



## COVID-19 and e-Learning: The skills and abilities required for e-learners in higher education during the coronavirus era

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### Abstract

The purpose of this research was to identify the skills and abilities learners need in a digital learning environment during the Corona crisis. The research approach was applied in terms of objective and the *data collected* using the mixed-method approach. In the first part, using a qualitative approach and a document search method, 33 components (related to the skills and abilities of e-learners) were identified, and then 19 components out of 33 with the highest frequencies were selected. The target population for this study included all MA students of the University of Tehran who had the experience of studying in an online learning environment, then 374 individuals were selected as a sample using the random sampling method. In the second part, using a quantitative approach and a descriptive-analytical research method, the questionnaire developed by the researcher relies on 19 components identified in the previous step. The experts' opinions proved the validity of the questionnaire—moreover, its reliability in 0.94 (Cronbach alpha). The data was analyzed by SPSS and LISREL, and the results of the data analysis demonstrate that the proposed model is a good fit. Among the 19 components surveyed, all are above average. Finally, the results indicated that the most critical components from e-learners' view which more critical in digital learning were effective communication, use of the computer, active learning, learning skills, resilience, motivation toward e-learning, emotional intelligence, interaction with e-learning system, self-direct learning, time management, flexibility and adaptability, critical thinking, creativity, asking someone for help, leadership skills, stress management, self-organized, cognitive skills and self-assessment.

**Keywords:** Coronavirus, Ability, Skill, E-Learner, Digital Learning, University of Tehran.

## Introduction

The COVID-19 Pandemic has significantly impacted higher education systems worldwide (Crawford et al., 2020). Higher education institutes have abruptly and nearly permanently closed their campuses and decided to establish online learning. They have also repatriated the students identified as high-risk cases to contract the COVID-19. However, the COVID-19 Pandemic grows rapidly in many countries such as Iran; therefore, campus administrators have been responsible for determining their fall plans. Institutional responses varied considerably, including the establishment of e-learning. Despite the intention to provide students with a conventional experience on campus, the necessary conditions for preventing the COVID-19 contraction, such as wearing face masks, observing physical distances, and preventing public gatherings, must be considered. In addition to this uproar, many initially reopened institutes had to change courses rapidly due to the on-campus spread of the COVID-19, which resulted in students being sent back home to participate in online courses (Ledder et al., 2020). The COVID-19 outbreak has resulted in the sudden shutdown of schools, colleges, universities, and other state-run institutes.

It is also necessary to recall that the Industrial Revolution quickly affected various aspects of societies in the 21st century when modern technologies have been binding and recommended. With the advent of digital technology, global developments are expanding and concentrating on information and knowledge elements (Handke, 2020). These developments also make significant advances in global education systems and provide universities and institutes with novel approaches to teaching and learning (Dilmac, 2020). The novel approaches are known as e-learning, distance learning, flexible teaching and learning, and open learning. As discussed earlier, although higher education institutes have been closed due to the COVID-19 outbreak, many efforts have been made to ensure that the teaching-learning process would not stop and would continue through information and communication technology and television programs. Therefore, it can be stated that higher education centers have been closed; however, education has not been stopped. In these challenging times, teachers are using e-learning platforms to provide educational opportunities for students. In fact, e-learning refers to the use of modern technologies to access curricula outside the conventional classroom settings. The use of desktop computers, laptop computers, or smartphones and the Internet can provide rapid growth in e-learning, proving to be the best in all fields of education, especially during this Pandemic (Radha, Mahalakshmi, Kumar & Sivakumar, 2020). Therefore, efforts and experiences in this method of learning are greatly appreciated worldwide (Ibrahim & Heijden, 2019). Due to certain advantages such as flexibility, student orientation, and independence from space and time constraints, e-learning has managed to find a particular position in education, especially in higher education systems.

According to a literature review, the quality of e-learning depends on several factors and variables such as teachers, learners, technology equipment, instructional designs, financial resources, and training policies.

Moreover, e-learning is student-centred. In other words, learners play a significant role in this approach. Consequently, the success of an e-learning system requires learners with specific skills to participate in this kind of education (Astafieva, Zhyltsov, Proshkin & Lytvyn, 2020). The negligence of their required abilities and skills can deprive learners of the necessary satisfaction and desire to learn and reduce their effectiveness (Lopez, Manuel, Vazquez & Ramirez, 2020). Therefore, it is essential to pay close attention to the roles of learners and their required skills in e-learning environments during the COVID-19 Pandemic. Hence, this study focuses on identifying and assessing student abilities and skills in a digital context during the COVID-19 Pandemic. The research results enable policymakers to better implement education in crises by improving the most critical factors of learner preparation.

Thus, the most important research questions are as follows:

1. What skills and abilities do learners require in a digital environment during the COVID-19 Pandemic?
2. What is the current status of skills and abilities required by e-learners?
3. How are the components ranked from an e-learner's perspective?

## **Literature review**

The COVID-19 refers to the coronavirus disease 2019 caused by the novel coronavirus 2019 or “2019-nCoV” (Bender, 2020). The COVID-19 is associated with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV) that can also be life-threatening (Meng, Hua & Bian, 2020). The novel virus spreads within minutes through a droplet or by touching surfaces, metals, or other materials infected with respiratory problems. Elder and very young children are easily affected; however, it is not safe once the body survives this novel infection. Therefore, everyone is susceptible to its devastating effects (Bender, 2020; Meng, Hua & Bian, 2020, cited by Toquero, C. M. (2020)). The World Health Organization (WHO) (2020, b) has announced that the COVID-19 is a pandemic and introduced top 10 countries for reporting cases like China, Italy, the United States of America, Spain, Germany, Iran, France, South Korea, Switzerland, and the United Kingdom (WHO, 2020a). For safety measures against the COVID-19, thousands of schools have been shut down worldwide. As of April 6, 2020, UNESCO (2020) reported that 1,576,021,818 students were affected out of 91.3% of the total registered students in 188 countries at all levels of education.

Based on an online report issued by the Department of Health (DOH, 2020), the COVID-19 Pandemic has left a massive impact on educational institutes, most of which have postponed in-person classes. Since educational institutes are closed, many countries worldwide have focused on e-learning because it is an alternative to conventional learning. In fact, e-learning refers to the use of ICT in teaching and learning processes (Alqahtani & Rajkhan, 2020). According to the Organization for Economic Cooperation and Development

(OECD), e-learning is defined as the use of ICT in various learning processes to enhance and support learning in higher education institutes as well as in-person classrooms by adopting conventional, complementary learning, online learning, or a combination both methods ( Arkhorful & Abaidoo, 2015). In this study, e-learning refers to a method students use the Internet to acquire knowledge, create personal emotions, develop learning experiences, and grasp learning materials and interact with content, educators, and other learners to gain support during the learning process. Therefore, the students trained in this method need diverse abilities and skills to succeed. Due to the current COVID-19 Pandemic and the transition from conventional learning to e-learning, and the use of e-learning as a completely student-centred approach, students need a wide range of competencies to succeed in digital environments. In other words, it is naturally essential to pay attention to learner needs and identify the necessary skills and abilities required in designing online learning methods. Practical experience has shown that assessing the requisite skills of learners has had a long history in higher education studies. According to Table 1, many studies have been conducted on the competencies of e-learners. Some of the most prominent studies are highlighted in this table. For example, Mirke, Kasparova, and Cakula (2019) indicated that digital skills such as information literacy, communication, collaboration, digital content creation, and problem-solving were necessary for lifelong learning. These skills help students learn with confidence in an e-learning environment.

Sanchez, Cervera, and Esteve (2020) stated that students should have specific competencies such as content creation, ethics, problem-solving, and technical skills. According to their findings, most students lack these skills and should be made aware of them.

Stephanie (2020) found that students should have specific competencies such as leadership skills, flexibility and adaptability, critical thinking, technical knowledge, communication, emotional intelligence, creativity, and innovation. Muhia (2020) indicated that students should have soft skills such as self-directed learning, negotiation skills, stress management, self-assessment, and resilience. He concluded that all countries should ensure that the outputs of their education systems would be the students who could be competent in school, social, and emotional terms. The competency-based program has promoted digital literacy, communication, collaboration, critical thinking and problem-solving, creativity and imagination, and social responsibility. Although there are no definite sets of soft skills that can help tackle the challenges in everyday life, people should be purposeful in acquiring diverse delicate abilities to put them to practice when they confront challenging conditions. Huang, Lei, Xu, Liu, & Yu (2020) emphasized that digital technology changed the way people learn and created more learning opportunities. Therefore, learners who take e-Learning courses need digital and socioemotional skills. In addition, resilience is now identified as a mechanism for helping students adjust to current and future crises. Gay (2020) stated that the competencies of students during the COVID-19 were technical readiness (which evaluates a

student's possession of and access to technology such as devices with appropriate software, access to the Internet and stable network connectivity, and digital literacy skills), study habits (e.g., essay writing skills and ability to collaborate online, student interaction with the course content, savviness with online communication), and preference for online learning (e.g., self-directed learning and self-confident). These competencies help students do their best during this Pandemic. Chung, Noor, and Mathew (2020) pointed out that the students using the e-learning approach during the COVID-19 Pandemic would need specific skills to do their best in this kind of learning. Based on their research findings, students need a computer (hardware and software) and cognitive and self-assessment skills, which are more critical to success in a digital learning environment.

Maksyutova and Zolotyh (2020) indicated that digital technology changed people's learning styles and created more learning opportunities. The online learners who have no experience in e-learning need digital skills and abilities, including 1- the use of digital devices and programs to access network resources and the skills to search for information; 2- critical thinking that means the ability to read, select, analyze, interpret, and evaluate data; 3- ethical behaviour related to the ability to communicate effectively and constructively with other people. Pham and Tran (2020) stated various factors raised by students' acceptance of e-learning systems in universities. They described a series of skills that the learners would need to actively and effectively participate in online courses, such as computer-related skills, communication skills, innovation, and creativity. Reimers, Schleicher, Saavedra, and Tuominen (2020) stated that students should have specific competencies in online learning systems such as learning skills, meta-cognitive skills, technical skills, communication skills, and self-directed learning skills.

Torun (2020) described e-learning during the COVID-19 Pandemic as a predictor of academic success. Students require specific skills and abilities such as computer self-efficacy, internet self-efficacy, online self-efficacy, self-learning, learner control, and motivation for online learning. Analyzing the results acquired from the previous studies, the increasing speed of changes and developments in the higher education system, and the need to keep up with these changes have multiplied the necessity and importance of identifying the competencies required by learners. According to Table 1, an appropriate model should consider students' capabilities from different dimensions. Therefore, the existence of a research gap in this regard necessitates identifying and analyzing the competencies of learners in a digital environment.

Table 1. Skills and abilities required by learners in an e-learning environment

Researchers (year)	Dimension/Factor
Stephanieh, 2020	Leadership skills, flexibility and adaptability, critical thinking, tech-savvy, communication, emotional intelligence, creativity, and innovation
Muhia, 2020	Self-directed learning, adaptability, negotiation skills, stress management, self-assessment, and peer pressure resilience
Huang, Lei, Xu, Liu & Yu, (2020)	Digital skills, emotional intelligence, and resilience
Gay, 2020	Technical readiness (which evaluates a student's possession of and access to technology such as devices with appropriate software, access to the Internet and stable network connectivity, and digital literacy skills), study habits (e.g., essay writing skills and ability to collaborate online, student interaction with the course content, savviness with online communication), preference for online learning (e.g., self-directed learning, self-confident)
Chung, Noor & Mathew, 2020	Students require computer-related skills (hardware and software), cognitive skills, and self-assessment skills.
Torun, 2020	Computer self-efficacy, Internet self-efficacy, online self-efficacy, self-directed learning, learner control, and motivation toward e-learning
Widodo, Wibowo & Wagiran, 2020	Technology skills, self-directed learning skills, motivation, and perceived usefulness
Aboagye, Yawson & Appiah, 2020	Effective communication, reading and writing skills, and learner intentions toward e-learning
<u>Deligiannis, 2020</u>	Enthusiasm for upskilling creativity, effective communication, problem-solving, emotional intelligence, and adaptability to change
Berger, Garcia, Catagnus, & Temple, 2021	Time management, structuring a personal learning environment, active learning, and asking for help
Huang, Liu, Amelina, Yang, Zhuang, Chang, & Cheng (2020).	Active learning, self-regulated learning, scheduling learning and playing in balance, selecting on-demand learning resources, and cooperative learning, checking the quality of learning
Reimers & Schleicher, 2020	Cognitive skills, interpersonal skills, creativity, self-efficacy, leadership, responsibility, and asking for help
Chong, Chen, Lien, Yang, Wang, Liu & Ko(2021).	Boosting study skills and keeping up social connections
<u>Papaki, 2020</u>	Critical and contextual thinking, creativity, empathy, and resilience
Almaiah, Al-Khasawneh & Althunibat, 2020	IT skills and positive interaction with e-learning system
Hamade, L. (2020)	Time management, staying in touch with professors, setting up a healthy learning environment, and instructions for using the most online learning tools
Gillingham, L. (2020).	Time management, study skills, stress management, money management, assertiveness skills, well-developed self-care skills, keeping safe and avoiding risky behaviour, seeking assistance when needed, respecting the rules and policies, and showing honesty, integrity, and perseverance
Sanchez, Cervera & Esteve, 2020	Information skills, communication, content creation, ethical skills, problem-solving, and technical skills
Kennedy & Foster (2021)	Self-organization, planning a schedule, adjusting study strategies, working in groups
Deasy, 2020	Self-organization (identifying the learning objectives and goals, building a study plan, setting aside specific time for learning), optimizing learning (having a dedicated study space and improving the digital literacy), adapting the learning habits (finding the proper study technique, diversifying learning habits), connecting with others, staying positive and informed (taking study breaks, exercising, rewarding yourself for your work), and finding reliable information resource

The components repeating two or more times were selected. According to the background of the research, for classifying all of the components, were used two primary resources 1) Occupational Information Network<sup>1</sup>, 2) classified by using Economic Co-operation and Development<sup>2</sup> in OECD framework for 2030. According to the definition in Occupational Information Network<sup>1</sup>, abilities are enduring attributes of the individual that influence performance and skills are developed capacities that facilitate learning or the more rapid acquisition of knowledge. Finally, a more general classification of learners' required abilities and skills will be provided for e-learning environments.

Table 2. Classifying learner's skills and abilities in e-learning environments

Classification of skills and abilities of e-learners	Components
Skills	Using computers (hardware and software), learning skills, self-directed learning, time management, critical thinking, leadership skills, stress management, self-organization, cognitive skills, self-assessment, asking for help
Abilities	Creativity and innovation, effective communication, flexibility and adaptability, emotional intelligence, resilience, active learning, motivation toward e-learning, interaction with e-learning system

## Materials and Methods

### Statistical Population

The statistical population included 16 faculties of the University of Tehran and 13,532 on-campus e-learning courses within the 2020–2021 academic year. The Cochran formula and the proportionate stratified sampling technique were employed to select 374 students as respondents.

### Measurement Tool

In this applied mixed-methods study, 33 components were identified for students in the digital context. The most frequent components were identified and delivered by experts to determine their importance. Finally, 19 components were selected and classified as two general groups called skills and abilities. Based on the 11 skills and eight abilities, a questionnaire was designed with 50 items on a six-point Likert scale (1 for “very high” and 6 for “very low”). For validation of the research tool, content validity and construct validity methods were employed. For content validity, the views of seven e-learning experts were used through the content validity index (CVI). Experts classified the items as 1 for “irrelevant”, 2 for “relatively relevant”, 3 for “relevant”, and 4 for “completely relevant”. After the expert feedback was obtained, the CVI was calculated at 0.85, indicating the appropriateness of the questionnaire items. In addition, confirmatory factor analysis was used for construct validity.

1. O NET [O net \(2021\). https://www.onetcenter.org/content.html](https://www.onetcenter.org/content.html)

2. OECD

The results indicate that the proposed model is appropriate and that the sample data supports the proposed model. The reliability was reported 0.94 by Cronbach's alpha.

## Data Analysis

The statistical tests such as univariate t-test, confirmatory factor analysis, and Friedman test were conducted to analyze the findings in SPSS and LISREL.

Table 3. Distribution of participants by Faculty/College

Faculty/College	Students
Faculty of Law and Political Science	750
Faculty of Economics	261
Faculty of Theology and Islamic Studies	306
Faculty of Management	1111
Faculty of Physical Education and Sport Sciences	728
Faculty of Foreign Languages and Literature	576
Faculty of Psychology and Education Sciences	532
Faculty of Entrepreneurship	677
Faculty of Literacy and Human Sciences	677
College of Engineering	3801
College of Fine Arts	1134
Faculty of Science	898
Faculty of Geography	566
Faculty of Social Sciences	426
Faculty of New Sciences and Technologies	796
Faculty of World Studies	293
Total	13532

## Data Analysis

1. Identifying the components of abilities and skills required by learners in the e-context during the COVID-19 Pandemic:

According to the literature review, 19 components were identified as skills and abilities. The 11 skill components were the use of a computer (hardware and software), learning skills, self-directed learning, time management, critical thinking, leadership skills, stress management, self-organization, cognitive skills, self-assessment, and asking for help. Moreover, the eight ability components were creativity and innovation, effective communication, flexibility and adaptability, emotional intelligence, resilience, active learning, motivation toward e-learning, and interaction with e-learning systems. The second-order factor analysis was employed to ensure the relationships of components and the validation of the resultant model.

Table 4 shows the confirmatory factor analysis (CFA) fit indices of the initial questionnaire.



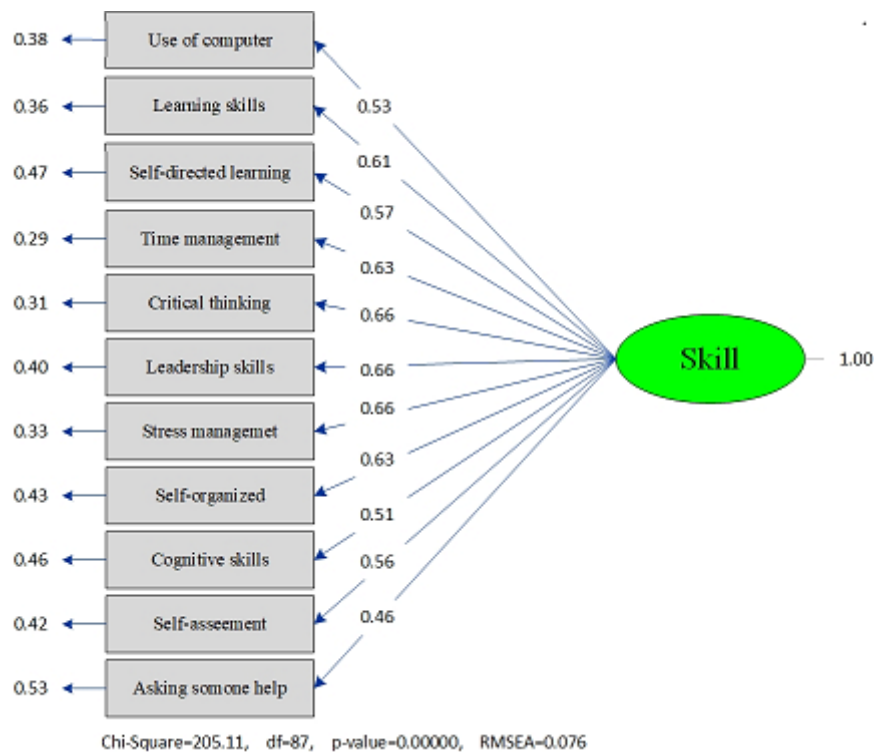


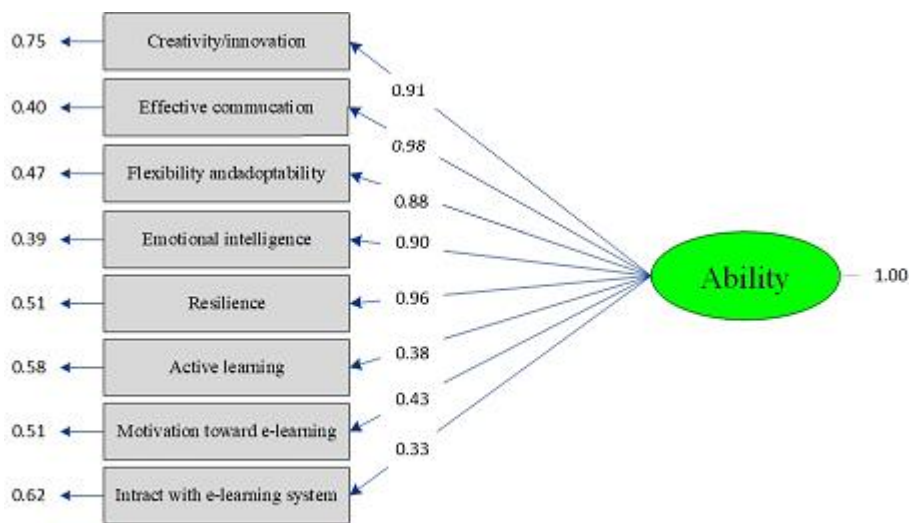
Figure 1: Standardized coefficients related to skills

Table 4. The indices of the model fitness

Index	Model Estimation	Result
$X^2$	Df=87 205.11 P= (0.000)	Confirmed
$X^2/df$	2/35	Desirable
RMSEA	0.076	Acceptable
SRMR	0.042	Desirable
GFI	0.97	Desirable
AGFI	0.96	Desirable
CFI	0.98	Desirable
NFI	0.97	Desirable
NNFI	0.96	Desirable

According to Table 4, the chi-square value was reported 205.11, which is significant at the level of 0.05. The  $X^2$  test analyzed the null hypothesis ( $H_0$ ), stating no differences between the sample covariance matrix and the implicit covariance matrix (community). As a result, the chi-square test confirmed the correct fit of the model to the observed data. Since  $X^2$  is sensitive to the sample size, some researchers use the chi-square-to-freedom ratio ( $DF / X^2$ ) as an alternative index. A value below three is considered a good fit (Bolen, 1989). The chi-square ratio was calculated at 2.35, which indicates a good fit for the model. Moreover, the root error index of the mean squares of the RMSEA approximation was reported at 0.076,

which indicates that the model had an acceptable fit. The SRMR value for the model was reported as 0.042, which indicates a good model fit. GFI and NFI values were estimated at 0.97, suggesting a good model fit for the values ranging between 0.95 and 1. Furthermore, the AGFI value ranging between 0.90 and 1 was estimated at 0.96 in the proposed model. The value of NNFI was reported 0.96 indicating good signs of the model fit. Finally, the CFI value of the model was estimated at 0.98, which indicates a good model fit. Therefore, it can generally be stated that the proposed model had a good fit, and the sample data supported the developed model.



Chi-Square=101.74, df=35, p-value=0.00000, RMSEA=0.078

Figure2:Standardized coefficients related to abilities

Table 5. The indices of the model fitness

Index	Model Estimation	Result
X <sup>2</sup>	DF=35 101.74 P= (0.000)	Confirmed
X <sup>2</sup> /df	2.90	Desirable
RMSEA	0.078	Acceptable
SRMR	0.043	Desirable
GFI	0.97	Desirable
AGFI	0.99	Desirable
CFI	0.96	Desirable
NFI	0.97	Desirable
NNFI	0.96	Desirable

According to Table 5, the model fitness was assessed with the model chi-square test (X<sup>2</sup>). Moreover, the root mean squares of the approximation (RMSEA) for the proposed model were reported at 0.078, a value that indicated the model was acceptably fit. The SRMR value

was reported at 0.043, whereas GFI and NFI were estimated at 0.97, indicating a good model fit for the values ranging between 0.95 and 1. Furthermore, the AGFI value of good models ranging between 0.90 and 1 was estimated at 0.99 in the proposed model. Reported 0.96 in this study, the NNFI values between 0.95 and 0.97 are the acceptable signs of model fit. Finally, the CFI values ranging between 0.97 and 1 indicate the good model fit; however, it was estimated at 0.96 in this study. Therefore, it can generally be stated that the proposed model had a good fit, and the sample data supported the proposed model.

Table 6. Evaluation results of the measurement section for the general model

Hidden variables	Obvious variables	$\beta$	T	$R^2$
Skill	Use of computer	0.53	--	0.38
	Learning skills	0.61	7.12	0.36
	Self-directed learning	0.57	8.73	0.47
	Time management	0.63	9.39	0.29
	Critical thinking	0.66	15.17	0.31
	Leadership skills	0.66	14.08	0.40
	Stress management	0.66	11.12	0.33
	Self-organization	0.63	6.90	0.43
	Cognitive skills	0.51	10.08	0.46
	Self-assessment	0.56	8.07	0.42
	Asking for help	0.46	6.92	0.53
Ability	Creativity/innovation	0.91	--	0.75
	Effective communication	0.98	25.36	0.40
	Flexibility adaptability	0.88	9.09	0.47
	Emotional intelligence	0.90	7.01	0.39
	Resilience	0.96	9.08	0.51
	Active learning	0.38	5.04	0.58
	Motivation toward e-learning	0.43	9.03	0.51
	Interaction with e-learning system	0.33	6.08	0.62

## 2. Assessing the status of learners based on known abilities and skills

A one-sample t-test was conducted for analysis in this section. Table 7 reports the results

Table 7. Status of learners based on the identified components

Component	t	df	Sig	Mean	Mean Difference	Result
Use of computer	15/17	272	0/001	3/89	0/39	Above average
Learning skills	8/42	272	0/001	3/75	0/25	Above average
Self-directed learning	16/14	272	0/001	3/82	0/39	Above average
Time management	10/15	272	0/001	3/78	0/22	Above average
Critical thinking	8/04	272	0/001	3/71	0/19	Above average
Leadership skills	5/14	272	0/001	3/61	0/15	Above average
Stress management	13/09	272	0/001	3/83	0/33	Above average
Self-organization	16/07	272	0/001	3/90	0/40	Above average

Cognitive skills	16/69	272	0/001	3/94	0/44	Above average
Self-assessment	9/31	272	0/001	3/68	0/18	Above average
Asking for help	8/21	272	0/001	3/72	0/20	Above average
Creativity/innovation	11/24	272	0/001	3/91	0/42	Above average
Effective communication	8/01	272	0/001	3/91	0/32	Above average
Flexibility adaptability	10/12	272	0/001	3/72	0/43	Above average
Emotional intelligence	15/76	272	0/001	3/85	0/31	Above average
Resilience	5/89	272	0/001	3/59	0/17	Above average
Active learning	13/93	272	0/001	3/88	0/26	Above average
Motivation toward e-learning	8/91	272	0/001	3/88	0/33	Above average
Interaction with e-learning system	9/67	272	0/001	3/75	0/34	Above average

### 3. Prioritizing the ability and skill components required by learners based on their views

The Friedman test was employed to analyze the prioritization of ability and skill components required by learners based on their views. Table 8 reports the results.

Table 8. The results of the Friedman test for analyzing the prioritization of ability and skill components required by learners based on their views

Components	Mean Rank	Priority
Effective communication	12/46	1
Use of computer	12/40	2
Active learning	12/13	3
Learning skills	12/09	4
Resilience	11/29	5
Motivation toward e-learning	11/04	6
Emotional intelligence	10/87	7
Interact with e-learning system	10/52	8
Self-directed learning	10/48	9
Time management	10/24	10
Flexibility and adaptability	9/32	11
Critical thinking	9/30	12
Creativity/innovation	9/28	13
Asking for help	8/14	14
Leadership skills	7/98	15
Stress management	7/86	16
Self-organization	7/33	17
Cognitive skills	6/78	18
Self-assessment	6/48	19

According to the Friedman test results, the most critical components of abilities and skills required by learners were effective communication, use of a computer, active learning, learning skills, resilience, motivation toward e-learning, emotional intelligence, interaction with e-learning system, self-direct learning, time management, flexibility and adaptability,

critical thinking, creativity/innovation, asking for help, leadership skills, stress management, self-organization, cognitive skills, and self-assessment, respectively.

## **Discussion and Conclusion**

During the COVID-19 Pandemic, higher education institutes and universities must identify the abilities and skills required by learners on an electronic platform. Therefore, all universities have decided to hold classes online on electronic platforms. This study aimed to identify the abilities and skills required by learners on an electronic platform at the University of Tehran. A total of 19 abilities and skills components required by learners were proposed and classified as two general categories, i.e. skills with 11 components and ability with eight components. The skill category included 11 components identified as the use of a computer (hardware and software), learning skills, self-directed learning, time management, critical thinking, leadership skills, stress management, self-organization, cognitive skill, self-assessment, and asking for help. These components align with the findings reported by Berger, Garcia, Catagnus, & Temple (2021), Reimers and Schleicher (2020), Gillingham (2020), Aboagye, Yawson and Appiah (2020), Huang, Liu, Amelina, Yang, Zhuang, Chang, & Cheng (2020), Widodo, Wibowo and Wagiran (2020), Torun (2020), Chung, Noor and Mathew (2020), Gay (2020), and Muhia (2020). In a study, Gay (2020) pointed out the importance of skills and experience and stated that enhancing the student skills would improve their competencies and help students with the desired professions. According to Gay (2020), the skills related to learners within the context of e-learning were critical and vital for them to do their best in that context and help them succeed during the COVID-19 Pandemic. The study conducted at Gillingham (2020) also reported that some skills were required for students in an electronic context during the COVID-19 Pandemic. The skills were identified as time management, learning skills, stress management, and assertiveness, which were essential for attending online courses. According to Chung, Noor, and Mathew (2020), since the primary tool for learning in the electronic context is a computer, the students who have sufficient skills and knowledge of hardware and software can perform better in learning within the electronic context. Chong, Chen, Lien, Yang, Wang, Liu, & Ko (2021) pointed out the importance of learning skills and stated that students should learn how to make notes more efficient to remember their lessons better. They should also learn how to organize themselves better to work at peak times when their minds are more transparent to adapt to assignment completion. Muhia (2020) believed that e-learning would be a student-centred approach. Students should have self-directed learning skills to succeed in this learning approach. Muhia also believed that the students having this skill would perform better in learning because the electronic context is completely student-centred and requires personal decisions by students. Therefore, the students who can act independently in this context will be more successful in learning. The eight components of the ability category were identified as creativity and innovation, effective communication, flexibility and adaptability, emotional intelligence, resilience, active learning, motivation toward e-learning, interaction with e-learning systems.

These components align with the findings reported by Stephanieh (2020), Muhia (2020), Torun (2020), and Papaki (2020). The abilities of learners are among the essential factors for them to attend e-learning courses. By comparing the students with and without the necessary abilities, Papaki (2020) concluded that the lack of necessary abilities within the e-learning context would lead to failure and inefficiency to attend courses. Both Deligiannis (2020) and Stephanieh (2020) stated that creativity and innovation would be the necessary abilities required by learners within the e-learning context and that the students who succeeded in online courses needed such abilities. They also identified communication as the most critical factor in learning, whether face-to-face or online. Improving the ability to communicate effectively can increase the use of collaborative learning ability. Analyzing the abilities required by students within the electronic context, Muhia (2020) discussed the importance of student adaptation in the e-learning environment and stated that this learning approach was new. Due to the COVID-19 Pandemic, all students have to use this type of learning. Therefore, they need to adapt to this method, for it can help them do their best. Active learning is another ability that helps students in the e-learning environment. Active learning is an approach to instruction that actively engages students with the course material through discussions, problem-solving, and case studies.

According to Huang, Liu, Amelina, Yang, Zhuang, Chang, & Cheng (2020), having this ability can help students reinforce essential materials, concepts, and skills. It also provides students with an opportunity to think about, talk about, and process course materials to create personal connections to materials. This study also aimed to evaluate the abilities and skills required by learners based on the identified factors from their perspective. The analysis results showed that all components were above average. Moreover, the study sought to rank the components of abilities and skills required by learners from their points of view. According to the results, the following components were identified as the most important to students: 1) effective communication, 2) use of a computer, 3) active learning, 4) learning skills, 5) resilience, 6) motivation toward e-learning, 7) emotional intelligence, 8) interaction with e-learning systems, 9) self-directed learning, 10) time management, 11) flexibility and adaptability, 12) critical thinking, 13) creativity/innovation, 14) asking for help, 15) leadership skills, 16) stress management, 17) self-organization, 18) cognitive skills, and 19) self-assessment. Based on the status of abilities and skills required by learners and their importance in higher education systems, the following recommendations were made to maintain the current conditions and improve them in the future:

- According to the perspectives of students in skill factors, the use of computers was ranked first. Therefore, learners must have basic information about computers (hardware and software), and those who lack sufficient information should improve their skills.
- According to the perspectives of students in skill factors, learning skills was ranked second. Hence, the teachers of online courses must pay attention to the differences of students, and the assigned projects should be appropriate to their study skills.

- According to students' perspectives, effective communication plays a critical role in their success in the e-learning environment. Thus, a proper context should be provided for mutual interactions. Furthermore, teachers should provide students with a chance to express their opinions and ask questions. It is also possible to provide an adequate communication context by encouraging students to join in-class discussions and express their viewpoints.
- According to the perspectives of students inability factors, resilience was ranked second.

### **Research Limitations**

This study faced the following limitations: There were several limitations on providing valuable recommendations and suggestions for future research. First, the statistical sample included 374 participants; however, 308 questionnaires were collected due to the COVID-19 Pandemic. Second, only a few studies have identified the abilities and skills required by learners within the electronic context. Therefore, a qualitative approach was employed to identify the necessary abilities and skills from the perspectives of key stakeholders (i.e., students, faculties, etc.).

### **Conflict of interest**

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

### **Funding**

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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#### **Bibliographic information of this paper for citing:**

Narenji Thani, Fatemeh, Tizhoosh Jalali, Fatemeh & Mostafavi, Zeinab sadat (2021). COVID-19 and e-Learning: The skills and abilities required for e-learners in higher education during the coronavirus era. *Journal of Information Technology Management*, 13(4), 39-56.

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