Measuring Teachers' Readiness for E-learning

In Higher Education Institutions associated with the Subject of Electricity in Turkey

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Abstract—**Implementing e-learning in higher education institutions (HEIs) is influenced by various barriers and drivers. The majority of barriers are related to the challenging issue concerning the integration of e-learning into universities. Hence, it is deemed relevant to understand whether different stakeholders in HEIs tend to embrace or ostracize e-learning for their work. This study investigates the extent to which the HEIs associated with the science of electricity in Turkey are ready for e-learning. It also examines two factors that presumably affect the perceptions of academic staff on e-learning: first, the degree to which teachers believe that e-learning would be free of effort and would enhance their teaching; second, whether teachers need training on e-learning before embarking on it. To address these issues, a web-based survey was distributed to 417 programs in 360 HEIs in Turkey. More than 1206 active academic staff were invited to participate in the survey with 289 answering all the questions and 53 some of them. Descriptive and inferential statistics were computed. Overall, the findings indicate that the academic staff in the HEI associated with the subject of electricity in Turkey generally show positive experiences, confidences and attitudes towards e-learning. In spite of the fact that their readiness seems to be sufficient, their attitudes towards e-learning must be strengthened in order to facilitate effective adoption of e-learning.**

Keywords-component; e-learning; readiness for e-learning; electricity; higher education institutions

I. INTRODUCTION

Information and communication technologies (ICT) concern any device or application (e.g. the Internet, television, radio and computers) for communicating, storing, creating, disseminating and managing information electronically [18]. ICT are considered as a potential accelerator for social and economic advancements as they contribute to the transformation of universities and societies, especially in developing countries in a positive way [22]. Today, ICT offer a whole new dimension to learning, namely e-learning. E-learning is defined as "*to use multimedia technologies and the Internet to improve the quality of learning by facilitating access to facilities and services as well as remote exchanges and collaboration*" [12]. The number of studies aiming to find out how to implement e-learning in higher education institutions (HEIs) and organizations is ever increasing. There are a number of advantages of e-learning, which transcends time and location constraints, increases learner motivation, simplifies the acquisition of basic skills, and enhances teacher training in a cost-effective way [13, 27]. Additionally, e-learning is seen as a good solution for dealing with fast-changing knowledge, reducing carbon footprint, and saving natural resources [2].

However, e-learning may not have the same effect for every individual, institution, organization or country. The actual benefit of e-learning in education may not reach the expected level because the effectiveness of e-learning depends on the aim of usage and the way e-learning is used [18]. This indicates that the integration of e-learning into the current practice in HEIs is a challenging issue as it involves different stakeholders such as policymakers, educators, researchers, education administrators, learners, etc. The lack of research on the user side of information systems is partly responsible for the underutilization of information systems in developing countries [22]. The readiness of stakeholders for e-learning should be taken into consideration to ensure some success of e-learning. Readiness for e-learning is defined as the ability of an organisation to take advantage of e-learning [20]. Besides, it is the mental and physical preparedness of users to gain some e-learning experience or action [8]. Furthermore, using ICT for implementing and accommodating learning strategies successfully is highly associated with assessing readiness for e-learning to discover local needs [16].

Hence, it is deemed relevant to understand whether different stakeholders in HEIs tend to embrace or ostracize e-learning for their respective work. In this regard, the goal of this study is three-fold. First, we aim to understand the factors that affect the readiness of the institutions associated with the science of electricity (e.g. electric and electronics engineering) in Turkey and how people in those institutions are ready for e-learning. Second, based on the recent Technology Acceptance Model (TAM3) [11 & 26], we investigate the degree to which teachers believe that e-learning would be free of effort and would enhance their teaching. Third, we focus on the degree to which people in those institutions need training for e-learning before embarking on it.

II. LITERATURE REVIEW

Integrating e-learning into education and training has been considered as an essential approach by the European Union to transform Europe into the most competitive and dynamic knowledge-based economy in the world [21]. A number of countries have developed their own strategies to implement e-learning for the higher education sector which aim to meet needs for lifelong learning [21]. Nonetheless, there is still a growing need to find out how to integrate e-learning into organizations, especially in HEIs. The interest in implementing e-learning has been influenced by various drivers and barriers. The majority of drivers can be classified as enhancing

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reputation, developing information skills, widening access, supporting disabled students, improving quality of teaching and learning, increasing flexibility, reducing cost, and improving cost-effectiveness [21]. E-learning may help save the planet by reducing the amount of CO_2 emissions and energy use engendered by individuals' activities on campuses [2]. Conversely, barriers are the challenging issues concerning the integration of e-learning into the current practice of universities. Information systems in developing countries are not used as much as they should have been due to the lack of research studies that focus on factors influencing their adoption by users [22]. Hence, there is a strong implication for the need to help HEIs implement e-learning to utilize its advantages effectively. The initial step is to assess readiness for e-learning from the organizational as well as individual perspectives. Upon the confirmation of readiness for e-learning, the actual implementation may then be undertaken. This may mitigate the misuse or underuse of e-learning or prevent universities from wasting resources. Investigating the extent to which an organization is ready for e-learning helps to set up strategies for e-learning and to implement its goals in an effective way [17].

Several models have been designed (e.g. [3], [7], [9]) to assess individuals' or organizations' readiness for e-learning, which have been mainly developed for commercial organizations rather than HEIs. These authors highlight that it is necessary to adopt e-learning with careful planning to prevent failure [5]. Our current model (Figure 1) is designed in a similar way, because these existing models consider views, needs and experiences of different stakeholders such as policy-makers, administrators, lecturers and learners. Chapnick, in his often cited model for assessing e-learning readiness [9], identifies a list of 66 main factors that influence individuals' readiness, which are classified as psychological, sociological, environmental, financial, human resource, equipment and content readiness. In addition, a model similar to Chapnick's was developed by Haney [15] where she suggests 70 factors under seven categories. These and the other models guide commercial organizations rather than educational organizations to justify whether they are ready for e-learning. However, Kaur and Abbas [17] criticize that those models do not fully fit the higher education sector and developed another model applicable for HEIs by considering eight dimensions: learner, management, personnel, content, technical, environmental, cultural, and financial readiness. In spite of the fact that there are many models to assess individuals' or organizations' readiness for e-learning, every system, be it a commercial organization or an academic institution, should have its own way of measuring readiness for e-learning or any innovation [23]. Aydın and Taşçı [5] also add that a standard model for measuring e-learning readiness may not work for other countries. Hence, it is necessary and important to develop a model with factors influencing the e-learning readiness of HEIs associated with the subject of electricity in Turkey.

III. A MODEL FOR MEASURING READINESS

E-learning readiness is defined not only in terms of attributes pertaining to an organization but also those to individuals. Hence, there is a need to generate a model for assessing individuals' readiness for e-learning. Specifically, the factors that we intended to measure were identified after detailed analyses of the existing e-learning readiness models combined with the cultural and environmental characteristics of the institutions associated with the science of electricity in Turkey. Integrating these concepts resulted in the model presented in Figure 1: *Readiness*, *Acceptance* and *Training* for E-learning.

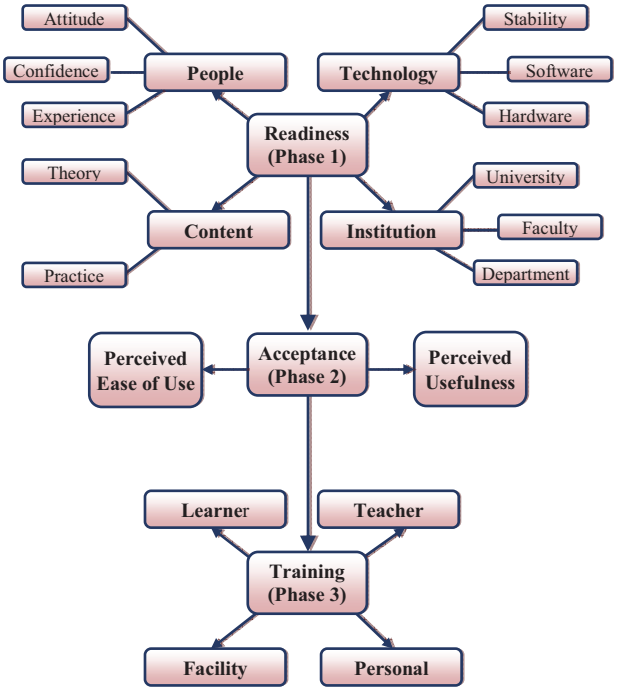

Figure 1: A model for measuring readiness for e-learning

A. Readiness for E-learning

The eight-dimension model of Kaur and Abas [17] as described earlier is generic and seems applicable to any type of HEI. We have adapted their model because our study aims to measure e-learning readiness in Turkey focusing on the subject of electricity. As a result, four main factors, which are assumed to support the institutions associated with the subject of electricity in Turkey and thus can be used for indicating their readiness for e-learning, have been identified: technology, content, institution and people. In addition, each of these four main factors subsumes a set of sub-factors. Each sub-factor should be taken into consideration as much as possible during the assessment process. For instance, the stability of the internet connectivity, which is a sub-factor of technology, is essential for e-learning readiness; the lack of such a sub-factor and others will result in failure.

1) Technology

Technology is the fundamental factor because e-learning, apart from other critical elements, is essentially based on computer and internet. Rogers [23] describes the readiness of technology in terms of two components, namely hardware and software. Hardware refers to physical components whereas software is the information aspect of technology [5]. The availability of both of them should be investigated for our study because we aim at implementing e-learning by using an

open-source web-based virtual learning environment (VLE). This requires having access to the Internet with a PC or laptop as hardware and a web browser such as Internet Explorer or Firefox as software. This motivates us to investigate the access to the Internet at home and at university because e-learning transcends the temporal and location constraints. Furthermore, it is also important to find out the ease and flexibility of such an access. For this purpose, we are interested in finding out how individuals are connecting to the Internet at home, for example, broadband or dialup and at university, for example wired or wireless. This is investigated under the sub-factor of technology. An easy and flexible access to the Internet is also associated with the downloading and uploading speeds. While it may not possible to find out these speeds by posing the related questions to our target group, it is possible as well as relevant to investigate to what extent they are satisfied with their internet connection at university and at home.

2) People

People are referred to as another significant component of measuring readiness as e-learning is implemented by people. The factor *people* deals with the characteristics of individuals in HEIs. It is obvious that the more skilled people working at institutions the more likely they can have a successful e-learning implementation. It is hence deemed relevant to find out about individuals' self-reported competence, experience, confidence and anticipation for deploying various ICT for different purposes. Relevant skills, experiences, confidence levels, and attitudes of the people concerned, namely researchers, lecturers, administrators and strategists towards e-learning may have an effect on the integration of e-learning. The readiness of individuals in those institutions is analyzed by considering their own experiences and confidences in the use of various ICT and their attitudes towards e-learning. The users' adoption of an innovation is highly associated with their usage of other functionally similar technologies [22]. Besides, a system usage is significantly affected by previous experiences of other systems [14]. As the internet usage is affected by the computer usage [19], they are also significant factors that affect the e-learning adoption. Furthermore, the existing work on e-learning readiness (e.g. [4], [5], [20] & [25]) tends to investigate the skills and confidence of individuals for the particular usages of ICT. For instance, a person who searches for information about something for 10 hours may not be more skilful than a person who searches for the same thing for only three hours in case he is aware of a key word system. For this reason, individuals' confidence for any particular ICT usage should be used to determine the level of readiness for e-learning, because there is generally a linear relationship between internet/software skills and confidence regarding e-learning [1]. Besides, the pessimistic or optimistic opinions or beliefs of individuals about e-learning are considered relevant. The actions that individuals take are assumed to be greatly influenced by their expectations regarding the likely consequences of those actions [24]. Scheir and Carver [24] also emphasize that those individuals who have optimistic beliefs about something continue to work towards the desired outcome even their progresses are slow, and they strive for it. This motivates us to find out whether positive attitudes towards e-learning can be a significant factor that influences the readiness for e-learning. In summary, this research investigates the readiness of individuals for e-learning with respect to three aspects: experience, confidence and attitude.

3) Content

Content is associated with the availability of existing content, its format, levels of interactivity, reusability, and interoperability [20]. However, it is almost impossible for us to instantiate all these aspects because the curriculum currently applied in the HEIs associated with the subject of electricity is massive. Hence, we address the appropriateness of e-learning for enhancing the quality of learning and teaching electricity at a broad – theoretical and practical - rather than a fine-grained level. .

4) Institution

Institution is an environment which can be instantiated as a university with its faculties and departments [10]. It should support e-learning by offering a good infrastructure, a supportive culture, incentives, models and resources. By investigating the current strategy and curriculum of institutions as well as their facilities and personnel, it can be somewhat easy to justify their appropriateness for e-learning.

B. Acceptance for E-learning

This part aims to understand the degree to which a teacher believes that e-learning would be free of effort and enhance his or her teaching. As there is a high rate of failure of ICT initiatives for the creation of development opportunities, a solid understanding of the determinants of user acceptance of particular ICT is crucial not only for theory building but also for effective practice [22]. A number of studies aim to understand the process of user acceptance of new initiatives. The often cited related work is Technology Acceptance Model (TAM), which was introduced by Davis [11] to measure the perceptions of users of new ICT in terms of two constructs: perceived usefulness and perceived ease of use. TAM is still valuable for understanding the determinants of individuals' adoption and use of ICT, whereas Venkatesh & Bala [26] identified more relevant factors and thus augmented the related model to become TAM3. Nonetheless, in our study, we adhere to the original TAM, highlighting the significant role of perceived usefulness and perceived ease of use in determining the acceptance for e-learning (Figure 1). We elaborate the two constructs subsequently.

1) Perceived Usefulness

The perceived usefulness is defined as the extent to which a user believes using a system can support the attainment of his specific goal or need. According to Davis [11], the tendency that individuals adopt or not adopt an innovation is dependent on their belief whether it will help them perform their work better. He developed fourteen items to measure the perceived usefulness of a system and found that there was a positively significant relationship between the usage of a system and the user's perceived usefulness of the system. The majority of

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these fourteen items were directly generated to measure the extent to which a system can enhance the performance of users. The rationale why Davis used more than one item to measure perceived usefulness in terms of user performance because he wanted to reduce the extraneous effects of individual items as different individuals may assign different meanings to particular items. Generally speaking, the multi-item approach is to ensure the reliability of a questionnaire. Nonetheless, in the recent TAM3 [26], four instead of 14 items on perceived usefulness are used without compromising the reliability. Hence, we have adopted the parsimonious approach for our own study, given that a long questionnaire will demotivate respondents to complete it.

2) Perceived Ease of Use

The perceived ease of use is defined as the extent to which the user believes that using a particular ICT, e-learning in our case, would be free of effort. Davis [11] says that individuals may believe the usefulness of a given innovation, but they may find it difficult to use; the potential benefits of the application are then outweighed by the effort of using it. Similarly, instead of using Davis's [11] fourteen items, we adopted as well as adapted the TAM3 approach to use two items to evaluate this construct.

C. Training for E-learning

In addition to understand how people in the institutions tend to accept or reject e-learning, it is also deemed relevant to evaluate whether the people in the institution need training for e-learning before embarking on it. Training for e-learning is important for e-learning readiness and it should be considered in the process of implementation of e-learning [1].

IV. METHODOLOGY

A. Questionnaire Design

Based on the assumption that a web-based survey can effectively and efficiently reach widely distributed respondents, we have developed an eight-section one to assess the extent to which the institutions are ready for e-learning based on the literature and our model of readiness for e-learning (Figure 1). The first section consisted of several items to gather data regarding demographic characteristics of the participants such as age, gender and the role of individuals in the institutions. Section 2, 3, 4, 5 and 6 of the questionnaire were designed to measure how the institutions are ready for e-learning by considering four major components and sub-factors: technology, people, content and institution (cf. Figure 1; Section III). Section 7 of the questionnaire was designed to understand the degree to which teachers believe that e-learning would be free of effort and enhance their teaching. Section 8 was designed to evaluate whether the participants in the institutions need training for e-learning before embarking on it. Besides, in some of the sections, a free format text box is provided for the respondents to enter comments on the issues addressed. Finally, the participants were invited to be interviewed to discuss current issues of education and training in HEIs and explore how e-learning should be implemented.

B. Sampling of Participants

417 programs in HEIs in 113 of 165 universities in Turkey were selected for the study. The participating institutions were determined by considering whether they were associated with the subject of electricity such as electrical and electronics engineering according to the official data in 2010 provided by the ÖSYM, which stands for the Student Selection and Placement Centre in Turkey. The number of universities is categorized into public (n=102) and private (n=63). The number and percentage of the programs in the HEIs associated with the science of electricity in 113 universities in Turkey are shown in Table 1. Administrators, strategists, lecturers and researchers in those institutions were chosen as respondents who can provide data regarding their institutions' readiness for e-learning. A personalised invitation and reminders to participate in the web-based questionnaire was e- mailed to each of them.

TABLE 1: HEIS ASSOCIATED WITH THE SUBJECT OF ELECTRICITY IN TURKEY

Institutions	n	%
Aircraft Electrics and Electronics	3	0.7
Avionics	1	0.2
Electrical and Electronics Engineering (Theory-Based)	140	33.6
Electrical and Electronics Engineering (Practice-Based)	8	1.9
Electrical Education	10	2.4
Energy Generation, Transmission and Distribution	7	1.7
Electrical Appliance Technology	10	2.4
Electrical Engineering	6	1.4
Electricity	230	55.2
Rail Systems Electric and Electronics Technology	2	0.5
Total:	417	100.0

C. Assessment Method

The majority of the items in the questionnaire were evaluated with a five-point Likert-scale with the leftmost and rightmost anchors being "Strongly Disagree" and "Strongly Agree" respectively. However, given the relatively short history of e-learning in Turkey, a new option "Not applicable / don't know" was also included. For some items, alternative descriptors were presented: "Not at all", "A bit", "Medium", "High" and "Very high". These alternatives were ordered in a way that responses could easily be coded into a five-point Likert type where 1 indicates the lowest readiness while 5 the highest. As the alternatives were coded as 1, 2, 3, 4 and 5 in a five-point Likert-type scale, Aydın and Taşcı [5] suggest that the mean score of 3.40 can be identified as the expected level of readiness with the items being able to show higher and lower levels of readiness for e-learning. They determined the mean score over 3.40 as the expected level of readiness because the five point scale includes 4 intervals and 5 categories, and the ratio 4 intervals / 5 categories is 0.8 (Figure 2). The assessment model developed by Aydın and Taşcı is used through the paper to indicate whether the institutions are ready for e-learning in an adequate way.

D. Items

There are altogether 41 items in the questionnaire which gauge respondents' self-reported perceptions on different

aspects of e-learning. Specifically, the three Phases depicted in Figure 1 correspond to the three parts of the questionnaire. A list of the items is shown in Table 2.

TABLE 2: LIST OF ITEMS OF THE E-READINESS SURVEY

Item Identifier and Content	
Phase/Part 1: Readiness for E-learning	
I1	Do you have access to the Internet at home?
I2	What type of Internet connection do you have at home?
I3	Do you have access to the Internet at your university?
I4	What type of Internet connection do you have at university?
I5	I am satisfied with my university network.
I6	I use the Internet as information source.
I7	I use e-mail as the main communication tool.
I8	I use office software for content delivery and demonstration.
I9	I use social network sites (e.g. Facebook or Orkut).
I10	I use electrical software (e.g. AutoCAD or Matlab).
I11	I use instant messaging (e.g. MSN, Yahoo).
I12	I use computers confidently
I13	I use web browsers (e.g. Internet Explorer, Google Chrome) confidently.
I14	I use search engines (e.g. Google, MSN Search) confidently.
I15	I use digital file management tools confidently.
I16	I use tools to create learning materials confidently.
I17	I have information about what e-learning is.
I18	I have enough ICT competencies to prepare e-learning materials.
I19	I feel that I am ready to integrate e-learning in my teaching.
I20	I have enough time to prepare e-learning materials.
I21	I believe my students will like e-learning.
I22	The top-level administration understands what e-learning is.
I23	The top-level administration supports the use of e-learning.
I24	E-learning is applied in my department (I24), in my faculty (I25) and at my university (I26)?
I25	
I26	
I27	E-learning can enhance the theoretical part of the subject electricity
I28	E-learning can enhance the practical part of the subject electricity.
I29	E-learning can be applied to the theoretical part of the subject electricity.
I30	E-learning can be applied to the practical part of the subject electricity.
Phase / Part 2: Acceptance for E-learning	
I31	E-learning can improve the quality of your teaching.
I32	I believe that using e-learning can increase my productivity.
I33	I believe that e-learning is useful for my research.
I34	E-learning enables me to accomplish my teaching more effectively than the traditional classroom-based approach.
I35	It is easy for me to use e-learning tools (e.g. (VLE).
I36	I believe that my students find it easy to use VLE.
Phase / Part 3: Training for E-learning	
I37	I do not need training on e-learning.
I38	My students do not need training on e-learning.
I39	Technical and administrative personals do not need training.
I40	The facilities of university are sufficient for e-learning.
I41	To what extent do you support the integration of e-learning in your department/program if your institution seems to be ready for e-learning?

E. Procedure

With the survey questionnaire ready, we used the open-source Lime-Survey to convert the questionnaire into the web-based format. We successfully sent invitations via email on 16th March 2010 to 1206 people, including lecturers, administrators, strategists and researchers in HEIs associated with the science of electricity in Turkey to participate in the online survey. Until 16th May 2010, 342 individuals responded to the survey; 289 of them fully completed the survey and 53 only partially. No incentive was offered to the respondents whose participation was entirely voluntary. The responses of only 289 participants are analyzed for this paper.

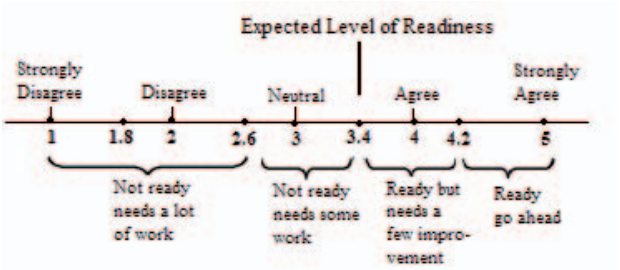

Figure 2: An Assessment model for measuring readiness adapted from [5]

F. Research Group

The study revealed that the majority of the participants are male (85.1%). The age groups of the respondents are categorized as follows: 3.8% under 24, 36.3% between 25 and 34, 38.4% between 35 and 44, 16.6% between 45 and 55 and 4.8% over 55. This indicates that more than 90% of the participants are between 25 and 55 years old. Another criterion to categorise the participants is type of affiliation: 90.7% of the respondents are currently working in public universities across Turkey and the others are in private ones. Besides, the participants are also classified according to their roles: 38.4% teachers, 36.3% researchers, 4.8% administrators and 20.4% strategists. Furthermore, 22.1% of teachers are currently registered in the institutions that take 2 academic years to attain an associate degree while 77.9% are working in institutions offering 4-year Bachelor's degree programmes. Table 3 indicates the distribution of the participants according to their regions and institutions.

TABLE3: REGIONAL AND INSTITUTIONAL DISTRIBUTION

Regions	N	%
Black Sea	30	10.4
Central Anatolia	84	29.1
East Anatolia	31	10.7
Aegean	29	10.0
Marmara	85	29.4
Mediterranean	17	5.9
South Eastern Anatolia	13	4.5
Institutions	**N**	**Percent**
Aircraft Electric and Electronics	6	2.1
Avionics	1	0.3
Electrical and Electronic Engineering	161	55.7
Electrical Education	32	11.1
Electrical Engineering	25	8.7
Electricity	61	21.1
Energy Generation Transmission and Distribution	2	0.7
Rail Systems Electrical and Electronic Technology	1	0.3
Total	**289**	**100.00**

N= Number %: Percentage of the respondents for each region and institution

V. RESULTS AND DISCUSSION

This section is divided into two parts: The first part reports the descriptive statistics among items in the study whereas the second part compares the mean scores of variables such as the gender and age of the respondents to find out whether there were significant differences with respect to these variables.

A. Descriptive Statistics

The number, mean, and standard deviation of the scores of the majority of the items in the study are presented in the

Table 4. The descriptive analyses of the items I1-I4 and I24-I26 are explained separately as they are based on yes-no questions. The results of the descriptive statistics of the respective items are presented into three parts corresponding to the three phases depicted in Figure 1. The first part presents the results that indicate whether the participants were ready for e-learning. The second part reveals the results of those items that were designed to measure whether the respondents accepted or rejected e-learning for their respective work, and the final part reports the potential needs for training on e-learning.

TABLE 4: NUMBER, MEAN AND STANDARD DEVIATION OF ITEMS

Item	N	M	S.D	Item	N	M	S.D
1-4*	289	-	-	22	261	**3.29**	0.968
5	289	**3.37**	0.984	23	254	3.54	0.913
6	287	4.64	0.627	24-26*	289	-	-
7	289	4.52	0.791	27	285	3.82	0.938
8	285	4.45	0.832	28	285	**3.31**	1.160
9	284	**2.94**	1.393	29	285	3.98	0.882
10	288	4.41	0.887	30	285	**3.08**	1.171
11	287	**3.38**	1.358	31	282	3.63	0.943
12	289	4.51	0.678	32	280	3.68	0.875
13	288	4.47	0.672	33	279	3.67	0.967
14	289	4.51	0.667	34	282	**3.24**	1.064
15	273	4.05	0.908	35	282	3.78	0.728
16	274	3.83	0.961	36	281	3.80	0.703
17	274	3.72	0.941	37	284	**2.61**	1.005
18	279	3.72	0.997	38	287	**2.14**	0.810
19	278	3.73	0.935	39	273	**2.00**	0.836
20	281	**2.79**	0.999	40	279	**3.32**	1.077
21	275	3.65	0.971	41	289	**3.25**	1.048

N: Number; **S.D:** Standard Deviation; **M:** Mean;
*Items with binary answers (I1-4 and I24-26) have no values in M or SD

1) Results in Readiness for E-learning

a) Findings in the Factor Technology

For the ***technology*** sub-factors, the participants were asked about their ownership of hardware and software at home and at university, because e-learning is facilitated by the access to the Internet and a computer. All the participants reported that they have access to the Internet at university whereas only 88.2% of them at home, as shown in Table 5.

TABLE 5: ACCESS TO THE INTERNET

Item	N	%	n	%
	Home		University	
Yes	255	88.2	289	100.0
No	34	11.8	0	00.0

N: Number; %: Percentage

In order to find out how the participants access the Internet both at home and at university, they were also surveyed for the way they usually do so: whether they connect to it using a broadband or dial-up at home or using wireless or wired at university. As shown in Table 6, 90.6% of the respondents, use broadband at home whereas at university 66.8% of the participants have access to both wired and wireless connection, 30.8 % with only wired and 2.4% with only wireless.

TABLE 6: TYPES OF THE INTERNET CONNECTION

Item	N	%	Item	N	%
Home			University		
Broadband	231	90.6	Wireless	7	2.4
Dialup	13	5.1	Wired	89	30.8
3G	7	2.7	Both	193	66.8
LAN	4	1.6			
Total	255	100.0	Total	289	100.0

N: Number; **%:** Percentage

For the sub-factor ***stability*** (i.e. Item I5), the participants were asked to what extent they are satisfied with the university network. The mean score of the respondents' answers for item 4 in Table 4 indicates that the stability of the internet at university is not sufficient. According to the views of the participants, the mean score of their responses is under the expected readiness level for e-learning ($M=3.37 < M_0=3.40$).

b) Findings in the Factor People

For the sub-factor ***experience*** (i.e. items I6 to I11 in Table 2), Table 4 illustrates the mean score of the participants' experiences in the usage of different ICT for their work. From the table, it can be observed that the mean scores of the items 6, 7, 8 and 10 are higher than the expected level of readiness ($M_0=3.40$) whereas those of the items 9 and 11 are not. Based on these results, it can be inferred that the experiences of the participants in ICT usage are mostly sufficient for e-learning, although their experiences of using social network sites and instant messaging for synchronous communication are under the expected level.

For the sub-factor ***confidence*** (i.e. items I12 to I16 in Table 2), Table 4 displays mean scores for the questions associated with the confidence in ICT usage. The results show that the participants in those institutions have sufficient level of confidence in using particular ICT. All items related to the sub-factor confidence are higher than the expected level of readiness, revealing that the participants are confident in using computers, web browsers, search engines, digital file management tools and authoring tools to create learning materials.

For the sub-factor ***attitude*** (i.e. items I17 to I23 in Table 2), the perceptions of the participants towards e-learning are indicated in Table 4. Its mean score, although overall higher than the expected readiness level, was lower than the sub-factors experience and confidence. As can be seen from Table 4, except item 20 and 22, the mean scores of all the items were higher than the expected readiness level. These findings seem to imply that the participants have information regarding e-learning; they feel that they are ready for e-learning and have sufficient competence and they feel their managers' support for e-learning. However, the respondents are afraid that they may not have time to prepare for e-learning materials. Furthermore, although their managers will support the integration of e-learning, they may lack the information regarding e-learning.

c) Findings in the Factor Content

For the sub-factors ***theory*** and ***practice*** (i.e. items I27 to I30 in Table 2), the participants were asked to what extent they agree

that e-learning can enhance the quality of the theoretical and practical parts of the subject of electricity and can be applied to those parts. Table 4 shows that the participants believe that e-learning can enhance the quality of theoretical parts of the subject electricity. However, their mean scores indicate that e-learning may not be applicable for the practical parts of the subject electricity because the items I28 and I30 are under the expected readiness level. It is also interesting to note here that their belief that e-learning can enhance the practical part of the subject of electricity is stronger than their belief that e-learning can be applied to that part. This implies that the participants consider that e-learning can be integrated into theory to enhance the quality of the courses on electrical engineering but not in practice.

d) Findings in the Factor Institution

The participants were also investigated for the fact whether e-learning is currently implemented in their university in terms of three units: their own departments, other departments and their university as shown in the Table 7. It shows that 28.04% of the institutions associated with the science of electricity currently implement e-learning officially or with the personal efforts of the teachers. Besides, it seems that the almost half of participants' universities, according to the responses of the teachers, apply e-learning in Turkey.

TABLE 7: THE CURRENT PRACTICES OF E-LEARNING

Item	n	%	n	%	n	%
	University		Faculty		Department	
Yes	148	51.2	93	32.2	82	28.04
No	141	48.8	196	67.8	207	71.6

2) Findings in Acceptance for E-learning

For the second phase of the study, the participants were asked to opine for 6 items to measure their acceptance for e-learning (i.e. items I31 to I36). Table 4 shows the mean score and standard deviation of the responses for those items; the mean scores of all the items except I34 (M=3.24, SD=1.065) is over the expected readiness level. It can be easily interpreted that the respondents hold positive attitudes towards e-learning. However, the participants do not believe that e-learning enables them to accomplish their teaching more effectively than the campus-based approach. As a result, we may conclude that the respondents believe that e-learning can enhance their teaching and can be implemented without effort.

3) Findings in Training for E-learning

For the last part of the study, the participants were required to answer four questions to find out whether there is a need of training for e-learning before it is implemented (Items I37 to I40). The mean scores of I37 to I39 in Table 4 indicate that the participants highly need training for themselves, for their students and for their colleagues. Additionally, they think that their institutions do not have sufficient facilities to implement e-learning (I40).

B. Inferential Statistics (Comparative Findings)

Independent-sample t-test, one-way ANOVA and chi-square test were used to verify statistical significance of differences in mean scores on various variables, namely between male and female, public and private universities, 2-year and 4-year bachelor degree programs, among different regions and institutions, and among teachers, researchers, administrators and strategists. Chi-square tests were used to examine the relationships between two categorical items I1-4 and I24-26. Besides, the one-way ANOVA and independent-sample t-test were used for the remaining items. A row at the end of each table was inserted to display two statistics: first, the number of items that are over the expected readiness level (3.40) with "$\mathbf{M_0}$"; second, the items have significant differences at levels 0.05 and 0.01 on various variables with "$\mathbf{P_T}$".

1) Gender Differences

The gender difference on the readiness for e-learning is always assumed to be a controversial topic as it is not consistently observed [25]. As shown in Table 8, for the first part of the study (i.e. readiness for e-learning), the female respondents (M=4.70) show higher confidence than the male ones (M=4.48) with respect to the use of search engines such as Google (I14). However, the attitude of the female respondents (M=3.38) whether they believe their learners will like e-learning (I21) is substantially weaker than that of the male ones (M=3.70), and is less than the expected level of readiness (M_0=3.40).

TABLE 8: SURVEY RESULTS OF GENDER DIFFERENCES

I	Mean		t / X^2	*p*	I	Mean		t / X^2	*p*
	F	M	Value	Value		F	M	Value	Value
1	-	-	0.295	0.587	22	3.08	3.32	-1.439	0.151
2	-	-	8.485	0.014	23	3.34	3.58	-1.401	0.162
4	-	-	5.074	0.079	24	-	-	0.435	0.509
5	3.37	3.37	0.038	0.969	25	-	-	2.929	0.087
6	4.71	4.62	0.858	0.392	26	-	-	0.114	0.736
7	4.65	4.50	1.188	0.236	27	3.48	3.88	-2.607	**0.010**
8	4.57	4.43	1.032	0.303	28	2.98	3.36	-2.001	**0.046**
9	3.15	2.90	1.043	0.298	29	3.60	4.04	-3.071	**0.002**
10	4.47	4.40	0.444	0.658	30	2.81	3.13	-1.631	0.104
11	3.63	3.33	1.319	0.188	31	3.17	3.71	-3.532	**0.000**
12	4.42	4.52	-0.908	0.365	32	3.40	3.72	-2.187	**0.030**
13	4.49	4.46	0.244	0.807	33	3.36	3.72	-2.267	**0.024**
14	4.70	4.48	1.987	0.048	34	3.05	3.28	-1.303	0.194
15	3.90	4.08	-1.166	0.245	35	3.36	3.85	-4.164	**0.000**
16	3.85	3.83	0.098	0.922	36	3.52	3.85	-2.840	**0.005**
17	3.66	3.73	-0.418	0.676	37	2.65	2.60	0.297	0.767
18	3.61	3.74	-0.769	0.442	38	2.43	2.09	2.559	**0.011**
19	3.69	3.74	-0.325	0.745	39	2.29	1.95	2.320	**0.021**
20	2.59	2.82	-1.398	0.163	40	3.34	3.31	0.167	0.867
21	3.38	3.70	-1.995	0.047	41	2.91	3.31	-2.362	0.019
F: Female; **M:** Male; **I**: Item					$\mathbf{M_0}$	**17**	**21**	$\mathbf{P_T}$	**10**

With regard to the second part of the study, which is the *Acceptance for E-learning*, the responses of the females for all the items designed to assess whether they accept e-learning are lower than those of males and four of these items are under the expected readiness level (M_0=3.40). This indicates that the females do NOT believe that using e-learning can enhance the quality of their teaching (I31); e-learning is useful for their research (I33) or e-learning is better than the campus-based approach (I34). Besides, they do not believe themselves that they will use e-learning tools with ease (I35). However, they believe that e-learning can increase their productivity

(I32) and their students will use e-learning tools with ease (I36). The responses of males for all these questions are over the expected readiness level. In terms of the third part of the study, which is *Training for E-learning* (i.e. item I37 to I40 in Table 2), the responses of both females and males show that teachers need training for e-learning for themselves, for their students and for technical and administrative personals. Besides, they think that their institutions' facilities are not sufficient for e-learning because the mean score of all the responses is under the expected readiness level. Interestingly, the females scored higher than the males on all the items. These results indicate that female participants do not believe in the importance of training for e-learning as much as the males do or they feel they are more ready for e-learning and have the same feeling for other people, namely, students and administrative personals. In summary, the male participants are more positive about the e-learning conditions in terms of facilities and training than their female counterparts are.

2) University Financial Mode Differences

Table 9 shows the differences between the participants who work in private and in public universities. For the first part of the study, a significant difference ($t(285) = 2.274$, $p < 0.05$) was found between private (M=2.81) and public (M = 3.43) universities on the measure of using instant messaging (I11). Interestingly, the responses of the participants in private universities show that their usage of instant messaging is under the expected level of readiness and much lower than the mean score of the respondents in public universities.

TABLE 9: SURVEY RESULTS OF DIFFERENCES IN MODES OF UNIVERSITY

I	Mean		t / X^2 Value	*p* Value	I	Mean		t / X^2 Value	p Value
	M1	M2				M1	M2		
1	-	-	0.545	0.460	22	3.73	3.24	2.487	**0.014**
2	-	-	0.078	0.962	23	3.92	3.50	2.256	**0.025**
4	-	-	0.792	0.673	24	-	-	10.828	**0.001**
5	3.37	3.37	0.020	0.984	25	-	-	0.018	0.893
6	4.67	4.63	0.253	0.801	26	-	-	10.922	**0.001**
7	4.70	4.50	1.276	0.203	27	3.78	3.83	-0.252	0.802
8	4.26	4.47	-1.248	0.213	28	3.52	3.28	1.004	0.316
9	2.89	2.94	-0.187	0.852	29	3.96	3.98	-0.077	0.939
10	4.30	4.42	-0.698	0.486	30	3.48	3.04	1.878	0.061
11	2.81	3.43	-2.274	**0.024**	31	3.92	3.60	1.662	0.098
12	4.67	4.49	1.302	0.194	32	3.92	3.65	1.522	0.129
13	4.63	4.45	1.337	0.182	33	3.44	3.69	-1.229	0.220
14	4.63	4.50	0.961	0.337	34	3.40	3.23	0.764	0.446
15	4.12	4.05	0.356	0.722	35	3.77	3.78	-0.054	0.957
16	3.70	3.85	-0.730	0.466	36	3.77	3.81	0.266	0.790
17	3.56	3.73	-0.929	0.354	37	2.81	2.59	1.057	0.291
18	3.67	3.73	-0.294	0.769	38	2.31	2.12	1.135	0.258
19	3.70	3.74	-0.176	0.861	39	2.58	1.94	3.790	**0.000**
20	2.78	2.79	-0.048	0.962	40	3.44	3.30	0.606	0.545
21	3.89	3.63	1.323	0.187	41	3.30	3.25	0.227	0.821
HEIs in Private (**M1**) / Public (**M2**) Universities					**M_0**	**26**	**22**	**P_T**	**6**

Conversely, an analysis of t-test also shows that there are significant differences between the mean scores of the respondents in private and public universities on the items whether their top administration understand what e-learning is (I22) and support e-learning (I23). The trust that the participants from private universities have in top administration is higher than their counterparts from public universities. No significant differences are found for the items in the second part of the survey. With regard to the third part, the responses of the respondents in private universities are significantly different from those in public universities. Those in private institutions believe that their universities' facilities are sufficient for e-learning (I40) because the mean score of this item (M = 3.44) is over the expected level of readiness whereas the mean score of the same item (M = 3.30) for those in public universities is under the expected level. In summary, private universities show higher readiness than public universities for e-learning.

3) Academic Year Differences

Table 10 indicates the statistical results calculated according to the institutions' academic year, namely: 2- and 4-year.

TABLE 10: SURVEY RESULTS OF ACADEMIC YEAR DIFFERENCES

I	Mean		t / X^2 Value	*p* Value	I	Mean		t / X^2 Value	*p* Value
	Y1	Y2				Y1	Y2		
1	-	-	0.418	0.518	22	3.31	3.28	0.234	0.815
2	-	-	1.065	0.587	23	3.64	3.52	0.853	0.394
4	-	-	9.848	**0.007**	24	-	-	14.600	**0.000**
5	3.38	3.36	0.076	0.940	25	-	-	0.619	0.431
6	4.63	4.64	-0.039	0.969	26	-	-	7.675	0.006
7	4.31	4.58	-2.387	**0.018**	27	4.14	3.73	3.133	**0.002**
8	4.48	4.44	0.371	0.711	28	3.37	3.29	0.503	0.615
9	3.56	2.75	4.204	**0.000**	29	4.31	3.88	3.403	**0.001**
10	4.20	4.47	-2.126	**0.034**	30	2.95	3.12	-0.986	0.325
11	3.62	3.31	1.611	0.108	31	4.03	3.52	3.850	**0.000**
12	4.50	4.51	-0.069	0.945	32	4.07	3.57	4.018	**0.000**
13	4.39	4.49	-1.008	0.315	33	4.20	3.52	5.028	**0.000**
14	4.55	4.50	0.472	0.637	34	3.57	3.15	2.761	**0.006**
15	4.08	4.05	0.263	0.792	35	3.93	3.73	1.922	0.056
16	4.00	3.79	1.518	0.130	36	3.82	3.80	0.193	0.847
17	3.98	3.64	2.46	**0.015**	37	2.40	2.67	-1.833	0.068
18	3.81	3.70	0.77	0.442	38	1.71	2.25	-4.857	**0.000**
19	3.88	3.69	1.401	0.162	39	1.85	2.04	-1.578	0.116
20	2.98	2.73	1.791	0.074	40	3.10	3.37	-1.756	0.080
21	3.93	3.58	2.541	**0.012**	41	3.64	3.14	3.417	0.001
I:Item ; 2-year (**Y1**) and 4-year (**Y2**) institutions					**M_0**	**25**	**21**	**P_T**	**14**

4) Role Differences

As shown in Table 11, in the first part of the survey, we find that there are significant differences in terms of roles in six items: the experience of the participants in the use of electrical software (I10) and instant messaging (I11), the confidence of them in the use of web browsers, whether e-learning can enhance the quality of the theoretical (I27) and practical (I28) part of the subject of electricity and whether e-learning can be practicable for the theoretical part of the electricity (I29). With regard to the second part, there was only one significant difference among the role of the participants. It was associated with the fact that whether e-learning can enhance the quality of their teaching (I31). For the third part, we found that the perceptions differed in whether their students need training for e-learning. In summary, the strategists show more positive responses than lecturers, researchers and administrators do.

5) Age Differences

Table 12 lists the statistical results for age differences. For the first part of the study, the following differences in average scores by the age groups are statistically significant at $p < 0.05$

according to the experience in the use of social network sites (I9); of electrical software (I10); of instant messaging (I11) and according to the confidence in the use of computers (I12); of web browsers (I13) and of search engines (I14). No significant differences are found for the items on the second and third parts of the study. In summary, age is an influencing factor for the perceived e-learning readiness with the 24-54-year-old group holding more positive views than their younger and older counterparts.

TABLE 11: SURVEY RESULTS OF DIFFERENCES IN RESPONDENT ROLES

Item	Roles/Mean Scores				F / X^2	P
	R1	R2	R3	R4	Value	Value
1	-	-	-	-	11.610	**0.009**
2	-	-	-	-	4.404	0.622
4	-	-	-	-	14.836	**0.022**
5	3.23	3.44	3.49	3.43	1.287	0.279
6	4.56	4.69	4.67	4.79	1.098	0.350
7	4.43	4.58	4.58	4.50	0.762	0.516
8	2.95	4.52	4.40	4.43	0.389	0.761
9	4.41	2.99	2.81	2.93	0.214	0.887
10	4.32	4.63	4.32	3.86	4.554	**0.004**
11	3.14	3.65	3.34	3.36	2.673	**0.048**
12	4.41	4.57	4.56	4.50	1.126	0.339
13	4.31	4.55	4.58	4.57	3.298	**0.021**
14	4.43	4.54	4.61	4.50	1.029	0.380
15	3.99	4.07	4.15	4.00	0.423	0.736
16	3.83	3.86	3.79	3.85	0.52	0.984
17	3.68	3.62	3.98	3.62	1.970	0.119
18	3.68	3.69	3.90	3.57	0.815	0.486
19	3.67	3.71	3.95	3.57	1.315	0.270
20	2.80	2.75	2.78	3.00	0.260	0.854
21	3.68	3.51	3.83	3.79	1.443	0.230
22	3.14	3.37	3.38	3.38	1.169	0.322
23	3.36	3.62	3.70	3.71	2.224	0.086
24	-	-	-	-	4.930	0.177
25	-	-	-	-	5.243	0.155
26	-	-	-	-	1.683	0.641
27	3.84	3.63	4.05	4.14	3.344	**0.020**
28	3.23	3.20	3.47	4.08	2.780	**0.041**
29	4.07	3.73	4.24	4.00	4.945	**0.002**
30	3.04	3.06	3.19	3.14	0.235	0.872
31	3.72	3.39	3.83	3.93	4.0.43	**0.008**
32	3.74	3.50	3.78	4.00	2.539	0.057
33	3.73	3.52	3.78	3.71	1.173	0.320
34	3.27	3.05	3.47	3.57	2.601	0.052
35	3.77	3.69	3.86	4.07	1.555	0.201
36	3.79	3.77	3.83	4.00	0.458	0.712
37	2.58	2.64	2.31	2.67	0.525	0.665
38	2.12	2.30	2.07	1.90	3.161	**0.025**
39	2.00	2.01	1.92	2.00	0.041	0.989
40	3.20	3.51	3.42	3.17	1.944	0.123
41	3.18	3.19	3.46	3.43	1.185	0.316
M_0	**20**	**24**	**26**	**25**	**P_T**	**10**

R1: Teacher; R2: Researcher; R3: Strategist; R4: Administrator

VI. CONCLUSION

The main goal of the study was to investigate teachers' readiness for e-learning in HEIs associated with the subject of electricity in Turkey in three aspects: readiness, acceptance and training for e-learning and to analyse whether their readiness differed based on their gender, age, role, institution, regions and universities' financial mode, namely public and private. A number of HEIs associated with science of electricity (e.g. Electrical and Electronics Engineering) were selected for taking part in the web-based survey. The staff members of those HEIs (i.e. lecturers, researchers, strategists and administrators) were eligible to participate in the study. Personalised invitations to take part in the survey were delivered to 1206 respondents, who have published their email address on their university website.

TABLE 12: SURVEY RESULTS OF AGE DIFFERENCES

Item	Age Group Mean Scores					F / X^2	P
	≤ 24	25-34	35-44	45-54	55 ≥	Value	Value
1	-	-	-	-	-	8.145	0.086
2	-	-	-	-	-	6.574	0.583
4	-	-	-	-	-	5.636	0.688
5	3.55	3.45	3.26	3.35	3.50	0.649	0.628
6	4.64	4.75	4.61	4.44	4.64	2.176	0.072
7	4.82	4.58	4.56	4.23	4.50	2.277	0.061
8	4.64	4.58	4.43	4.26	4.14	1.958	0.101
9	3.36	3.31	2.68	2.73	2.57	**3.706**	**0.006**
10	4.82	4.69	4.37	3.94	3.93	**8.340**	**0.000**
11	4.00	3.71	3.26	2.98	2.71	**4.378**	**0.002**
12	4.64	4.63	4.50	4.29	4.29	**2.594**	**0.037**
13	4.45	4.60	4.50	4.17	4.23	**4.040**	**0.003**
14	4.55	4.63	4.52	4.29	4.29	**2.582**	**0.038**
15	4.00	4.15	4.10	3.79	4.00	1.362	0.248
16	3.50	4.01	3.78	3.70	3.67	1.520	0.197
17	3.00	3.73	3.77	3.80	3.46	2.036	0.090
18	3.55	3.78	3.81	3.62	3.00	2.235	0.066
19	3.27	3.79	3.79	3.72	3.31	1.536	0.192
20	2.45	2.72	2.78	3.00	2.85	0.952	0.435
21	3.45	3.61	3.73	3.70	3.33	0.673	0.611
22	3.40	3.36	3.28	3.22	3.00	0.495	0.739
23	3.40	3.72	3.46	3.49	3.31	1.283	0.277
24	-	-	-	-	-	2.869	0.580
25	-	-	-	-	-	6.562	0.161
26	-	-	-	-	-	1.869	0.760
27	3.45	3.78	3.94	3.73	3.79	1.074	0.370
28	3.00	3.25	3.36	3.38	3.21	0.384	0.820
29	3.64	3.93	4.09	3.96	3.71	1.260	0.286
30	2.88	3.08	3.09	3.21	2.79	0.502	0.734
31	3.18	3.48	3.78	3.74	3.57	2.216	0.067
32	3.09	3.60	3.77	3.75	3.71	1.855	0.119
33	3.00	3.61	3.74	3.81	3.50	1.937	0.104
34	2.73	3.28	3.29	3.21	3.14	0.779	0.540
35	3.82	3.80	3.80	3.74	3.50	0.589	0.671
36	3.91	3.76	3.91	3.66	3.71	1.294	0.273
37	2.73	2.63	2.62	2.62	2.29	0.409	0802
38	2.55	2.15	2.11	2.06	2.14	0.843	0.499
39	2.44	2.03	1.90	2.09	2.00	1.199	0.312
40	3.18	3.39	3.15	3.63	3.14	1.884	0.113
41	3.00	3.30	3.31	3.19	2.93	0.653	0.625
M_0	**19**	**23**	**21**	**22**	**20**	**P_T**	**6**

Some potential respondents cannot be reached because of the lack of contact information. Nevertheless, the number of this unreachable sample is estimated to be relatively small with about 290. Furthermore, the results of the survey revealed that the mean scores of the female participants were lower than those of the male participants on a range of measures of their readiness for e-learning in general. While only 14.9% of the survey respondents are female, the sample is assumed to be representative, given that the subject of electricity is rarely selected by females. It is also worth to mention that the participation of all the 342 respondents was entirely voluntary. No incentive was offered for their participation but 289 of them completed the whole questionnaire. This may indicate that the topic of e-learning can arouse the interest of the staff in the academic institutions in Turkey.

Surveying via the Internet is criticized for the biased sample because individuals who are online and who are motivated to take the survey have been included in the sample [6]. As our survey was implemented via the Internet, we discuss whether our research results would be biased. We tend to conclude that such a bias is remarkably low in our case, given the following considerations: Firstly, the mean scores of the items vary between 1.00 and 5.00. This shows that many respondents show (strong) disagreements to several items despite their (easy) access to ICT. Furthermore, this biased sample issue could be a major problem in the early days of the Internet revolution [6]. However, today the Internet and e-mail becomes a part of everyday life. Indeed, a survey on ICT usage by the Turkish Statistical Institute indicates that as of August 2010, 42% of households have access to the Internet; sending and receiving e-mail is reported as the most frequent activity by 73% of individuals in households.

In addition, we have conducted a number of post-survey interviews to gather qualitative comments from the respondents who indicated their willingness to be interviewed in the final question of the survey. The data analysis is ongoing. Findings from the interviews and the comments given by the participants on the survey for ten items will be used to design a model for implementing e-learning in HEIs associated with the subject of electricity in Turkey as an important challenge of our future work. Initial results are insightful as they enable us to gain in-depth understanding of the related issues. Upon completion of the analysis, the findings will be published and serve as significant inputs for the design of an e-learning system on the domain of electricity. Another major step of our future research plan is to measure students' readiness for e-learning in the HEIs associated with the science of electricity in Turkey to compare with the current results of teachers' readiness for e-learning. The model for measuring readiness for e-learning will be used to find out students' readiness for e-learning. The model will further be validated and refined by adding a component to investigate students' traditional skills, such as self-motivation, self-responsibility, and time management skills. Finally, it is relevant to point out that the universities involved are located in Turkey and the domain is electricity. Hence, our empirical findings are not generalizable to other contexts or domains However, our study can heighten the awareness of the related issues on e-learning for developing countries like Turkey.

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