% and global rate of 15% - 30%. Nevertheless, American and European institutions currently hold 60% and 15% of the e-learning market, re-

spectively (6).

There are many reasons for the growth of e-learning implementation projects, most notably the cost of education. A review of the literature revealed that institutions made good savings by implementing e-learning, since its most important feature is that it can occur at any time even in the workplace and does not require the physical presence of a teacher and traditional classroom scheduling (7). Due to the flexibility created for both the learner and the teacher, many universities, institutes, and educational organizations are rapidly implementing this technology (8). For example, Shultz and Fogarty reported that the large International Business Machines (IBM) saved US$16 million by being pioneer in the implementation of e-learning. PricewaterhouseCoopers could also reduce its training costs by 87% through the implementation of e-learning. They reported that implementing e-learning resulted in 33% - 50% cost savings, 50% time savings, and better results (9).

Implementation of e-learning, in addition to cost savings, has other advantages such as faster development, updating courses, faster training, access at any time and place, opportunities for external learning, improving motivation, and implementing strategic issues (10, 11).

In addition to e-learning advantages, many experts and researchers pointed out that the e-learning projects should be implemented carefully, since without careful planning, e-learning may lead to extra costs, failure to achieve goals, and ultimately, project failure. Researchers also argue that, like many other innovations, successful implementation of e-learning requires considerable analyses, time for development, sufficient funding, appropriate technological structure, and senior management support. Therefore, the necessary preparations should be assessed for implementing e-learning (12-15). Many studies are conducted to assess the readiness of an organization for implementing e-learning (16-18).

A review of the literature showed that several strategies, tools, models, and guidelines are available for practitioners to assess the implementation of e-learning. For example, Haney suggested that the practitioners answer 70 questions to assess the implementation of e-learning. He categorized the questions into seven factors as human resources, e-learning management system, learners, content, IT, financial resources, and e-learning providers (19). Similarly, the studies by Rosenberg (20), Panda and Mishra (21), and Jacobs and Washington (22) also assessed e-learning implementation.

Rogers (23) stated that any system (e.g., culture, country, manpower, etc.) has its own norms and is effective in spreading innovation in the system. Therefore, the considered indicators may not be applicable to other environments, countries, cultures, etc. Many e-learning assessment variables and indicators are tailored for a certain environment and are not suitable for other settings or should be customized (23); the present study was no exception. Therefore, the variables and factors measured in the current study were determined by examining the details of the assessment models, indicators, and tools available in e-learning and fitting them with cultural features; accordingly, four key elements were assessed: technology, innovation, human resources, and personal growth.

Technology is one of the first factors that should be effectively addressed in adapting technical innovation (23). In general, technology consists of two essential components of hardware and software. Organizations deciding on the implementation of e-learning should meet the minimum hardware and software requirements. E-learning hardware includes tactile tools such as servers and networks. It is very difficult to implement e-learning without proper equipment and ease of access (13). The e-learning readiness assessment tool should determine the accessible hardware. Therefore, the present study included questions on easy access to computers, internet, and intranet. Nevertheless, the ease of access to hardware is not enough and users should have basic skills to work with these tools.

Innovation means exploring past experiences. Past experiences within a system about an innovation can be effective in adopting a new technology (23). Past experiences of e-learning practitioners about an innovation and their previous information about its acceptance or rejection in any process and project, in addition to internal, external, legal, and political barriers, have a significant impact on being pioneer in the implementation of e-learning. Therefore, the present study also evaluated the innovation factor.

A review of the literature revealed that human resource skills play a key role in the success of e-learning (13). In this regard, the education level of e-learning practitioners is one of the predictors of readiness. In other words, organizations, institutions, and universities with more skilled human resources are more likely to succeed in e-learning implementation.

Personal growth is the last factor in assessing e-learning readiness. Institutions planning to invest in pioneering individual and organizational developments have managers who believe in personal growth capability and their employees have a positive attitude toward development and can more easily apply innovations such as e-learning (13). In addition, individuals with more personal growth appear to be more inclined to learn about technology, understand new online education and learning ways, and being familiar with mere educational processes.

Since e-learning is still in its infancy in higher educa-

tion, especially medical sciences universities, and implementing e-learning is very sensitive, assessment of universities and evaluation of their attitudes and requirements to address their weaknesses and strengths and taking the right measures are of particular importance.

## 2. Objectives

Therefore, the present study aimed at assessing the readiness degree of Kerman University of Medical Sciences for the implementation of the e-learning project and ranking the related factors. The research questions were as follows: (1) how ready is the Kerman University of Medical Sciences for the implementation of e-learning from the viewpoint of faculty members?; (2) is there a relationship between the faculty members at Kerman University of Medical Sciences and their attitudes toward readiness for e-learning?; (3) is there a relationship between the academic rank of faculty members at Kerman University of Medical Sciences and their attitude toward readiness for e-learning?; (4) what is the academic rank of e-learning practitioners at Kerman University of Medical Sciences using fuzzy PROMETHEE?

## 3. Methods

The present survey was performed in 2017. The statistical population included all faculty members of Kerman University of Medical Sciences (n = 402) of whom 196 subjects were selected by stratified random sampling and Morgan table. This sampling method was employed in order to involve all academic departments (seven faculties) in the research.

Table 1 shows the number of faculty members at Kerman University of Medical Sciences and the number of subjects selected from each department.

**Table 1.** Number of Statistical Population and Samples Based on Academic Department at Kerman University of Medical Sciences

| Academic Department | Statistical Population, N | Sample Size, N |
|---|---|---|
| **Faculty of Public Health** | 28 | 14 |
| **Faculty of Midwifery and Nursing** | 24 | 12 |
| **Faculty of Medicine** | 230 | 112 |
| **Faculty of Allied Medicine** | 7 | 3 |
| **Faculty of Pharmacy** | 27 | 13 |
| **Faculty of Dentistry** | 67 | 33 |
| **Faculty of Management and Medical Informatics** | 19 | 9 |
| **Total** | 402 | 196 |

To evaluate the readiness of Kerman University of Medical Sciences for the implementation of e-learning project and the attitude of faculty members towards it, a questionnaire was used, which its validity and reliability were confirmed in other studies on e-learning (13). To be more reliable, the validity of the questionnaire was evaluated and verified using the opinions of experts and academic staff. For this purpose, the content validity was used; i.e., six academic staff and experts were asked to express their views on the items of the questionnaire and determine their appropriateness using the options of excellent fit, good fit, partially fit, poor fit, and very poor fit, scored respectively as 1, 0.75, 0.5, 0.25, and 0. The validity of the questionnaire was 0.93, which was confirmed.

Cronbach's alpha coefficient was used to evaluate the reliability of the questionnaire, which was 0.87 and confirmed. The questionnaire used consisted 25 items in two parts. The first part dealt with demographic information including gender, academic department, and academic rank of professors and the second part included items on the readiness of the university and teachers' attitudes toward e-learning based on four factors of technology, human resources, personal growth, and innovation. A five-point Likert scale from 1 to 4 was used for scoring. Thus, faculty members were asked to choose one of the strongly disagree, somewhat disagree, somewhat agree, and strongly agree options with regard to the degree of their faculty readiness or their personal attitude toward the subject.

According to the scores given, the average level of readiness or the line between university readiness and non-readiness for e-learning implementation was 3.4, because dividing the number of intervals by scales results the distance of 0.8. Hence, levels of readiness were identified (Figure 1) (24). In addition, overall university readiness for e-learning was assessed using the mean score of the research questions (or the mean score of the research variables). As soon as the validity and reliability were confirmed, the questionnaire was placed at disposal of the faculty members and then collected after completion.

Data were analyzed using descriptive and inferential statistics. In descriptive statistics, mean and standard deviation and in inferential statistics ANOVA were used. Finally, the data were analyzed in SPSS version 22 (IBM Corporation, version 22, Armonk, NY).

Next, a new fuzzy PROMETHEE was used to rank the e-learning readiness factors. It falls into the category of techniques for ranking options. The PROMETHEE I (partial ranking) and PROMETHEE II (complete ranking) were introduced in 1982 by Brans et al. (25), and a few years later, they developed PROMETHEE III (ranking based on intervals) and PROMETHEE IV (continuous case). Likewise, in later years, other versions of the technique- i.e.,

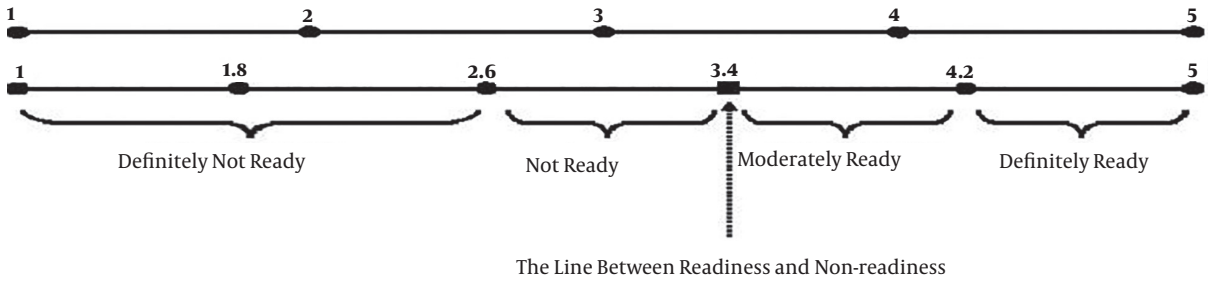


**Figure 1.** Classification of e-learning readiness

PROMETHEE V (multi-criteria decision making with segmented restrictions) and PROMETHEE VI (representation of the human brain) were introduced. This technique is successfully used in various fields so far. The fuzzy PROMETHEE introduced by Ho (26) is the combination of fuzzy logic and the PROMETHEE with greater flexibility (27).

After examining the factors and the readiness of the university for the implementation of e-learning, the questionnaires were given to experts (one expert per faculty, except the faculty of medicine with two experts) to determine the importance of each question according to their viewpoints. Since it was essential to choose participants who were fully aware of the current status, experts were selected from the heads or deputies of each faculty. Since the involved experts had different abilities, experiences, and competencies in group decision-making, different weights were given to them (Table 2). Also, since the faculty of medicine was more privileged than the other ones, higher weights were given to its experts. Since personal characteristics of individuals influence their subjective interpretations of qualitative variables, by defining the domain of qualitative variables, experts responded to the questions with the same mentality. These variables are defined as triangular fuzzy sets in Table 3.

The fuzzy sets in Table 3 determined by the Minkowski formula were calculated using Equation 1.

$$x = m + \frac{(\beta - \alpha)}{4} \quad (1)$$

Also, the fuzzy mean of each component was calculated using Equations 2

$$A_i = \left(a_1^{(i)}, a_2^{(i)}, a_3^{(i)}\right), i = 1, 2, 3, \ldots, n \quad (2)$$

$$A_{ave} = (m_1, m_2, m_3) = \left(\frac{1}{n}\sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_2^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_3^{(i)}\right) \quad (3)$$

where Ai represents the $n_i$ viewpoint of the expert and $A_{ave}$ represents the mean of expert views.

After receiving the questionnaires, the experts described the importance of each question with one of the fuzzy linguistic variables (very low, low, medium, high, and very high). Then, after evaluating the questionnaires, the data were ranked using fuzzy PROMETHEE in Visual PROMETHEE software.

The present study protocol was approved by the Ethics Committee Kerman University of Medical Sciences (code no.: IR.KMU.REC.1397.623).

## 4. Results

Descriptive statistics of participants' demographic variables are shown in Table 4.

The findings of each question and factor as well as overall readiness of the university for e-learning implementation are shown in Table 5. Among the questions on human resource factor, question 2 got the lowest mean score indicating that the number of e-learning experts at Kerman University of Medical Sciences (i.e., education via internet or use of software for presenting courses; e.g., graphics software) was at a moderate level. Also, among the questions raised, question 4 with a mean score of 4.07 indicated lack of enough experts outside the university to implement e-learning.

Based on Table 5, data on faculty members' attitudes toward personal growth and university readiness were analyzed using seven questions, of which question 9 had the lowest mean score indicating that the professors were not enough ready to participate in e-learning. Question 6 also had a lower mean score, indicating the lack of enthusiasm of the faculty members to present the lessons electronically. The mean score of question 8 indicated that according to the viewpoint of faculty members, funding could be earmarked for e-learning. The higher mean scores of questions 10 and 13 indicated that faculty members believed that e-learning can help achieve university goals, and the personal growth of faculty members may lead to the enhancement of the university standing in Iran.

**Table 2.** Expert Weights to Rank Factors of E-learning Readiness

| Expert Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Expert weight | 0.07 | 0.06 | 0.28 | 0.28 | 0.02 | 0.06 | 0.18 | 0.05 |

**Table 3.** Definition of Verbal Research Variables

| Verbal Variables | Triangular Fuzzy Set | Crisp Set |
|---|---|---|
| Very high | 0, 0.25, 1 | 0.9375 |
| High | 0.15, 0.15, 0.75 | 0.7500 |
| Moderate | 0.25, 0.25, 0.5 | 0.5000 |
| Low | 0.15, 0.15, 0.25 | 0.2500 |
| Very low | 0.25, 0, 0 | 0.625 |

**Table 4.** Demographic Characteristics of Faculty Members at Kerman University of Medical Sciences[a]

| Demographic Variable | Values |
|---|---|
| **Gender** | |
| Male | 125 (64) |
| Female | 71 (36) |
| **Academic rank** | |
| Lecturer | 13 (7) |
| Assistant Professor | 159 (81) |
| Associate Professor | 18 (9) |
| Professor | 6 (3) |

[a]Values are expressed as No. (%).

Technology was another factor that assessed teachers' attitudes via questions 14 to 21. Accordingly, questions 14 and 15 indicated that access to technology (personal computers as well as intranet and internet) was desirable, but in terms of basic skills for using computer and internet as well as regular use of technology and adoption of new technological innovations, the faculty members were at a lower level and there were weaknesses. Questions 20 and 21 also showed a somewhat desirable level and managers had a positive attitude toward technology and sufficient funding was earmarked for e-learning.

The mean scores of questions on innovation factor were somewhat in the same range, 4.11 to 4.56, implying that the university readiness to adopt innovation was at a desirable level.

Finally, the overall mean score of the factors indicated that the overall readiness of Kerman University of Medical Sciences was at a good level. All factors, except the human resources, had a favorable status.

In addition to the descriptive analysis of the data, it was attempted to provide inferences about attitudes of faculty members toward e-learning. For this purpose, ANOVA was used to answer question 2; the results and scores of attitudes toward e-learning in each department are shown in Table 6. Comparing P = 0.279 and acceptable error value ($\alpha$ = 0.05) showed that P value was greater than that of acceptable error (P > 0.05); thus, with 95% confidence interval, no relationship was found between faculty members' attitudes and readiness for the implementation of e-learning, and their academic departments.

ANOVA was used to answer question 3. The results and scores of attitude toward e-learning are shown based on academic rank of respondents in Table 7. Comparing P = 0.671 and acceptable error value ($\alpha$ = 0.05) showed that P value was higher than that of acceptable error (P > 0.05). Thus, with 95% confidence interval, there was no relationship between the faculty members' attitude and readiness for e-learning, and their academic rank.

In order to answer question 4 and rank the e-learning readiness factors at Kerman University of Medical Sciences, the experts were provided with a questionnaire to determine the importance of each question through verbal variables.

Mean fuzzy score of experts on the importance of questions and factors are presented in Table 8. These scores were the inputs of Visual PROMETHEE to rank the factors. According to the software output shown in Figure 2, human resources was the most important factor followed by technology, personal growth, and innovation (Table 9).

## 5. Discussion

The present study investigated the readiness of Kerman University of Medical Sciences for e-learning implementation from the viewpoint of faculty members and ranked the related factors. The results showed that the university was generally ready to implement the e-learning project, but performance should to be improved in some areas, especially the human resources. This means that professors and academic staff who play role as e-learning practitioners should first be familiarized with general issues such as a positive attitude toward innovation and new electronic and information technologies, and necessary trainings have to be delivered to them. Then, to better implement such a project, e-learning professionals including experienced content designers, network and computer experts, IT managers, educational managers, and professors

**Table 5.** Attitude of Professors at Kerman University of Medical Sciences Toward the Readiness of the University for E-learning

| Item | Question | Mean Score |
|---|---|---|
| 1 | Experienced human resources is available at the university to run and manage short-term courses for the enhancement of professors' level. | 4.14 |
| 2 | There are experts in e-learning at the university. | 3.98 |
| 3 | Professors have sufficient knowledge and skills in technology-based education. | 4.39 |
| 4 | Professionals are available outside the university to design, implement, and manage e-learning. | 4.07 |
| 5 | Most university staff has sufficient knowledge and skills in technology-based education. | 4.34 |
| **Mean human resources score** | | 4.18 |
| 6 | Professors have enthusiasm to present their lessons electronically. | 4.07 |
| 7 | Professors have enough day time to enhance their education. | 4.11 |
| 8 | Funding can be earmarked for e-learning at the university. | 4.67 |
| 9 | Professors are ready to participate in e-learning. | 4.05 |
| 10 | E-learning helps the university achieve its goals. | 4.65 |
| 11 | The organizational structure of the university is appropriate for the implementation of e-learning. | 4.29 |
| 12 | The university is definitely ready to implement e-learning. | 4.43 |
| 13 | Senior and middle managers believe that the personal growth of professors can enhance the standing of the university in Iran. | 4.57 |
| **Mean personal growth score** | | 4.36 |
| 14 | All professors have access to a personal computer. | 4.85 |
| 15 | All professors have access to internet and the university intranet. | 4.81 |
| 16 | All professors have sufficient basic knowledge and skills in computers. | 4.12 |
| 17 | All professors have sufficient basic knowledge and skills in internet. | 4.16 |
| 18 | Professors are eager to regularly use technology in their affairs. | 4.01 |
| 19 | Most professors embrace technological innovation. | 4.16 |
| 20 | Senior and middle managers have a positive attitude toward the application of technological innovation in affairs. | 4.23 |
| 21 | Based on previous experience, the university earmarks funds for technology. | 4.33 |
| **Mean technology score** | | 4.33 |
| 22 | Most of the past innovations at the university are welcomed by professors. | 4.55 |
| 23 | Most of the past innovations at the university are welcomed by staff. | 4.22 |
| 24 | Most of the past innovations at the university are welcomed by senior and middle managers. | 4.56 |
| 25 | There is no domestic or foreign legal and political prohibition to embrace innovation. | 4.11 |
| **Mean innovation score** | | 4.36 |
| **Overall readiness of the university** | | 4.31 |

interested in such innovations are required that access to such experts was somewhat problematic in Iran.

A deeper examination of the tables revealed that all questions with slightly lower mean scores were related to the direct performance of faculty members. Knowledge and skills of professors in technology-based education, their eagerness and interest in delivering lessons via e-learning, readiness of professors to participate in e-learning, their sufficient knowledge and skills in computer and internet, and interest in regular use of technology for affairs were the factors that had lower scores, and the reason can be attributed to the traditional structure of Iranian universities and the lack of movement towards entrepreneurial and value-creating universities, and lower interest of professors, especially older ones, to such environments. Therefore, the attitude and skills of professors in innovation and new technologies should be enhanced and improved before the implementation of such projects.

Ranking factors using expert opinions and fuzzy PROMETHEE showed that the human resources was the most important factor for the implementation of e-learning at Kerman University of Medical Sciences. Many

**Table 6.** Mean Scores of Academic Departments and Relationship with Faculty Members' Attitude Toward the University Readiness[a]

| Academic Department | Number | Mean |
|---|---|---|
| Faculty of Public Health | 14 | 4.23 |
| Faculty of Midwifery and Nursing | 12 | 4.35 |
| Faculty of Medicine | 112 | 4.32 |
| Faculty Of Allied Medicine | 3 | 4.09 |
| Faculty of Pharmacy | 13 | 4.23 |
| Faculty of Dentistry | 33 | 4.38 |
| Faculty of Management and Medical Informatics | 9 | 4.29 |
| Total | 196 | 4.31 |

[a] F = 1.257 and P value = 0.79.

**Table 7.** Mean Scores of Faculty Members' Academic Rank and Relationship with Their Attitudes Toward University Readiness[a]

| Academic Rank | Number | Mean |
|---|---|---|
| Lecturer | 13 | 4.13 |
| Assistant Professor | 159 | 4.34 |
| Associate Professor | 18 | 4.27 |
| Professor | 6 | 4.18 |
| Total | 196 | 4.31 |

[a] F = 0.503 and P value = 0.671.

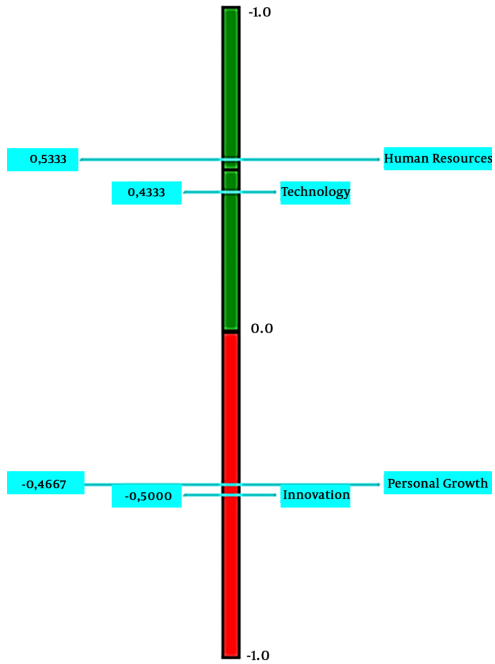


**Figure 2.** Visual PROMETHEE software output and ranking of e-learning readiness factors

studies state that the most fundamental organizational resource is human resources and its approach and performance toward the organization, environment, and clients (28); e-learning is no exception. The rules of e-learning and human resources development are rapidly changing today. New rules of e-learning every day fulfill some of its value-added promises and further marginalize rules of traditional learning, but this important is fruitless without its essential elements, which human resources is the most important ones. Therefore, the creative and knowledgeable human resources with positive attitude is the main factor in implementing e-learning.

Questions 2 and 3 were to investigate the relationship between academic department and academic rank of Faculty Members at Kerman University of Medical Sciences and their attitudes toward the university readiness for e-learning implementation. According to the results, there was no significant relationship between faculty members' attitude, and their academic department and academic rank. In other words, there was no difference in the attitude of faculty members from different faculties with different academic ranks regarding the readiness of Kerman University of Medical Sciences for the implementation of e-learning.

Because of contingency of the subject, although the results of the present study can be compared with those of some aforementioned ones, it should be conducted with caution, since the application of e-learning in medical sciences is still at the forefront and the present study only focused on four factors affecting the readiness of the university for the implementation of e-learning project from the viewpoint of faculty members and it is not possible to claim that these factors and questions were sufficient to obtain information and data related to readiness for e-learning. Further factors and questions can be easily raised.

However, the questionnaire items assessed some important issues for the implementation of e-learning by examining the research literature, but further factors can be considered in other institutions and universities to obtain more detailed information. In comparison, the first step in developing and promoting e-learning in a university is to determine the current status of the university and consider all the variables and factors influencing the implementation of e-learning project correctly and appropriately.

Nowadays, with the advent of computers and internet in education, universities cannot ignore e-learning. Computers and internet are the indispensable part of higher education and medical education, and utilization of these capabilities are recommended for most educational sys-

**Table 8.** Mean Defuzzified Scores of Experts

| Expert Number | Human Resources | Personal Growth | Technology | Innovation |
|---|---|---|---|---|
| **1.** | 0.8996 | 0.7810 | 0.8278 | 0.7810 |
| **2.** | 0.8122 | 0.7498 | 0.8903 | 0.5625 |
| **3.** | 0.8496 | 0.7731 | 0.7731 | 0.7185 |
| **4.** | 0.8622 | 0.8669 | 0.7810 | 0.6096 |
| **5.** | 0.9370 | 0.7810 | 0.8356 | 0.8278 |
| **6.** | 0.7748 | 0.7185 | 0.8356 | 0.5468 |
| **7.** | 0.7622 | 0.7185 | 0.7810 | 0.8278 |
| **8.** | 0.8996 | 0.7263 | 0.8590 | 0.7810 |

**Table 9.** Ranking of E-Learning Readiness Factors Using Fuzzy PROMETHEE

| Factor | Phi | $Phi^+$ | $Phi^-$ |
|---|---|---|---|
| **Human resources** | 0.5333 | 0.5333 | 0.0000 |
| **Personal growth** | 0.4333 | 0.4733 | 0.0400 |
| **Technology** | -0.4667 | 0.0600 | 0.5267 |
| **Innovation** | -0.5000 | 0.0933 | 0.5933 |

tems and institutions, but in the meantime, understanding of facts, conditions, and capabilities is essential for successful implementation of e-learning projects. In many cases, negligence of current prerequisites, program, and capabilities can lead to the failure of e-learning projects. Understanding the strengths, threats, and opportunities in the e-learning environment, as well as the needs of audiences, and designing and delivering effective educational materials, and creating learners' communities to build knowledge ensure the success of such a project. What was done in the present study was to understand part of existing conditions and examine the readiness of Kerman University of Medical Sciences from the viewpoint of faculty members based on four factors of human resources, personal growth, technology and innovation. According to the obtained results, the university was ready for the implementation of e-learning. However, understanding the current facts, conditions, and prerequisites requires more instruments that can be found in other studies.

## Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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## Footnotes

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**Ethical Approval:** The ethical code of the study was IR.KMU.REC.1397.623.

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