



A Framework for Improving the Effectiveness of the E-Learning System in Hyper Famili Chain Stores

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ABSTRACT

Before the coronavirus pandemic, higher education centers and companies paid little attention to e-learning. The outbreak of the pandemic and the development of digital technologies have caused companies to pay much attention to e-learning. Therefore, companies are looking for the effective use of e-learning tools. The current research seeks to provide a framework to improve the effectiveness of the e-learning system in Hyper Famili chain stores. The current research is applied in terms of orientation and has a quantitative nature in terms of methodology. This study used two Fuzzy Delphi and Marcos methods for data analysis. The theoretical population of the research was managers, experts, and consultants in the field of education in Hyper Famili. Sampling was done as a judgment based on the expertise of experts in eLearning. The sample size was equal to 10 people. Interviews and questionnaires were used to collect data. The questionnaires used in this research were expert and priority questionnaires. In the first stage, 32 factors were obtained through literature review and interviews with eLearning experts. As a next step, these factors were screened by the distribution of expert questionnaires and the fuzzy Delphi method. Ten factors were selected for final prioritization with Marcos. The screened factors were prioritized by distributing priority questionnaires and Marcos. According to the scores, the most important factors have been found. Practical research proposals were developed based on the most prioritized factors. Some practical suggestions of the research were holding a training workshop on the benefits and applications of e-learning for senior managers, considering the appropriate budget for purchasing and preparing the necessary infrastructure in the field of e-learning, preparing strategic and operational documents based on future developments of new technologies in Iran and the world and the use of instructors with electronic teaching skills.

Keywords

Training, E-learning, System, Effectiveness, Marcos, Fuzzy delphi.

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1. Introduction

Rather than focusing on indicators such as wealth production and human power, today's global economy emphasizes human capital development. Meanwhile, education plays an undeniable role in the development of the human capital of societies, and educational activities should be developed. Education plays a key role in success and has a strategic value in business in today's competitive world. The World Bank says international investment in e-learning systems is growing rapidly. The e-learning system is used mainly because of its profitability, credibility, and marketability. More diverse and effective education methods are required due to the requirements and necessities of new businesses. As an effective tool, e-learning reduces the time and space between the learner and the teacher as much as possible, making education costs economical.

Operating systems based on new technologies are used in electronic learning, from computer-based learning to online collaborative learning. Learners are expected to make significant progress in their learning process using e-learning (Omar et al., 2011; Smith et al., 2008). E-learning is mainly used to increase flexibility in learning and efficiency and effectiveness. Many studies have considered e-learning their objective (Megahed and Mohammed, 2020; Pham et al., 2019; Ramírez-Correa et al., 2015; Shi et al., 2020). It can be generally argued that e-learning has developed a new paradigm and has provided the possibility of learning in any field for any person at any time and at any place.

In the e-learning environment, learners and teachers are separated from the point of view of time and place. Educational content is provided to learners through course management software, multimedia resources, and video conferencing. Learners interact with teachers, other learners, and other people or resources using computer communication facilities to perform individual and group learning activities.

Companies that allocate more of their dedicated budget for learning and development to e-learning are the most important drivers of e-learning development in the future (Tamm, 2020). The share of the global e-learning market will reach 50 billion dollars in 2026. 90% of companies now use e-learning, which was only 4% in 1995 (Tamm, 2020). The Dow Chemical Company saved \$34 million and reduced training costs from \$95 per human to \$11 by shifting from physical classrooms to e-learning tools (Tamm, 2020).

Japan is one of the world's most successful countries in e-learning. E-learning is used in all Japanese universities and most companies. Most Japanese higher education institutions and companies use e-learning in their educational programs (Wang et al., 2018). Türkiye is one of

the most successful countries in the Middle East in e-learning. The e-learning market in Turkey is expected to reach more than \$200 million by the end of 2023 (Çınar et al., 2021).

Health protocols focused on social distancing as the COVID-19 pandemic spread worldwide (Sajed and Amgain, 2020). In this regard, face-to-face training in schools, universities, and many companies was stopped in most countries, including Iran, to prevent the spread of COVID-19 (Viner et al., 2020). As Microsoft announced, the use of cloud services during the COVID-19 pandemic has grown by more than 700% (Singh, 2020). The COVID-19 pandemic made many companies feel the need to pay attention to the e-learning system. Nevertheless, the literature review shows that most of the studies in the field of e-learning have been conducted in higher education and universities. Instead of a systemic approach, these studies have examined a specific part of e-learning, for example, content or instructor, focusing on a sectorial perspective. Accordingly, the study seeks to identify and prioritize the factors affecting the effectiveness of the e-learning system in a non-academic environment (retail industry). The study questions are as follows:

1. What factors affect the effectiveness of the e-learning system in Hyper Famili chain stores?
2. What are the priority factors affecting the effectiveness of the e-learning system in Hyper Famili chain stores?

2. Literature review

Due to the development of ICT, progress has been made in many fields, such as finance and business, health, and education—E-learning results from the direct integration of education and technology (Al-Farihat et al., 2017). E-learning refers to the instructions digital devices provide for education (Clark & Mayer, 2016). E-learning provides access to educational resources and online learning through ICT (Perrin et al., 2014). E-learning is an information system that can transmit educational content to its audience through audio, video, and text media through e-mail, live chat sessions, discussions, forums, tests, and online assignments (Lee et al., 2011). E-learning at all educational levels enables learners to receive materials more quickly (Lee et al., 2011). Some researchers have mentioned the intervention of ICT in the education process concerning e-learning (Sun et al., 2008).

The educational paradigm has shifted from traditional education to electronic and virtual education. E-learning has many advantages for higher education, universities, companies, students, and learners. Some advantages include no need for physical presence and travel, lower cost, adjustment of learning speed, visual and auditory features, up-to-date content, and

improved learning quality. Learners need access to more learning resources in traditional education. However, various learning resources (text, image, audio, and video) are available to learners through the Internet and e-learning tools in electronic education (Al-Farihat et al., 2020). The development of ICT has caused many changes in various fields, including education. In this way, education and technology have been integrated, and e-learning has emerged as a powerful tool for teaching and learning. E-learning has been developed through various new smart technologies and has greatly affected teaching techniques (Al-Farihat et al., 2020). So, today's main educational paradigm shift is from traditional teacher-centered education to active learner-centered education (Son, 2016). Numerous studies have mentioned various factors such as e-learning content, tools, technologies, teachers, and evaluation processes as factors affecting the effectiveness of e-learning systems (Almaiah et al., 2020; Hammouri and Abu-Shanab, 2018; Kanwal and Rehman, 2017; Motaghian et al., 2013; Islam et al., 2010). Some studies on e-learning and the factors affecting it are given below.

In a study by Eli-Chukwu et al. (2023), the challenges facing e-learning in Nigerian higher education institutions were identified. The findings showed that Nigerian higher education institutions are still unprepared to adopt blended methods. There was no e-learning curriculum in Nigerian universities before the COVID-19 pandemic. Moreover, it was difficult for teachers and learners to adopt e-learning due to the lack of experience in using ICT and insufficient infrastructure to support e-learning. The results also showed that most universities in Nigeria only use traditional teaching methods despite the benefits of blended learning during the COVID-19 pandemic. In a study by Mastan et al. (2022), the models and development process of e-learning (learning management system) were evaluated. They derived e-learning development criteria using a systematic literature review and review of papers from three authoritative scientific databases from 2016 to 2021. E-learning development criteria were platform, evaluation model, evaluation, model, approach, problem, process, and challenge. The researchers suggested that these seven criteria could be used for future e-learning studies. The success of e-learning systems was evaluated by Al-Farihat et al. (2020). The findings indicated that the factors affecting the perceived satisfaction of e-learning were technical system quality, information quality, service quality, support system quality, learner quality, instructor quality, and perceived usefulness. Cidral et al. (2020) investigated the role of students' long-term attitudes towards electronic learning in its success. The study's main objective was to identify the drivers of e-learning success in Brazil. The study model suggested that students' long-term orientation affects the positive relationship between using e-learning systems and perceived net

benefits. The findings showed that the determinants of e-learning user satisfaction are information quality and the use of e-learning systems. In their study, [Parusheva et al. \(2018\)](#) examined the use of social media in higher education institutions. They sought to answer whether higher education institutions, which often operate in social, economic, and legal sciences, use the benefits of social media in learning management systems. The findings indicated that students use discussion forums, chats, and domestic messengers.

In a study by [Ahmadi et al. \(2021\)](#), a model was developed for the e-learning system of Iranian higher education institutions, and a conceptual model was designed at the level of components and indicators. The model had eight components: Knowledge transferability, interaction, teachers' attitude toward students, technical competence, content, attitude towards education, fluid experience, learning results, individual effects, and 28 indicators. According to the results, the highest rank belongs to learning results and individual effects, and the lowest rank belongs to interaction. [Nazari Farrokhi et al. \(2020\)](#) identified and ranked the components of e-learning technology in defense organizations. The findings suggested that attention should be paid to the components of using e-learning technology at Imam Ali Army Officer University.

Additionally, the value of information in the system is essential for users and plays a fundamental role. The information's quality, comprehensiveness, and up-to-dateness should be considered vital. Application software and software efficiency are other important components. Cloud computing technology and its capabilities to improve the quality of teaching and learning were investigated in a study by [Kazem Pourian et al. \(2017\)](#). They introduced cloud computing and its various services, examined its advantages and limitations in e-learning, and proposed solutions to improve the quality of higher education. Finally, the best model for using these services in e-learning and its success factors were presented after examining mobile cloud services in education. A fuzzy expert system to measure e-learner satisfaction was proposed in a study by [Saeed and Azimi Hammat \(2016\)](#). For this purpose, indicators such as learning interactions, feedback, quality, and usefulness of e-learning were extracted to measure learner satisfaction. The level of each indicator in the studied population was determined using fuzzy techniques, and the priority and contribution of each in learner satisfaction was obtained using the Analytic Hierarchy Process (AHP). The database of if-then rules was completed after obtaining these data and expert opinions, and the exact level of satisfaction was determined using Mamdani's fuzzy inference method. The study sample included 70 electronic master's students at Payam Noor University, whose satisfaction level was estimated to be high (equal to 0.75) after implementing the system with MATLAB. [Arasti et al. \(2015\)](#) explained the role of individual, environmental, and system components in the success of entrepreneurship e-

learning at the University of Tehran. According to the results, the factors affecting the success of entrepreneurship e-learning were individual factors, including teacher and student characteristics; environmental factors, including interactions and evaluation; and systemic factors, including the quality of education and content provided, the quality of the internet infrastructure and virtual education system, and the quality of university performance and services. The results of the quantitative analysis showed that the individual factor of student characteristics, the environmental factor of interactions, and the systemic factor of the quality of education and the content provided had the most significant effect on the success of entrepreneurship e-learning at the University of Tehran. [Nazarpoori and Tabarsa \(2014\)](#) investigated the factors affecting the acceptance of the e-learning system based on the technology acceptance model (TAM). They argued that the quality of content and the perception of network extent affect the acceptance of the e-learning system with an indirect effect on the perceived usefulness with an effect size of 0.28 and that the perception of network extent and computer self-efficacy affect the acceptance of e-learning system with an indirect effect on the perception of ease of use with an effect size of 0.20. Besides, learners with self-confidence in using computers believe in their ability to use the e-learning system to receive educational materials and have higher expectations of their abilities to use the system. So, they accept the system as a useful tool for learning.

There are many studies on e-learning. Some studies focus on the perception of e-learning quality, comparing e-learning with face-to-face learning and examining e-learning platforms ([Ali et al., 2021](#); [Natasia et al., 2022](#)). Some studies have discussed the effects of satisfaction with e-learning on learning outcomes and the application of ontology in e-learning recommender systems ([Rahayu et al., 2022](#)).

Studies in Iran have addressed the key drivers of e-learning success, the effect of structural and cultural factors on e-learning, faculty members, and e-learning ([Rajabi and Soltani, 2019](#); [Gelard and Davarzani, 2018](#); [Pourkarimi and Ramezanpour, 2019](#)).

A literature review shows that most previous studies lack a systematic view of e-learning, have a partial view of e-learning, and only highlight specific aspects such as learners, tools, technologies, processes, or teaching methods. They also discuss higher education. This study systematically views e-learning and has been conducted in a context other than higher education. Table 1 shows the most important points related to previous research.

Table 1. Evaluation of previous studies

The main topics discussed	Important studies in this field	Summary of the research	Weakness of research
Studying the challenges of e-learning	Eli-Chukwu et al. (2023)	In these studies, various challenges facing e-learning, especially in higher education, have been considered.	Most of these studies have been conducted in higher education, and other organizations have been less investigated.
Evaluating of e-learning models	Mastan et al. (2022), Ahmadi et al. (2021)	These studies have investigated various types of e-learning models and their advantages and disadvantages in different organizations.	Despite evaluating different models, a method for prioritizing them has not been provided.
Identifying factors affecting the success of e-learning	Al-Farihat et al. (2020), Arasti et al. (2015)	In these studies, various factors affecting the success and effectiveness of e-learning have been considered.	In these studies, only a part of the factors is considered, and there is no systematic view.
Studying the role of new technologies in e-learning	Kazem Pourian et al. (2017)	In these studies, an attempt has been made to investigate the role of using different technologies, such as cloud computing, in e-learning.	Only the effects of some technologies, such as cloud computing, have been investigated in these studies. Technologies such as big data and blockchain in e-learning seem very important. However, these technologies have received less attention in the past.
Studying the satisfaction level of e-learning	Saeed and Azimi Hammat (2016)	In these studies, an attempt has been made to evaluate the level of satisfaction of e-learning learners.	In these studies, satisfaction has been considered only from the point of view of some stakeholders, for example, e-learners.

3. Methodology

The study is conducted to identify and analyze the factors affecting the effectiveness of the e-learning system in Hyper Famili chain stores. For this purpose, fuzzy Delphi and Markus techniques, which are quantitative and use quantitative data for analysis, were used to analyze the data. The fuzzy Delphi technique was used to screen the factors, and the MARCOS technique was used to analyze and rank them. The study has a quantitative and qualitative mixed methodology due to the quantitative methods used. It is also an applied study because of its benefits for education in the retail industry.

The data collection tools were interviews and questionnaires. The factors were extracted by reviewing the literature on organizational learning, e-learning, and e-learning systems. The fuzzy expert and MARCOS priority questionnaires were distributed among the experts to rank the factors. The expert questionnaires were evaluated using the Fuzzy Delphi technique, and the priority questionnaires were evaluated using the MARCOS technique. Both questionnaires were highly valid because the factors were extracted by reviewing authentic international and domestic articles in the fields of e-learning and the effectiveness of the e-learning system and interviewing e-learning experts, managers, and consultants in Hyper famili stores. Moreover, the priority questionnaires were highly reliable due to the appropriate size of the sample (10)

and the screening of the factors. The sample size was 10, which is favorable for expert judgment methods.

Also, the validity of the components of the expert assessment questionnaire was evaluated with two content validity coefficients, i.e., content validity ratio and content validity index. Since the content validity ratio of all factors was higher than 0.62, the research questionnaires had good validity. In addition, the content validity index of all factors was more than 0.79, indicating the reasonable validity of the research questionnaires. The value of the content validity index for the screened factors was above 0.9, which showed that the prioritization questionnaires had more validity than expert questionnaires.

The sample size in expert-oriented research based on multi-criteria decision-making techniques is based on the two critical rules of avoiding inconsistency and theoretical saturation. In these studies, the sample size between 5 and 20 experts is desirable and avoids inconsistency. The appropriate sample size and screening factors made the results more reliable in this research.

The study experts were e-learning managers (named experts) and consultants in Hyper Famili stores. The samples were selected using judgmental sampling based on their expertise in education, e-learning, and e-learning systems.

The study was conducted in three phases. Factors affecting the effectiveness of the e-learning system were extracted in the first phase through a literature review and interviews with managers and consultants. These factors were screened in the next phase using the fuzzy Delphi technique. Finally, the most important factors were identified using the MARCOS technique. The fuzzy Delphi technique was used in the study to screen the factors affecting the effectiveness of the e-learning system. In the fuzzy Delphi technique algorithm, a suitable fuzzy spectrum should be developed first to fuzzify the linguistic variables of the experts to screen the factors. In this regard, common phase spectra could be used. In this study, a five-point Likert scale was used, as shown in Table 2 (Habibi et al., 2015; Zare Bahnamiri et al., 2023):

Table 2. The fuzzy spectrum of the delphi technique

Triangular fuzzy number	Fuzzy value	Linguistic variable
(0, 0, 0.25)	$\tilde{1}$	Very low
(0, 0.25, 0.5)	$\tilde{2}$	Low
(0.25, 0.5, 0.75)	$\tilde{3}$	Moderate
(0.5, 0.75, 1)	$\tilde{4}$	High
(0.75, 1, 1)	$\tilde{5}$	Very high

The MARCOS technique (measurement alternatives and ranking according to compromise solution) is one of the new multi-criteria decision-making techniques introduced by Stanković

et al. (2020). In this study, the MARCOS technique was used to analyze and prioritize the factors affecting the effectiveness of the e-learning system. The experts commented on the importance of each factor on a 10-point scale. The steps of the MARCOS technique are as follows (Stanković et al., 2020; Arabi et al., 2023):

Step 1. Development of the decision matrix: This is the first step in all multi-criteria decision-making methods that aim at prioritization. In the MARCOS technique, m options are evaluated using n criteria. Thus, each option is assigned a score based on each criterion. The experts commented on each factor in this study on a 10-point scale.

Step 2. Determining ideal and anti-ideal alternatives: In this section, the values of ideal and anti-ideal alternatives are obtained based on the equations 1 and 2.

$$AI = \max_i x_{ij} \text{ if } j \in B \text{ and } \min_i x_{ij} \text{ if } j \in C \quad (1)$$

$$AAI = \min_i x_{ij} \text{ if } j \in B \text{ and } \max_i x_{ij} \text{ if } j \in C \quad (2)$$

Step 3. Normalization: In this section, the values of the decision matrix are normalized linearly using the following equations. The normalization method is different for positive and negative indicators (Equations 3 and 4).

$$n_{ij} = \frac{x_{aj}}{x_{ij}} \text{ if } j \in C \quad (3)$$

$$n_{ij} = \frac{x_{ij}}{x_{aj}} \text{ if } j \in B \quad (4)$$

Step 4. Development of the weighted normal matrix: This matrix is extracted by multiplying the normal matrix by the weight of the indicators. In this study, the weight of the experts' opinions was considered the same due to the experts' expertise level closeness.

Step 5. Calculating the degree of utility of the alternatives (here, the factors): This section determines the ideal and anti-ideal utility of the alternatives according to the equations 5 and 6.

$$K_i^+ = \frac{S_i}{S_{ai}} \quad (5)$$

$$K_i^- = \frac{S_i}{S_{aai}} \quad (6)$$

Step 6. Determining the final performance and prioritizing the alternatives: In this section, the optimal performance of each alternative is determined using the equation 7.

$$f(k_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1 - f(K_i^+)}{f(k_i^+)} + \frac{1 - f(K_i^-)}{f(k_i^-)}} \tag{7}$$

4. Findings

The factors affecting the effectiveness of the e-learning system were extracted through an analytical literature review and interviews with e-learning managers and consultants in Hyper Famili chain stores. In this way, 32 factors were obtained, 25 from the literature review and the rest from the interviews. The factors can be seen in Table 3. Studies on employee training and e-learning were reviewed to extract the factors.

Table 3. Factors affecting the effectiveness of the e-learning system

Factors	Sources
The support of the senior managers of Hyper Famili stores	Interviews
The use of competent and expert teachers	Kanwal and Rehman (2017) , Motaghian et al. (2013) , Islam et al. (2010)
The use of multimedia content in education	Ali et al. (2021) , Natasia et al. (2022) , Almaiah et al. (2020)
Methods of evaluating teacher performance	Kanwal and Rehman (2017) , Motaghian et al. (2013) , Islam et al. (2010) , Saeed and Azimi Hammat (2016)
Methods of getting effective feedback	Saeed and Azimi Hammat (2016)
Methods of notifying employees about training courses	Motaghian et al. (2013) , Islam et al. (2010) ,
Effective educational needs assessment methods	Interviews
The curriculum used for employee training	Hammouri and Abu-Shanab (2018) , Kanwal and Rahmen (2017)
Effective tools for e-learning in the company	Hammouri and Abu-Shanab (2018) , Kanwal and Rahmen (2017)
The time of holding training courses	Interviews
The ability of manpower in e-learning and its tools	Megahed and Mohammed (2020) , Pham et al. (2019)
Methods of evaluating learners according to the type of education	Arasti et al. (2015)
The support level of e-learning tools and technologies	Megahed and Mohammed (2020) , Pham et al. (2019) , Ramirez et al. (2015)
The development of providing e-learning through smartphones	Ali et al. (2021) , Natasia et al. (2022) ,
Network security	Interviews
Using appropriate models of e-learning	Mastan et al. (2022) , Cidral et al. (2020)
The existence of suitable infrastructure for e-learning	Eli-Chukwu et al. (2023) , Arasti et al. (2015)
Financing e-learning needs and requirements	Interviews
The extent of using experiences of higher education and companies in holding e-learning courses	Interviews
Supervision of the correct implementation of e-learning courses	Arasti et al. (2015)
The extent of access to online and offline resources by learners	Arasti et al. (2015)
Development of appropriate strategic and operational programs in e-learning	Interviews
Strengthening organizational culture according to new changes	Eli-Chukwu et al. (2023)
Diversity of e-learning models	Rajabi and Soltani (2018) , Gelard and Davarzani (2018) , Pourkarimi and Ramezanpour (2019)
Teaching method suitable for e-learning	Ahmadi et al. (2021)
Teachers' skill with e-learning teaching methods	Al-Farihat et al. (2020)

Factors	Sources
E-learning platforms	Mastan et al. (2022)
Perceived benefits of e-learning	Al-Farihat et al. (2020), Cidral et al. (2020)
Utilizing the capacity of social networks	Parusheva et al. (2018)
The Extent of using application software	Nazari Farrokhi et al. (2020)
Information quality of e-learning system	Nazari Farrokhi et al. (2020)
Ease of using e-learning tools and technologies	Nazarpoori and Tabarsa (2014)

Thirty-two factors extracted from the literature review and interviews with e-learning managers and consultants were screened using the fuzzy Delphi technique. Techniques such as MARCOS are highly sensitive to a large number of factors. In this step, 22 factors were removed from the calculations, and 10 were selected for the final ranking. The MARCOS technique selected those with a diffusion number greater than 0.7 (10 factors) for the final ranking. The number 0.7 was considered the threshold limit for screening factors. The threshold limit is between 0.5 and 0.7 in most studies and 0.7 in this study. The list of factors screened and their diffusion numbers are given in Table 4.

Table 4. The results of applying the fuzzy delphi technique on the factors screened

Factors	Average expert opinions			Defuzzied number
	Lower limit	Middle limit	Upper limit	
The ability of manpower in electronic education and its tools (A)	0.55	0.74	0.83	0.71
The support level of e-learning tools and technologies (B)	0.65	0.74	0.83	0.74
Using appropriate models of e-learning (C)	0.62	0.7	0.83	0.72
The existence of suitable infrastructure for e-learning (D)	0.71	0.83	0.94	0.83
The extent of using experiences of higher education and companies in holding e-learning courses (E)	0.67	0.73	0.85	0.75
The extent of access to online and offline resources by learners (F)	0.57	0.71	0.85	0.71
Development of appropriate strategic and operational programs in e-learning (G)	0.69	0.74	0.95	0.79
Teaching method suitable for e-learning (H)	0.63	0.8	0.85	0.76
Perceived benefits of e-learning (I)	0.75	0.83	0.96	0.85
Ease of using e-learning tools and technologies (J)	0.65	0.86	0.92	0.81

The content validity of the factors affecting the effectiveness of the e-learning system was measured using the content coefficient of the Lawshe model. A 10-member expert panel was formed to measure the content factor. Table 5 shows the minimum acceptable values for content validity coefficients for the number of different panels.

Table 5. Minimum appropriate content coefficients

Minimum acceptable values	The number of experts
0.99	5 to 7
0.78	8
0.75	9
0.62	10
0.59	11
0.56	12
0.54	13
0.51	14
0.49	15
0.42	20

The content factor values of each factor affecting the effectiveness of the e-learning system were calculated based on the equation 8.

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \tag{8}$$

n_e : the number of experts who evaluated the desired factor as necessary

N : the total number of experts

Table 6 shows the content factors of the factors screened.

Table 6. The list of the factors screened

Factors affecting the effectiveness of e-learning system	Definitions	Notation	Sources	Content factors
The ability of manpower in e-learning and its tools	This factor means the skills and expertise of employees regarding different methods and tools of e-learning.	A	Megahed and Mohammed (2020), Pham et al. (2019)	0.68
The support level of e-learning tools and technologies	In case of problems in the e-learning system, experts must fix these errors quickly and continuously.	B	Megahed and Mohammed (2020), Pham et al. (2019), Ramirez et al. (2015)	0.7
Using appropriate models of e-learning	There are different models in the field of e-learning. The model used should be compatible with the target audience, the intended industry, and the intended goals.	C	Mastan et al. (2022), Cidral et al. (2020)	0.71
The existence of suitable infrastructure for e-learning	This factor means the hardware and software infrastructure and required databases.	D	Eli-Chukwu et al. (2023), Arasti et al. (2015)	0.8
The extent of using experiences of higher education and companies in holding e-learning courses (E)	The purpose of this factor is to prepare documented reports about the lessons learned from the experiences of successful companies and universities in the field of e-learning.	E	Interviews	0.74
The extent of access to online and offline resources by learners	For each course, resources should be made available to employees to study the courses more effectively and accurately.	F	Arasti et al. (2015)	0.74
Development of appropriate strategic and operational programs in e-learning	Senior managers and officials in the training field should prepare long-term goals, perspectives, strategies, and a table of	G	Interviews	0.77

Factors affecting the effectiveness of e-learning system	Definitions	Notation	Sources	Content factors
	actions and indicators.			
Teaching method suitable for e-learning	It should be noted that electronic education teaching methods differ from traditional education.	H	Ahmadi et al. (2021)	0.75
Perceived benefits of e-learning	This factor represents the advantages and benefits of e-learning for the organization's performance and employees (in the opinion of the organization's senior managers).	I	Al-Farihat et al. (2020), Cidral et al. (2020)	0.82
Ease of using e-learning tools and technologies	This factor means user-friendliness and ease of learning methods and technologies.	J	Nazarpoori & Tabarsa (2014)	0.79

According to Table 5, the content coefficient of all screened factors for the 10-person panel is above 0.62, which shows the content validity of the screened factors. According to Table 5, the content factor for all screened factors for the 10-member panel is above 0.62, indicating the content validity of the screened factors. In the following, the screened factors were analyzed using the MARCOS technique.

In this section, the factors affecting the effectiveness of the e-learning system are ranked using the MARCOS technique. The decision matrix must first be formed. The experts commented on the importance of each factor on a 10-point scale. The values of the decision matrix were then normalized by the linear method. The weighted normal matrix was then obtained by multiplying the weight of the experts' opinions by the values of the normal matrix. In this study, the weight of the opinions of all experts was considered equal and 0.1 due to the slight difference in knowledge and position of the experts. The values of the weighted normal matrix are shown in Tables 7 and 8.

Table 7. The weighted normal matrix (the first five experts)

Factors	The first expert	The second expert	The third expert	The fourth expert	The fifth expert
A	0.03	0.022	0.044	0.04	0.056
B	0.04	0.056	0.056	0.06	0.067
C	0.03	0.044	0.044	0.05	0.056
D	0.09	0.1	0.089	0.09	0.078
E	0.05	0.044	0.067	0.05	0.056
F	0.04	0.056	0.056	0.06	0.067
G	0.07	0.067	0.067	0.07	0.056
H	0.06	0.056	0.078	0.06	0.056
I	0.1	0.1	0.1	0.1	0.1
J	0.07	0.089	0.1	0.07	0.078
Ideal alternative	0.1	0.1	0.1	0.1	0.1
Anti-ideal alternative	0.03	0.022	0.044	0.04	0.056

The values of the weighted normal matrix for the following five experts are given in Table 8. The results are given in two separate tables due to the high volume of calculations.

Table 8. The weighted normal matrix (the next five experts)

Factors	The sixth expert	The seventh expert	The eighth expert	The ninth expert	The tenth expert
A	0.04	0.03	0.033	0.02	0.02
B	0.05	0.04	0.033	0.03	0.04
C	0.05	0.06	0.044	0.03	0.04
D	0.07	0.08	0.1	0.09	0.08
E	0.07	0.06	0.056	0.06	0.05
F	0.08	0.07	0.044	0.03	0.04
G	0.07	0.08	0.078	0.07	0.07
H	0.07	0.07	0.089	0.05	0.06
I	0.1	0.1	0.1	0.1	0.1
J	0.08	0.08	0.1	0.07	0.06
Ideal alternative	0.1	0.1	0.1	0.1	0.1
Anti-ideal alternative	0.04	0.03	0.033	0.02	0.02

The four indices of the MARCOS technique, including K_i^+ , K_i^- , $f(K_i^+)$, and $f(K_i^-)$, which are used for the final evaluation and analysis of the factors, were then obtained according to the weighted normal matrix data. The final scores of the factors can be seen in Table 9, which is the criterion for prioritization and final analysis.

Table 9. The final score of the factors affecting the effectiveness of the e-learning system

Factors	K_i^+	K_i^-	$f(K_i^+)$	$f(K_i^-)$	Final score	Ranking
A	0.335	1	0.74906	0.25094	0.309	10
B	0.472	1.409	0.74907	0.25093	0.435	8
C	0.448	1.337	0.74902	0.25098	0.413	9
D	0.868	2.588	0.74906	0.25094	0.8	2
E	0.563	1.682	0.74911	0.25089	0.519	6
F	0.543	1.621	0.74908	0.25092	0.501	7
G	0.698	2.084	0.7491	0.2509	0.644	4
H	0.649	1.937	0.74903	0.25097	0.599	5
I	1	2.985	0.74906	0.25094	0.922	1
J	0.798	2.379	0.74906	0.25094	0.735	3

As seen in Table 9, the perceived benefits of e-learning, the existence of suitable e-learning infrastructure, the ease of using e-learning tools and technologies, the development of appropriate strategic and operational plans in e-learning, and the teaching method suitable for e-learning have the highest priority, respectively. The Discussion and Conclusion section provides practical recommendations based on the priority factors. A seven-member panel interviewed the focus groups to strengthen the practical recommendations.

5. Managerial insights

The perceived benefits of e-learning can be said that the more senior managers of the organization understand and are aware of these concrete advantages and benefits, the more possible the use of these technologies will be. This study requires designing tools to measure

the benefits of this training for the organization, its processes, and performance.

Another problem for organizations implementing e-learning is the lack of required infrastructure. In this case, cooperation with reliable companies that support e-learning and using the experiences of universities can help organizations a lot. Without proper infrastructure, the e-learning system will be vulnerable.

Regarding strategic and operational plans, the organization's actions regarding e-learning will be scattered and inconsistent. In this case, cooperatively developing long-term and short-term goals, measures, and performance indicators will help the development of e-learning.

Another challenge for organizations in e-learning is not using appropriate models. Using traditional models in this system is incompatible with the e-learning goals and will cause dissatisfaction among learners.

6. Discussion and conclusion

This study aims to provide a framework for identifying and analyzing factors affecting the effectiveness of the e-learning system. For this purpose, 32 factors were extracted first through a literature review. Five e-learning experts at Hyper Famili stores were interviewed to strengthen the target list, and seven items were added. The distribution of expert questionnaires and the fuzzy Delphi technique screened the factors. Twenty-two factors with a defuzzified number less than 0.7 were excluded from the analysis. Ten selected factors were investigated by distributing priority questionnaires and the MARCOS technique. According to the calculations of the MARCOS technique, the perceived benefits of e-learning, the existence of suitable e-learning infrastructure, the ease of using e-learning tools and technologies, the development of appropriate strategic and operational plans in e-learning, and the teaching method suitable for e-learning have the highest priority, respectively.

This study differs from previous studies in two points. The first is its systematic approach to various factors involved in the effectiveness of e-learning. This study is not limited to a specific field or factor such as technology. The second is its focus on e-learning in a field other than higher education. Most of the studies on e-learning have been conducted in universities and higher education institutions.

For example, some studies have focused on system infrastructure. Some researchers have examined different models and methods of e-learning. There are other research studies for which the role of lesson plans and teachers has been important. Most of these research studies lack a systematic approach. In these studies, higher education and universities are mainly

considered, while there are many differences between the academic environment and economic enterprises.

The practical recommendations in the study are presented based on the priority factors, the first being the perceived benefits of e-learning. This factor is mentioned in the studies by Al-Farihat et al. (2020) and Cidral et al. (2020). Managers can adequately understand the benefits of implementing e-learning in the company by holding workshops and briefing classes on the advantages, disadvantages, challenges, and applications of e-learning. The content should be presented objectively and concretely based on statistics and figures and considering successful experiences in competing companies.

The lack of suitable infrastructure for e-learning is one of the main problems many companies operating in this field face. Some solutions for improving the infrastructure are considering the budget for providing the necessary hardware and software equipment, collaborating with some companies to hold joint training courses, and using the training services of some companies that provide e-learning services. This factor is focused on previous studies such as those by [Eli-Chukwu et al. \(2023\)](#) and [Arasti et al. \(2015\)](#).

The third factor is the ease of using e-learning tools and technologies. Fear of change and stress caused by new tools and technologies is one of the important obstacles to the development of e-learning in Iranian companies and businesses. New tools and technologies can be simplified by using teachers with high skills in e-learning, simple and effective course outlines, eliminating extra processes and activities, and using simple and practical software and applications. This factor is confirmed in the study by [Nazarpoori and Tabarsa \(2014\)](#).

The fourth factor is the development of appropriate strategic and operational plans for e-learning. The company's upstream documents cannot be indifferent to new technologies. The company's strategic plan should not be developed with a present-day approach but based on future trends and changes. Using the strategic foresight model in the company allows the consideration of future risks and drivers in various fields, especially training and learning, contributing to the effective training of employees. Metaverse, for example, is one of the new technologies that will completely transform corporate training. This factor was extracted from the interviews.

The last factor is the use of a teaching method suitable for e-learning. One of the reasons for the failure of e-learning systems in companies is the use of traditional methods in education. The teaching method can be improved by using teachers with high skills in e-learning, preparing a course outline suitable for e-learning, using new tools and technologies in education, paying

attention to new e-learning models, getting employee feedback, and evaluating teachers. This factor was confirmed by [Ahmadi et al. \(2021\)](#).

Recommendations include the future study of e-learning in the retail industry and the development of e-learning strategies. From a methodological point of view, scenarios for the future of e-learning in the retail industry should be designed with a systems dynamics approach.

Disclosure statement

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