



E-Learning Readiness of Technology Institutes in Ethiopian Public Universities: From the Teachers' Perspective

Abinew Ali Ayele^(✉) and Worku Kelemework Birhanie

Faculty of Computing, Bahir Dar Institute of Technology,
Bahir Dar University, Bahir Dar, Ethiopia

abinewaliaye@gmail.com, workukelem@gmail.com

Abstract. In this paper, we have presented an empirical study that aimed to investigate e-learning readiness of technology institutes in Ethiopia. Data was gathered from five technology institutes of Ethiopian universities. 400 teachers were sampled using simple random sampling method. An E-learning readiness level of those institutes has been assessed from the teachers' perspective. In terms of employee readiness, academic institutions have achieved the heist readiness index in general. This indicates that teachers are ready to go ahead for implementing e-learning. Particularly, employee readiness parameters like technical skill, awareness and attitudinal readiness were found to be above the expected level of readiness. Whereas, organizational readiness in general was found below the expected level that indicated academic institutions are not ready and needs some work to get ready. Particularly, all organizational readiness parameters like cultural, policy, top management and technological readiness were found to be below the expected level of readiness.

Keywords: E-learning readiness · E-learning implementation · Employee readiness · Organizational readiness · Academic institutions

1 Introduction

Academic institutions are integrating new information systems in their teaching, research and administrative works in order to utilize the benefits of those new technologies. The developments of Information and communication technologies (ICTs) have changed the world into an increasingly networked society in all sectors of the economy through creating vital opportunities. These days, the development of a nation is highly dependent on the strength of its information system and connectivity to the world [1]. It seems mandatory to use ICTs (like e-learning systems) in the day to day activities of academic institutions so as to successfully accomplish their objectives and compete with other similar institutions.

Hence, e-learning is becoming a useful tool for academic institutions. Measuring and assessing e-learning readiness of academic institutions must be the first priority

before implementing and investing on digital technologies. Moreover, identifying the main determinants of e-learning readiness is indispensable for the successful implementation of e-learning as a platform for learning environments. The greatest success of e-learning implementation in academic institutions can be achieved through assessing and understanding e-learning readiness levels [2]. Therefore, academic institutions should have clear and broad understanding about their e-learning readiness levels before implementation.

Implementing e-learning in any academic institution happens in one of the following three approaches. The first approach uses e-learning technologies to augment or supplement the traditional face-to-face course delivery systems. The second approach for implementing e-learning focuses on integrating online activities into a traditional course to improve the usual learning experience, while the third and the last approach emphasizes on a course that is delivered entirely online [3]. The choice of these implementation approaches that an institution may decide depends on the level of readiness in terms of infrastructure as well as human resources readiness in terms of experience, knowledge, skill, awareness and attitude [3].

More precisely, e-learning implementation highly requires the readiness of physical infrastructure, technical expertise, psychological motivation, policy and cultural transformation as well as management support and commitment. It is mandatory to have people with some level of psychological motives and technical skills in order to manage and administer e-learning platforms [4].

E-Learning implies learning conducted through electronic media, mainly on the Internet. [5], mentioning European Commission (2001), described that e-Learning entails the utilization Internet and state-of-the-art multimedia technologies in order to improve the quality of learning through creating easy access to services and facilities. It has been proved that e-learning can improve the collaborations among educators, administrators and, learners in academic institutions [5].

According to Webster's New College Dictionary, readiness has been defined as being "prepared mentally and or physically for some experience or action". Similarly, [6] defined that e-learning readiness is "the mental or physical preparedness of an institution for some e-learning experience or action". Therefore, the mental and physical preparedness of academic institutions for using e-learning must be evaluated before its implementation and deployment.

The objective of this investigation was to empirically assess and measure the e-learning readiness levels of academic institutions (mental or physical preparedness) of the technology institutes of Ethiopian Universities. The study has also tried to investigate the major determinant factors of e-learning implementation readiness specifically from the teachers' perspective.

2 Background and Literature Review

E-Learning can be upsetting and intrusive in learning environments if it is not implemented with prior and appropriate planning and management. The assessment of institutional readiness for up-to-date technological innovations can minimize the risk of its failure after implementation [7] as cited in Demiris et al. (2004). The well known scientist, Thomas Edison, stated that "success is 2% inspiration and 98% perspiration".

This is to mean that awareness and motivation only contributes 2% for success. Hence, the major determinant is perspiration which implies exerting a continuous effort on action and execute for successful implementation.

Readiness is an integral and preliminary step for successfully implementing new changes like adoption of new information systems. Therefore, evaluating e-learning readiness prior to its implementation saves money, time and energy by identifying the barriers that are going to limit and the communities that are not able to support the implementation process [8, 9].

Among the different studies conducted on e-learning readiness, a study conducted on measuring e-learning readiness had considered five factors namely motivation, self competence, financial, self-directed learning and usefulness [10]. Similarly, a study conducted in Malaysia considered students, lecturers, technology and the environment to be ready prior to e-learning implementation and had given special focus for technological readiness factor since it was the major determinant of e-learning implementation [11]. Another study conducted on the students' e-learning readiness and acceptance in Northeastern Thailand had also shown the situations and variables that impact the implementation of e-learning in the case of developing countries [12].

In addition, many other studies have showed that Organizational readiness and employee readiness are among the major e-learning readiness determinants that influence the implementation success [13]. Organizational readiness is the extent to which the organization is prepared for new technology implementations in terms of infrastructure, policy and culture [9]. This study has tried to measure the preparedness of academic institutions in terms of top management support and commitment, technology, infrastructure, policy and culture.

Employee readiness is the extent to which individual members of an organization are prepared psychologically, attitudinally, behaviorally and in terms of technical skill capabilities and basic awareness [9]. In this regard, the readiness of employees' technical skill, attitude and awareness are evaluated to use e-learning systems in technology institutes of Ethiopian Universities. The success of teachers in using e-learning systems depends on their prior technical competency, awareness and attitude to use new information and communication technologies [14, 15].

An empirical study conducted on e-Learning Readiness in Turkey has identified groups of e-learning readiness dimensions that can influence the implementation of e-learning. Among these, technical skill readiness, attitudinal readiness, cultural readiness and infrastructure readiness are the major once [1]. This study has also considered these factors as core determinants of e-learning readiness.

As defined by [1], these dimensions are described as follows:

- Technical skill readiness: refers to the observable as well as measurable technical competencies concerning users' abilities with computers and the Internet.
- Infrastructure readiness dimension: it is defined as the right infrastructure or equipment readiness, e-learning content delivery, provision of technical support and a learning management system adopted by the organizations.
- Attitude readiness: it refers to the users' attitude that involves confidence, motivation, enjoyment, importance and preference influencing the use of technology.

- Cultural readiness: It refers to the use of e-learning through the application of Internet and networked technologies to disseminate information enhance communication, interaction and teaching.

The role of top management readiness is also described as a core critical success factor for e-learning implementation. Top management readiness is the extent to which the top management is committed to support and encourage employees to use new technologies [16].

3 The E-Learning Readiness Assessment Framework

3.1 Readiness Assessment Framework

Measuring the extent of e-learning implementation readiness in higher education institutions needs clear understanding of the key e-learning platform environmental components and their interactions. The main e-learning implementation components that need to be examined are the people in the organization and the organization itself. Among the people component, the teachers are the once whose preparedness to accept and use e-learning should be measured. Moreover, the organization's infrastructure, technology, policy, culture and top management readiness to use e-learning systems should also be evaluated. The following framework shows the different levels of readiness cut points in an e-learning environment [17]. In this study, these cut points are used to differentiate the various levels of e-learning readiness in the selected technology institutes.

The model has been proved by different studies conducted in academic institutions [4, 14]. The readiness index level of 1–2.6 indicated that the institutions are not ready and needs a lot of work to get ready while the readiness index level of 2.6–3.4 showed that the institutions are not ready and needs some work to get ready. The readiness index cut point that ranges from 3.4–4.2 indicted that the institutions are ready but needs few improvements to implement e-learning. Whereas the readiness index cut point between 4.2 and 5.0 showed that the institutions are ready to go ahead in implementing e-learning. The model determines the expected level of readiness index reference cut point to be 3.4 [17]. Therefore, readiness index parameter values greater than 3.40 had achieved the readiness index cut point to implement e-learning.

Table 1. The readiness scales and indication of means

Readiness average scores	Readiness scale level
1.00–2.60	Not ready needs a lot of work
2.61–3.40	Not ready needs some work
3.41–4.20	Ready but needs a few improvements
4.21–5.00	Ready to go ahead

Each indicator has alternatives coded as 1 = strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly Agree in a five-point Likert scale type.

The alternatives were organized in a way that they provide easy coding and assessment. Aydin and Tasci [17] have designed a model by determining the different levels of e-learning readiness. These levels were obtained by identifying the critical level values (i.e. 4 intervals/5 categories = 0.80). Therefore the 3.41 mean average score was determined as an expected level of readiness. Based on the 0.80 distance critical level values, the actual levels of different readiness cut points were also identified as depicted in Fig. 1 and Table 1.

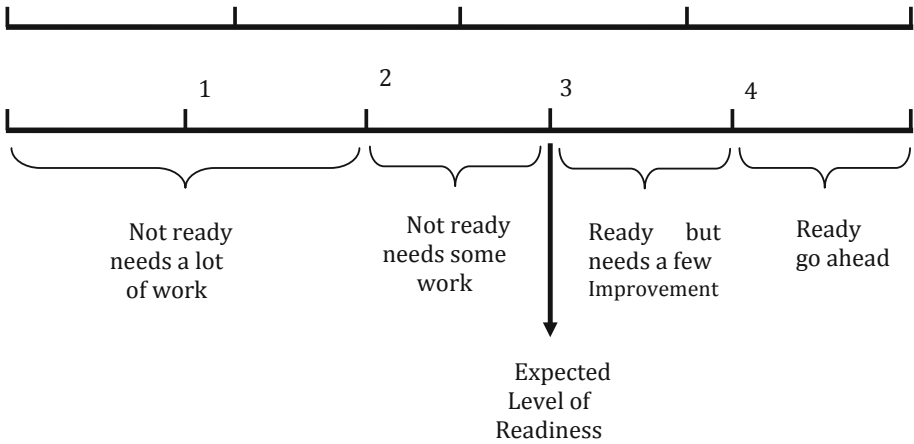


Fig. 1. E-learning readiness assessment model Adopted from [17]

3.2 Materials and Methods

Since the main objective of this study was to empirically investigate teachers’ e-learning readiness in technology institutes of Ethiopian public universities. The study mainly used a quantitative research approach. Self administered questionnaires were used as data collection instrument. Simple random sampling technique has been used to select representatives from the target population. The research data were collected from the faculty members of 5 technology institutes in Ethiopia. The size of representative samples was determined using the following formula [18]. The formula is appropriate for determining sample size of finite populations.

$$no = \frac{(z\alpha/2)^2 * p(1 - p)}{\delta^2}$$

- Where: N = total population
- n = required sample size
- α = 0.05 = level of significant (type-I error)
- δ² = 0.05 which is the margin of error

$P = 0.5$ for sample proportion of teachers

$$\begin{aligned}
 no &= \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} \\
 no &= \frac{(3.84) * 0.5 * 0.5}{0.0025} = 384.16 = 385 \\
 n &= \frac{no}{1 + \frac{no}{N}} \\
 n &= \frac{385}{1 + \frac{385}{1385}} = \frac{385}{1.278} = 301.257 = 302
 \end{aligned}$$

Based on the above calculation, the minimum sample size to study the target population was 302 teachers. However, this study has used random sample of 400 respondents which was more than the minimum sample size to insure that the samples are more representative of the target population. The target population of the study consisted of 1,385 faculty members from the five technology institutes of Ethiopian public Universities (Bahir Dar Institute of Technology-BiT = 460, Addis Ababa Institute of Technology-AAiT = 290, Ethiopia Institute of Textile & Fashion Technology-EiTEx = 200, Jima Institute of Technology-JiT = 210 and Hawasa Institute of Technology-HiT = 225).

For the descriptive part of this study, Statistical package for social science (SPSS version 20) has been applied. Means, standard deviations and cross tabulations were computed for each indicator and construct in order to determine the expected level of e-learning readiness.

4 Results and Discussions

4.1 Socio-Demographic Characteristics

As this study is the continuation of our previous work [19], we have used same samples but different parameter. Moreover, some of the basic facts and figures might also overlap. Out of 400 questionnaires distributed, 372 were collected. This indicated that the response rate of 93% was achieved. From 372 questionnaires collected, 356 (89%) questionnaires were found usable. The remaining 16 questionnaires which constitute 4% were rejected since they were either not properly filled or incomplete. Therefore, the main survey has achieved 7% non-respondent rate. This indicated that response rates exceeding 50% are acceptable, 60% are good, 70% are very good and 85% are excellent for questionnaire surveys [20] citing Mangione (1995). Hence, the 93% response rate in this study is Excellent.

As shown in Table 2, the majority of respondents 156 (44%) are from BiT (Bahir Dar Institute of Technology). The rest of respondents were taken from Ethiopia Institute of Textile & Fashion, Addis Ababa, Hawasa and Jima Institutes of Technology in order of the sample sizes. As indicated in the data, out of 356 respondents, 283 (79.5%) and 73 (20.5%) were found male and female respectively.

Concerning academic qualification, 82 (23%), 230 (64.6%) and 44 (12.4%) of the study participants had BSc degree, MSc degree and PhD degree respectively. Out of 356 respondents, 179 (50.3%), 121(34%), 46 (12.9), 8 (2.2%) and 2 (0.6%) were 21–30 years, 31–40 years, 41–50 years, 51–60 years and above 60 years old respectively as depicted in Table 3. Theses clearly indicated that the majority of teachers participated in the survey (84.3%) were young adults' with age bellow 40 years old.

Table 2. Respondents institute & Gender distribution

Institute	Gender		Total
	Male	Female	
Addis Ababa Institute of Technology	42	13	55
Bahir Dar Institute of Technology	123	33	156
Ethio. Inst. of Textile & Fashion Techno.	54	16	70
Hawasa Institute of Technology	38	7	45
Jimma Institute of Technology	26	4	30
Total	283(79.5%)	73(20.5%)	356

In the study, it has been indicated that colleagues and friends were the main source of awareness about e-learning (46.6%). The available facilitating conditions (33.4%) and the management body of the institutions (28.4%) were the next sources of e-learning awareness respectively.

Table 3. Age & Educational qualifications distribution

Age	Educational qualifications			Total
	BSc	MSc	PhD	
21–30 years	77	101	1	179 (50.3%)
31–40 years	5	99	17	121(34%)
41–50 years	0	24	22	46 (12.9)
51–60 years	0	5	3	8 (2.2%)
Above 60 years	0	1	1	2 (0.6%)
Total	82 (23%)	230 (64.6%)	44 (12.4%)	356

As indicated in this study, about 40.5% of the teachers participated in the survey had below 5 years teaching experience. The next portion of respondents, i.e. 36.5% constitutes teachers with 6-10 years of teaching experience. The majority of study participants, i.e. 289 (81.2%) were informed about the presence of e-learning system platforms in their Institute. Regarding the level of awareness, 162 (45.5%) of respondents were well informed about the presence of e-learning system in their institute. Another 127 (35.7%) of respondents were somehow aware of e-learning systems. The remaining 67 (18.8%) of respondents were not informed at all about the presence and importance of e-learning systems in their Institute as shown Table 4.

Table 4. Experience * Awareness level cross-tabulation

Experience	Level of awareness			Total
	Awared	Awared to some extent	Not awared	
Bellow 5 Years	51	50	43	144 (40.5%)
6–10 Years	74	46	10	130 (36.5%)
11–15 Years	25	22	12	59 (16.6%)
16–20 Years	6	5	2	13 (3.7%)
Above 20 Years	6	4	0	10 (2.8%)
Total	162 (45.5%)	127 (35.7%)	67 (18.8%)	356 (100%)

4.2 E-Learning Readiness in the Technology Institutes of Ethiopian Universities

The readiness of respondents measured in a five point Likert scale has been presented for two major e-learning readiness constructs (employee readiness and organizational readiness). The employee readiness construct consisted of three parameters namely technical skill, awareness, & attitude readiness. Organization readiness construct had also other five parameters; infrastructural, top management, cultural, policy and technological readiness. The reliability of the 22 readiness questions on the survey has been measured on cronbach's alpha method of reliability statistics as depicted in Table 5.

Table 5. Reliability statistics of e-learning readiness items

Construct	Number of items	Cronbach's alpha coefficient
Employee readiness	6	0.744
Organizational readiness	16	0.894
Total	22	0.882

Therefore, reliability of 0.744 and 0.894 has been achieved for employee readiness and organizational readiness indicators respectively. In addition, the overall reliability of 0.882 for the 22 e-learning readiness items was found. These values had confirmed a strong consistency of the responses on the indicators of the study [21].

E-Learning Readiness Components and Indicators

A total of 22 indicators were used in this study. These 22 indicators were grouped in two core readiness components of employee readiness and organizational readiness. The employee readiness construct consisted of three parameters, namely technical skill, awareness and attitude. The organizational readiness construct embraces infrastructural, policy, cultural, technological and managerial readiness parameters. The means and standard deviations of all the indicators and constructs have been computed as shown in Table 6.

Table 6. Average e-learning readiness measures for each indicator

Employee readiness items		Mean			Std. deviation
Technical skill readiness	Basic knowledge & skills to use computers	4.70	4.45	4.20	0.594
	Basic skills to use the Internet	4.71			0.562
	Basic knowledge & skills to use e-learning systems	3.94			1.071
Awareness	Enough awareness about the importance of e-learning	4.13	4.13		1.065
Attitude	Prefer to use e-learning than the traditional methods	3.84	4.02		0.997
	I intend to use the e-learning systems in the future	4.19			0.736
Infrastructural readiness	Sufficient access to wireless and or wired Internet	3.53	3.17	2.77	1.206
	Sufficient internet speed to use e-learning	2.91			1.238
	Have the necessary resources to use e-learning	3.07			1.130
Cultural readiness	Institute has good culture of using new technologies	2.88	2.50		1.114
	Inclusion of e-learning usage plan in course outline	2.12			0.876
Policy readiness	Curricula designed properly to align with e-learning	2.36	2.35		0.934
	Institute has an e-learning implementation policy	2.33			0.911
Technology readiness	The e-learning system has all the necessary functionalities	3.20	3.20		1.088
Top management readiness	The top management involvement with e-learning function is strong	2.56	2.63		0.940
	The top management is interested in the e-learning function	2.74			0.962
	The top management understand the importance & opportunities of e-learning	2.88			.950
	The top management support & encourage me to use the e-learning system	2.65			0.966
	The top management consider e-learning as a strategic resource	2.72			0.957
	The top management puts pressure on departments to use e-learning	2.56			0.940
	The top management of my institute owns e-learning as a core task	2.43			0.954
	The top management has a strong commitment to implement e-learning	2.47			0.965

In order to measure the expected level of readiness, the average readiness level for each construct in general and for each indicator in particular were computed as shown in Table 6. The results were compared against the expected level of readiness standards [17].

As the model clearly depicted 3.41 to be the expected level of readiness, the 4.20 average score of employee readiness implies that teachers were ready to use the e-learning systems. This is because; the 4.20 employee readiness index was higher than the expected level of readiness (3.40). The readiness index was computed for the three parameters of employee readiness (employees' technical skill = 4.45, awareness = 4.13 and attitude = 4.02). The employees' technical skill readiness index, TR = 4.45, clearly showed that teachers had sufficient technical skill to use e-learning systems. In terms of (attitude = 4.02 and awareness = 4.13), teachers were ready to use e-learning systems, yet needs some support and improvements. Therefore, academic institutions have no problem related to employee readiness to implement e-learning systems.

The organizational readiness index (OR = 2.77) was found below the expected level of readiness. Readiness index for all organizational parameters (Infrastructural Readiness = 3.17, Cultural Readiness = 2.50, Policy Readiness = 2.35, management readiness = 2.63 and Technological Readiness = 3.20) had been computed. The average readiness scores for infrastructure, technology and management lay under the category "not ready that needs the academic institutions to do some work to get ready" since their scores are between 2.61 and 3.40 cut points. The policy and cultural readiness index values lay between 1.81 and 2.60 cut points that indicated the academic institutions are not ready to implement e-learning and need a lot of work to get ready. Therefore, the management body of those institutions should play important roles and responsibly in creating favorable e-learning implementation environments. All other parameters can be expressed as a function management support and commitment as the top management is responsible to expand the infrastructure, establish good culture, policy, awareness and attitude and adopt new technologies.

5 Conclusion

Measuring e-learning readiness of universities is very crucial to utilize the advantages of new technologies. The study has revealed that universities have achieved good level of readiness in terms of employee readiness parameters (technical skill, awareness and attitude). The highest readiness index has been achieved for technical skill parameter. However, the organizational readiness parameters (like cultural, policy, management and technological readiness) have shown low level of readiness index to implement and use e-learning systems in universities. The worst readiness index was registered in the policy and cultural readiness parameters. The support and commitment of the top management was also found far below the readiness cut point index. This showed that universities shall improve their institutional weaknesses to implement e-learning systems and encourage teachers to use the technology.

6 Recommendation

According to the findings achieved so far in this study, the following recommendations are suggested to improve the utilization of e-learning systems in technology institutes of Ethiopian Universities. Besides, recommendations for future works are also forwarded.

The first suggestions recommended for the management body of the institutes at different administration levels. In order to be successful in e-learning implementation, members of the top management in those institutions should:

- Improve the infrastructures like internet connectivity, speed and accessibility in their campuses to succeed in e-learning.
- Design and deploy an e-learning implementation policy.
- Encourage and support their staff to build a better culture of applying new technologies.
- Encourage and support teachers to integrate e-learning usage plan while preparing their course guide books.

The recommendation for further research is the second suggestion. In this study, only teachers of the five technology institution were considered. Therefore, considering student respondents is another area to extend the study. In addition, incorporating respondents from all disciplines in study can also be another topic to deal with.

References

1. Parlakkılıç, A.: E-learning readiness in medicine: Turkish family medicine (FM) physicians case. *Turkish Online J. Educ. Technol.* **14**(2), 59–62 (2015)
2. Rohayani, A.H.H., Kurniabudi, Sharipuddin: A literature review: readiness factors to measuring e-learning readiness in higher education. *Procedia Comput. Sci.* **59**(Iccsci), 230–234 (2015)
3. Rais, M., Karim, A., Hashim, Y.: The experience of the e-learning implementation at the Universiti Pendidikan Sultan Idris, Malaysia. *Malaysian Online J. Instr. Technol.* **1**(1), 50–59 (2004)
4. Borotis, S., Poulymenakou, A.: Critical Success Factors for e-Learning Adoption: Handbook of Research on Instructional Systems and Technology, pp. 131–134. IGI Global, Greece (2008)
5. Ouma, G.O., Awuor, F.M., Kyambo, B.: E-learning readiness in public secondary schools in Kenya. *Eur. J. Open, Distance, E-Learn.* **16**(2), 97–110 (2013)
6. Arkorful, V., Abaidoo, N.A.: The role of e-learning, advantages and disadvantages of its adoption in higher education. *Int. J. Instr. Technol. Distance Learn.* **12**(1), 29–43 (2015)
7. Li, J., Ray, P., Seale, H., MacIntyre, R.: An e-health readiness assessment framework for public health services—pandemic perspective. In: 2012 45th Hawaii International Conference on System Sciences, pp. 2800–2809 (2012)
8. Jennett, P., et al.: Preparing for success: readiness models for rural telehealth. *J. Postgrad. Med.* **51**(4), 279–285 (2005)
9. Weiner, B.J., Lee, S.D.: Conceptualization and measurement of organizational readiness for change: a review of the literature in health services research and other fields. *Med. Care Res. Rev.* **65**(4), 379–436 (2008)

10. Alem, F., Plaisent, M., Zuccaro, C., Bernard, P.: Measuring e-Learning readiness concept: scale development and validation using structural equation modeling. *Int. J. e-Educ. e-Bus. e-Manag. e-Learn.* **6**(4), 193–207 (2016)
11. Mosa, A.A., Naz'ri bin Mahrin, M., Ibrahim, R.: Technological aspects of e-learning readiness in higher education: a review of the literature. *Comput. Inf. Sci.* **9**(1), 113 (2016)
12. Ngampornchai, A., Adams, J.: Students' acceptance and readiness for e-learning in North-eastern Thailand. *Int. J. Educ. Technol. High. Educ.* **13**(1), 34 (2016)
13. Schreurs, J., Ehlers, U.D., Sammour, G.: E-learning readiness analysis (ERA): an e-health case study of e-learning readiness. *Int. J. Knowl. Learn.* **4**(5), 496 (2008)
14. Ouma, G.O., Awuor, F.M., Kyambo, B.: Evaluation of e-learning readiness in secondary schools in Kenya. *World Appl. Program.* **310**, 493–503 (2013)
15. Darab, B., Montazer, G.A.: An eclectic model for assessing e-learning readiness in the Iranian universities. *Comput. Educ.* **56**(3), 900–910 (2011)
16. Al-mamary, Y.H., Shamsuddin, A., Aziati, A.H.N.: Key factors enhancing acceptance of management information systems in Yemeni companies. *J. Bus. Manag. Res.* **5**, 108–111 (2014)
17. Aydin, C.H., Tasci, D.: Measuring readiness for e-learning: reflections from an emerging country. *Educ. Technol. Soc.* **8**(4), 244–257 (2005)
18. Cochran, W.G.: *Sampling techniques*. Wiley, Hoboken (1977)
19. Ayele, A.A., Birhanie, W.K.: Acceptance and use of e-learning systems: the case of teachers in technology institutes of Ethiopian Universities. *Appl. Inf.* **5**(1), 1–11 (2018). <https://doi.org/10.1186/s40535-018-0048-7>
20. McColl, E., et al.: Design and use of questionnaires: a review of best practice applicable to surveys of health service staff and patients. *Core Res.* **5**(31), 101–174 (2001)
21. Chin, W.W.: The partial least squares approach to structural equation modeling. *Modern Methods Bus. Res.* **295**(2), 295–336 (1998)