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ORIGINAL PAPER

# A constantly improving model for universities readiness in the application of e-learning practices during the COVID-19 pandemic: a qualitative approach

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## Abstract

The sudden outbreak of a lethal virus known as the COVID-19 pandemic spotlighted e-learning systems worldwide. That forced instructors and faculty members around the world to try the existing instructional platforms in an attempt to shift toward an effective unprecedented learning system. The present study concentrated on enhancing a specific e-learning system experienced for the first time at the University of Tehran (UT) that faced several difficulties in the development process due to the lack of required readiness in diverse aspects. As a phenomenological approach bordered with a descriptive-interpretive framework, the study targets a group of 2000 faculty members at 35 diverse departments of the UT. Data have gathered from 603 faculty members using voice calls, video calls, and emails and then analyzed and diverged into four fundamental segments: sociocultural readiness, pedagogical readiness, organizational readiness, and technological readiness (SCPOT-R). Our findings indicated some remarkable results that underline the significance and high priority of virtual and electronic learning methods since the expansion of COVID-19 and following physical restrictions.

**Keywords** E-learning · Education during the COVID-19 Pandemic · The SCPOT-R model

## Abbreviations

| | |
|---|---|
| COVID-19 | 2019 Novel coronavirus |
| E-learning | Electronic learning |

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| | |
|---|---|
| SCPOT-R | Sociocultural readiness, pedagogical readiness, organizational readiness, and technological readiness |
| UT | University of Tehran |
| WHO | World Health Organization |

## Introduction

The sudden spread of contagious COVID-19 shocked humanity in multiple aspects of life. The subject of education was one of the most challenging aspects in which teachers, instructors, and professors had to shift toward online teaching overnight (Dhawan 2020). As the pandemic temporarily shut down universities and higher education institutions, about 1.5 billion learners on the planet lost their chance to present in classrooms. In response to these difficult circumstances, world authorities and the government of the Islamic Republic of Iran altered their view of using various electronic/virtual learning systems. But the results of this modification may not necessarily be as desirable as expected and regarded not only as an opportunity given to the fourth industrial revolution and digital transformation in all parts of societies but also as a serious threat to higher education (Petrillo et al. 2018). Although there are mixed views on how this form of instruction stands implemented in education and learning design (Torrau 2020; Dron 2018), one can acknowledge that professors who use new teaching methods play a vital role in innovation and transformation. This way of teaching motivates innovation and enables the application of new tools and technologies which assign students a more active role, promote network literacy and access to free resources, shape pathways to group learning, and provide opportunities for professional development (Paskevicius and Irvine 2019).

### University e-learning system

In a technology-based education, context-based e-learning is an innovative learner-centered concept. In describing features of e-learning, Tavangarian et al. (2004) pointed out that e-learning consists of various scholarly supports based on electronic tools of teaching–learning processes. The goal is to build knowledge based on personal experience, practice, and the learner's knowledge regardless of the acquisition of this knowledge does not always cover the same extent.

Concerning the current conditions of e-learning courses, Bloom's revised taxonomy provides an appropriate tool for enhancing the quality of the models adopted for e-learning in the moment of COVID-19. Because of its comprehensive nature, different researchers have used Bloom's revised taxonomy (Castleberry and Brandt 2016; Krathwohl 2002; Hubalovsky et al. 2019) for any characteristic of the learning process that needs validation and assessment of the extent to which learning objectives are designated.

Further can be inferred from reviewing the research background on e-learning environments. Several studies examined learning environments in terms of assessment: these include investigations that covered areas such as designing e-learning

environments and their connection to the internet of things (Freigang et al. 2018); e-learning and traditional learning environments, dynamic and structural elements of the learning environment (Dron 2018); examining realities in the application of e-learning tools into learning and teaching in universities (Al-Hamad et al. 2020); explaining assessment approach and educational context for studying features and advantages of new tools employed in education and the outcome of using this approach (Martens et al. 2019).

Another group of studies (Wang and Wu 2008) conducted in different environments with various research methodologies suggested that students who receive effective, timely feedback in e-learning environments exhibit better and higher-quality performance in e-learning. These studies showed the importance of providing a framework to assess student learning impact by emphasizing assessment during the learning process (Wang et al. 2019). The literature on e-learning environments points to the need for further systematization requires the development of models for designing several constructs, such as user-centered design, educational diversity, blended learning spaces, and facilitating mixed or blended learning (Freigang et al. 2018).

An e-learning environment is an atmosphere based on personal characteristics consisting of e-learning (human and non-human) components. This environment enables addressing weaknesses of the learning environment through interventions while addressing problems in physical environments (Dron 2018). More satisfactory methods can be used as a reference to develop models that can agreeably display student behaviors (Wang et al. 2019). Those methods represent "instructors' use of web-based computer-aided tools for learning" (Tatnall 2020).

## Learning in bloom's taxonomy

This section discusses several models used to develop ideas on e-learning, beginning with a discussion of Bloom's taxonomy and its comprehensive interpretation, pursued by a review of TPACK. Then a parallel model is drawn between existing models to better explain the research findings along these lines.

The mastery of E-learning characteristics can diverge into four measurements: professors, students, information technology, and support from the university (Selim 2007). The issue is uncovering how different faculty use of the e-learning environment is influenced by their opinions and preferences when they need to understand web-based activities and computer-aided learning (Tatnall 2020). Thus, a deep knowledge of professors' goals in adopting an e-learning environment is required to identify challenges and factors involved in the time of COVID-19 and to determine their openness to the e-learning environment and the solutions proposed in this regard. To this end, Bloom's taxonomy (Bloom et al. 1956) presents a good candidate for assessing how the process of imparting learning is affected by the learning environment and the professor's familiarity with teaching–learning approaches. Bloom et al. (1956) developed a classification of learning objectives to help professors assess course materials and test results, expecting that the model would classify cognitive functions in some way systematically.

Bloom et al. (1956) identified six different levels of objectives: (a) knowledge focuses on keeping, recognizing, and remembering information; (b) understanding enshrines the organization of ideas and interpretation of information; (c) application concerns problem-solving and applying details and principles; (d) analysis centers on dissecting a whole into its parts for learning; (e) synthesis or creating represents synthesizing a combination of ideas to shape a new important thing; and (f) assessment which is the highest level on Bloom's taxonomy and focuses on a judgment about problems and resolutions. Each level is above its preceding levels and combines them into a process of reaching maturity at higher levels. The affective domain represents a method in which individuals address something with their feelings, whereas the psychomotor domain involves motor skills.

Bloom's revised taxonomy has considerably used by many authors (Franchi 2020; Dickinson and Gronseth 2020; Sheth et al. 2020) and consists of two dimensions: (1) metacognitive dimension including remembering, understanding, applying, analyzing, and creating, and (2) knowledge dimension which was developed by Anderson and Bloom (Anderson and Krathwohl 2001; Lau et al. 2018) using a construct consisting of factual, conceptual, procedural, and metacognitive knowledge (Krathwohl 2002; Lau et al. 2018).

Factual knowledge includes features required for understanding and problem-solving, while facilitating the practical application of knowledge to experience and analyze facts. Procedural knowledge involves the implementation of processes to achieve results and functional efficiency. It also involves technical details beyond the level expected in factual and conceptual knowledge categories that require recognition of specific procedures or methods. Conceptual knowledge involves consistently linking individual concepts to each other, understanding complex processes as a result of developed factual knowledge, connection to matter-of-fact knowledge, and using the assessment, development, continuous evaluation, and planning dimensions in addition to discovery and teaching elements to mentor others in the area of factual knowledge.

And eventually, metacognitive knowledge, as the zenith of the knowledge measurement in Bloom's research that includes fragments of factual, conceptual, and procedural knowledge, requires awareness of one's cognition, ability to adapt to new processes and ways of thinking, plays a significant role in strategic thinking, and involves knowledge of past trends and application of cognitive dimensions such as observation, inference, surveys, and theorizing (Lau et al 2018). As a method for classifying academic goals that assess learner performance, Bloom's original taxonomy can be used by instructors to classify the levels of learning based on the expected outcome of a program.

The revised taxonomy links the knowledge category to the cognitive process category, which supports developing learning strategies and facilitates learning assessment. Since its introduction, this classification has received considerable attention from many authors (Franchi 2020; Dickinson and Gronseth 2020; Sheth et al. 2020), showing its significance in educational domains and particularly in e-learning (Castleberry and Brandt 2016). Although instructors mostly use it to assess the extent to which learning objectives have been realized (Chyung and Stepich 2003), the classification can also be of interest during an educational crisis like the one

posed by COVID-19 (Franchi 2020; Dickinson and Gronseth 2020; Sheth et al. 2020).

## Education and learning during the COVID-19 based on bloom's models and TPACK

The learning environment and the professor's acquaintance with teaching–learning approaches are so influential that student learning can take place over a spectrum ranging from superficial to deep understanding.

In bloom's classification, the first three levels (remembering, understanding, and applying) represent superficial learning, while the last three stations (analysis, synthesis, and assessment) represent deep learning. In physical classrooms where students and professors are physically present in the same place, it is possible to provide immediate feedback with professor–student interaction which can be viewed as the core of learning (Mirzaee 2020).

In actual classrooms, professors often experience complications regarding the individualization of students learning, and simultaneously, they should consider the average learning ability of students to complete the teaching–learning process at this moderated level. But in technology-enriched environments, including the space for the e-learning method, although instant feedbacks from the professor are rare, the professor can still individualize students' learning to enable them to access learning outcomes (Dron 2018).

Indeed, this requires an e-learning system where the professor, the learner, and the learning environment are all prepared to bring about the expected results. Students and professors must be thoroughly ready to put much more effort into learning and teaching. Moreover, a professor in a technology-enriched environment also needs techno-pedagogical skills (Svensson and Östlund 2007; Woldab 2014).

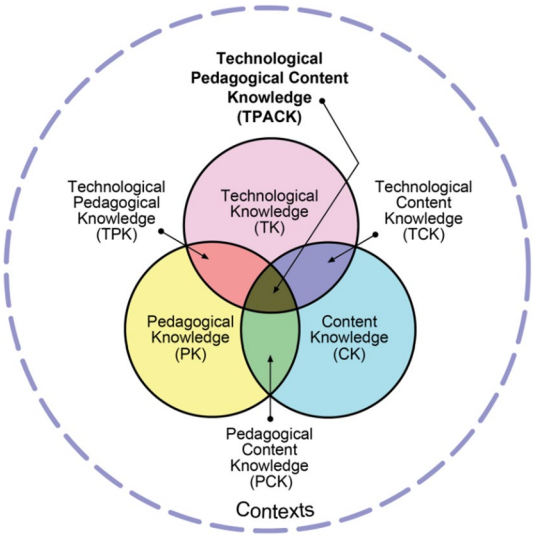
In line with the advancement in technology, TPACK (Koehler et al. 2012) was developed by adding technology as a new layer to a model proposed earlier by Shulman (1986). Mishra and Koehler (2006) put forth technological knowledge based on the definition of information technology. From this point of view, technical knowledge is beyond the traditional opinion of computer literacy. They believed that technological knowledge provides a deep understanding of how a diverse range of things are involved in applying information technology to the development of information, communication, and problem-solving throughout one's life (Mishra and Koehler 2006).

## Components of the TPACK model

In this view, the TPACK model consists of seven components (Fig. 1) which can be matched to the six types of teaching by faculty members in the time of COVID-19 based on a combination of different factors (infrastructure, organization, input, and process).

- Pedagogical knowledge (PK): It consists of a profound understanding of processes, approaches, and teaching and learning methods. That encloses educa-

**Fig. 1** TPACK model




tional goals, such as a general understanding of how students learn, classroom management and development, and curricula being implemented and assessed. In this circumstance, the instructors act in such a way that they would in an actual classroom. They operate digital texts as notes or manuscripts to lecture through audio messages. In this kind of system, the instructors apply the instructor-centered approach to education with limited interactions with students correspondingly to what they do in physical classrooms.

- Technological knowledge (TK): In its modern sense, technology includes the understanding of how to install, set up, and use computer software and hardware. That comprises skills such as system administration, using the internet, and working with programs like Word. Here, the professor uses media resources together with digital texts. In this variety of e-learning systems, the professor adds several media resources to digital textbooks.
- Content knowledge (CK): This represents the educators' knowledge of the content they are supposed to teach and what students are assumed to learn.
- Technological pedagogical knowledge (TPK): This is the knowledge of various technologies available for application in teaching and learning situations in complement to the understanding of how the way of teaching may change as a consequence of using these unrestricted technologies. In the two items above, the professor attempts to employ technological tools. He or she stresses professor–student interactions and the use of academic calendars, assignments, and learning sources. For this purpose, the professor prepares a lesson plan and offers it to the students, asking them to focus on learning objectives. In addition, prepared forums are used for this purpose (Calvo et al. 2013; Abel et al. 2009). Although the tools noted above can be used for teaching in these systems, the application of these tools depends on how well prepared the

students are and how skilled and experienced the professor is in using these tools.

- Technological content knowledge (TCK): This represents how specific contents are mutually linked to technology. Faculty members need to know not only about the content they teach but also about how these contents may change depending on technological requirements, since technological tools today may transform the structure of course subjects. Here, the professor acts as a mentor who guides the students. As a guide, the professor tries to establish professor–student interaction in the teaching–learning process where students are directed toward interactions with educational resources and content to realize learning objectives. In addition, attempts are made to establish collaboration between students.
- Pedagogical content knowledge (PCK): This proficiency determines which pedagogical approach matches each specific type of content. Here, the professor not just acts as a mentor/guide but additionally uses constructivist approaches (Anjaswari et al. 2020; Hung and Nichani 2001) and open educational resources (Mirzaee 2020; Rolfe 2012) to enable students to produce educational content and materials independently. In addition, in this system, teaching assistants work hand in hand with professors to support students.
- Technological pedagogical content knowledge (TPCK): This classification of knowledge is the outcome of and goes beyond the assortment of the three types of knowledge mentioned earlier, i.e., content, pedagogical, and technological proficiency. That requires a deep understanding of the concepts stated above and takes advantage of technology to structure content. In other words, this kind of knowledge enables solving educational problems using technology. The term abbreviated later as TPACK involves the establishment of an e-learning ecosystem that is defined by several features: (1) the professor, equipped with required skills, has been prepared for teaching in digital environments; (2) the students have acquired the skills required for affective and cognitive presence in the e-learning system before the learning process begins; (3) the course is offered based on the learners' needs, flexibility, and learning resources with a profound vision in an interactive manner; (4) the teaching–learning process takes place based on interaction and collaboration by and among the students; (5) learning analytics (Macfayden and Dawson 2012) help professors and professor assistants in assessing the learning process and providing constant feedback to students to achieve learning outcomes; and (6) quality requirements are followed not only by the professor but also by managers. In addition, to ensure quality, all structures, inputs, and system processes are constantly monitored and enhanced. In other phrases, the sixth type of e-learning system focuses on the active participation of students in the teaching–learning process in a simultaneous and non-simultaneous manner (Mirzaee 2020).
- A review of these seven components of TPACK with different levels of teaching based on learning levels in Bloom's revised taxonomy suggests that the first to the third types fall into the primary categories, and the fourth to the sixth types fall into the contextual categories of TPACK. In other words, the highest level of Bloom's revised taxonomy (i.e., exceeding cognitive level) in higher education. And during the COVID-19 pandemic and the university shutdown, almost

all classes had to be upgraded to this higher level through capacity building and follow-up efforts (Fig. 2).

## Rethinking e-learning in Iran during the COVID-19 pandemic

As reported by the UT's chair (Nili Ahmadabadi 2020), a considerable challenge that we experience today in e-learning is a consequence of lacking infrastructure, permits, and access to educational materials. Concerning how universities view these new conditions, he stated that almost all higher education institutions reported that COVID-19 impacted learning and teaching processes, and two-third of them replaced their conventional practices with distant learning. Regarding collaborations, 64% of universities conveyed that intercollegiate cooperation was affected by COVID-19.

Half of this population pointed to weakened collaboration, 18% reported that this reinforces partnerships, while 31% believed new opportunities have emerged in this area. Studies show that most negative attitudes are found in Asia since 85% of higher education institutions believe that COVID-19 will have a considerable unfavorable impact on registrations. In other words, on the one hand, enrolments in the Iranian higher education system reached 4.5 million cases in the first half of the 2010s, while on the other hand, the policies recently adopted by the Ministry of Science, Research, and Technology to enhance the quality of higher education centered on lowering the quantity, with the number of students in the Iranian higher education system dropping to 3,616,114 and the number of faculty members dropping to 85,594 in the academic year 2017–2018 (Mirabi et al. 2019). Although e-learning can be effective in enhancing the quality of higher education, it is essential to use

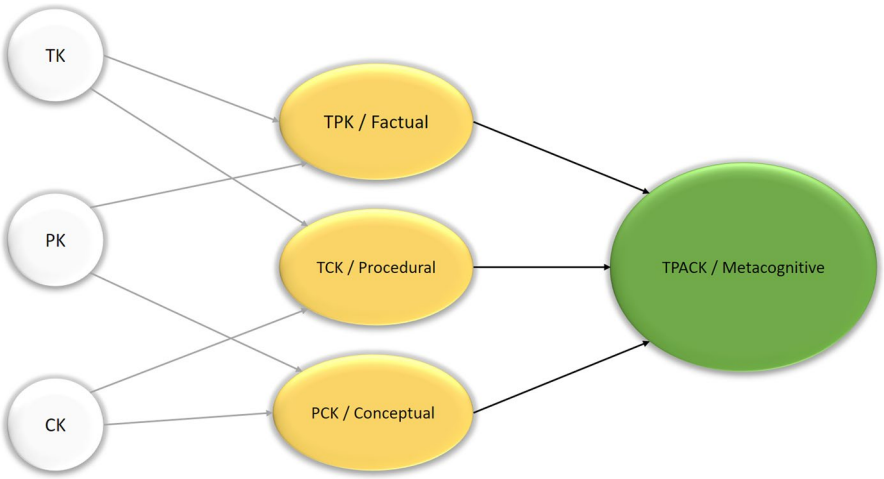



**Fig. 2** A deductive model based on the theoretical foundations

student-centered approaches and generally novel approaches to teaching–learning processes. Therefore, during the outbreak of COVID-19, emphasis can be placed on using mixed methods that combine physical classrooms with e-learning. For this purpose, policymaking and planning for the development of e-learning in Iranian higher education must require universities to adhere to the policies set by the Ministry at a macro level while developing strategic plans for universities to encourage e-learning. This modification can gradually bring university e-learning systems from the lower levels of Bloom's classification up to the sixth level, where it is essential to be ready socio-culturally, pedagogically, organizationally, and technologically. Various studies can complete the discussion on e-learning.

Freigang et al. (2018) used interviews to present a model for e-learning environments. Their findings showed that the literature on the e-learning environment needs further systematization and development of models for designing such constructs as user-centered approaches, educational diversity, blended learning spaces, and facilitated blended learning. When combining technology with novel learning and teaching techniques, the focus must always be on creating educational value. This study identified 30 factors classified into five categories based on their contribution: (1) collaborative culture, (2) user-centered design, (3) educational diversity, (4) blended learning environment, and (5) facilitating blended learning. (Fig. 3).

Thus, arguably, further research is needed into teaching using the internet of things, and previous success factors present a good starting point for further research into e-learning environments.

Dron (2018) compared learning environments in terms of their e-learning capabilities. He noted that this capability depends on the extent of opportunities and flexibility, professor–learner adaptability, and potential changes in the characteristics of the learning environment. Continuous interactions between professors, learners, and the learning environment can enhance learning. However, realistic environments are more complicated than this. They found that an e-learning environment relies on personal characteristics and consists of (human and non-human) components for e-learning. Such an environment needs environment-adaptable segments. Any learning environment can express an e-learning environment regardless of using digital tools. Even if the most advanced tools are in place, the improper structure can turn an e-learning environment into one which cannot support e-learning. In addition, for the same logic that most of the concerns in a physical learning environment are manageable, we must be able to manage weaknesses and faults in virtual or electronic learning platforms. Thus, within traditional educational establishments, the learning environment can be regarded as an e-learning setting merely for certain people since individuals are distinct from each other. Adaptive systems and the adaptability of e-learning agents can play a vital role in the learning environment, most notably in creating and enhancing communications. The most advanced e-learning environments provide excellent opportunities for communication, interaction, support, and challenges for better learning.

Martens et al. (2019) assessed the educational context in MeinKosmos, identifying effectiveness, efficiency, scalability, the autonomy of individuals, flexibility, adaptability, and customizability as requirements for an e-learning environment. Their findings suggest minor differences between the students in the control

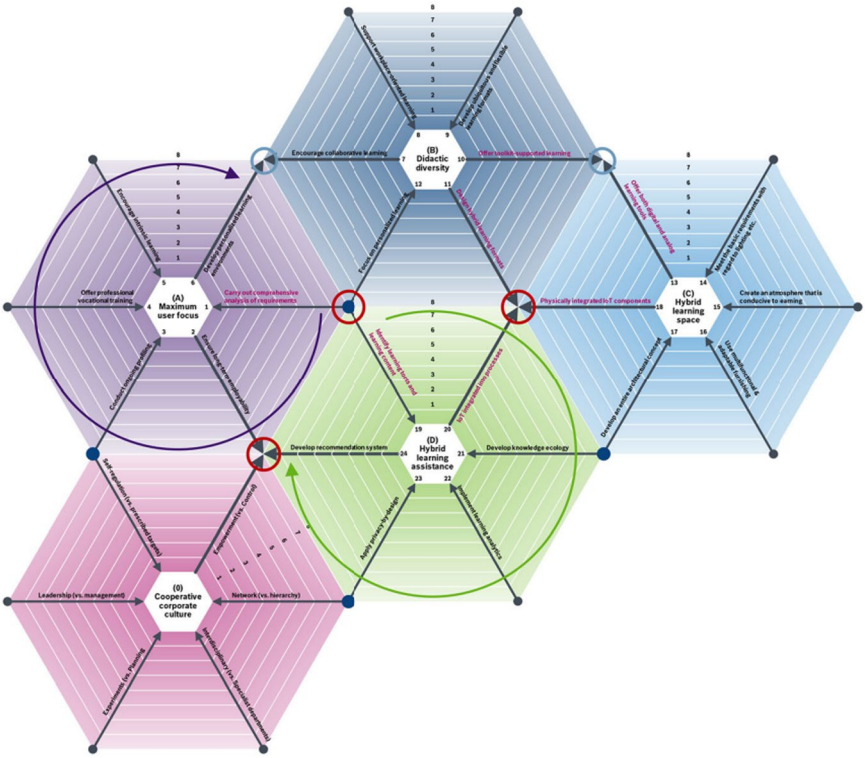



**Fig. 3** Thirty factors identified by Freigang et al. (2018)

group and those in the MeinKosmos group, probably because of the negligible advantages of this educational platform and gateway, the small number of participants, low levels of collaboration, and distributed tasks. Moreover, MeinKosmos is an effective tool that has enhanced the effectiveness of student performance compared to conventional content management practices. This cost-effective tool does not impose much higher expenses compared to traditional methods. The gateway can independently analyze the conditions of students. The system is flexible in terms of content and the number of users. Therefore, the approaches used by the new platforms can be generalizable to other learning systems and domains, while future research can provide people with brief information on meta-search techniques.

Wang et al. (2019) tried to present a framework to assess the impact of student learning. Using a framework consisting of four sections, namely data collection, data extraction, behavioral analysis, and process extraction, they found that students often complete all actions of one type first and then start the next type. They usually perform regulation actions instead of adding a new link or element. They often change the connection immediately after moving a part or an element. Some students have very irregular behaviors and some exhibit random behaviors.

A smaller number of changes in the link after moving each element often results in a better understanding of chart elements and better modeling of background knowledge. Therefore, more formulated methods can be used to develop models that can better show student behaviors.

Furthermore, examining realities in the application of e-learning tools, Al-Hamad et al. (2020) found that distraction, misuse, disordered classes, ineffectiveness in achieving class objectives, oversimplification of the young generation's efforts, lack of trust in technology, and absence of required skills are among the major obstacles. On the other hand, the possibility of interaction and higher levels of excitement are among the factors that encourage professors to incorporate technologies into their teaching. Therefore, it is essential to build a culture among instructors and professors to emphasize the importance of using technology in education. It is noteworthy to expand public awareness about e-learning by throwing public workshops, skill training courses, orientation programs for fresh instructors and professors, and graduate studies programs.

### Integrating (SCPOT-R) model into universities' e-learning systems

Although TPACK is the most widely used model in educational technology (Ottenbreit-Leftwich and Kimmons 2020), it has several limitations (Chai et al. 2011, 2013; Kimmons 2015) that prompted us to identify SCPOT-R.

Our results explain the applications of SCPOT-R during the COVID-19 pandemic. SCPOT-R consists of several subcomponents defined by the authors of this study as follows:

SCR: universities' sociocultural readiness knowledge during the COVID-19 pandemic
PR: universities' pedagogical readiness knowledge during the COVID-19 pandemic
OR: universities' organizational readiness knowledge during the COVID-19 pandemic
TR: universities' technological readiness knowledge during the COVID-19 pandemic
SCPOT-R: universities' knowledge about integrating sociocultural, pedagogical, organizational, and technological subcomponents into their e-learning system during the COVID-19 pandemic

### Purpose of the present study

It is essential to understand what professors desire to expand their paradigms to an e-learning environment during COVID-19. This study aims to develop a comprehensive model applicable to e-learning environments to help the academic community during the pandemic. Findings from reviewed studies about university e-learning methods are experimented with in the constitution of a primary model.

Higher education institutions can use the model during the COVID-19 pandemic.

It is difficult to assess developments during crises. This requires research that goes beyond conventional studies by taking a functionalist approach and a new research approach based on the interpretive-symbolic paradigm. The present study is an applied one. It can help us predict expectations of institutions where e-learning processes exist, whether implemented or binding decisions in this area. The present study also contributes to the existing knowledge in this area by making it completer and more systematic. The audience of the present study includes the whole academic community in higher education institutions. Therefore, the presented theoretical and practical solutions could be helpful for higher education institutions. Thus, the main objective of this article is to adopt a model for e-learning readiness at the University of Tehran (UT) during the COVID-19 pandemic.

## Methodology

In performing this study, the phenomenological approach has been employed, attempting to describe human experiences within the context where they happen (Streubert Speziale and Carpenter 2003). This research focuses on explaining the phenomenon of living studied as perceived by social actors. The case study here is the e-learning system used by the University of Tehran (UT) which experienced several problems in the initial stage of the COVID-19 outbreak.

The system ought to improve through readiness on various fronts. The readiness concept assumed as a context in which the SCPOT-R model needed to be identified. We drew on previous studies to address the existing gap by identifying two research questions. First, the faculty members asked for their opinions on what e-learning components should be given higher priority by UT during the COVID-19 outbreak. Then, we asked them to propose a final model for university readiness to confront COVID-19.

The phenomenological approach prompted a description of the major component involved in the phenomenon before we could properly understand the final model for university readiness to confront COVID-19. A selective coding system, followed by thematic analysis, was used since the questions asked here are open-ended. That conducts a more acceptable description and interpretation of the problem.

The coding process was then verified by applying the comments proposed by the second coder to ensure the elimination of biased coding in the first stage.

The interviews were completed in May 2020 by the participants who consented in advance. Since the COVID-19 outbreak had made in-person interviews impossible, we started the process by sending invitations to all 2000 UT faculty members at the following departments and colleges: Entrepreneurship, Law and Political Science, Literature and Humanities, Engineering, Economics, Foreign Language and Literature, Agriculture and Natural Resources, Graduate College of Environment, Physical Education, Theology and Islamic Knowledge, Islamic Thinking and Teachings, Social Science, Psychology and Educational Science, Geography, Modern Science and Technology, Veterinary Medicine, Management, Physics, World Studies, Fine Arts, Architecture, Institute of Biochemistry and Biophysics (IBB), Chemical Engineering, Electrical, and Computer Engineering, Mechanical Engineering, Industrial

**Table 1** Composition of issues (respondents) based on gender

| | Gender | Frequency | Percent |
|---|---|---|---|
| 1 | Male | 462 | 76/62 |
| 2 | Female | 136 | 22/55 |
| 3 | Unknown | 5 | 0/83 |
| 4 | Total | 603 | 100 |

**Table 2** Composition of issues (respondents) based on degrees

| | Degrees | Frequency | Percent |
|---|---|---|---|
| 1 | Bachelor's | 71 | 11/77 |
| 2 | Master's | 76 | 12/60 |
| 3 | Master's/PhD | 102 | 16/91 |
| 4 | Bachelor's/Master's | 166 | 27/53 |
| 5 | Bachelor's/Master's /PhD | 154 | 25/54 |
| 6 | Bachelor's/PhD | 12 | 2 |
| 7 | PhD | 19 | 3/15 |
| 8 | Unknown | 3 | 0/50 |
| 9 | Total | 603 | 100 |

Engineering, Mine Engineering, Geology, Mathematics, Statistics, and Computer Science, Surveying Engineering, Caspian College of Engineering, Campus of Science, Fouman College of Engineering, Farabi Campus, Abu-Reyhan Campus, and Kish International Campus. After receiving consent from potential interviewees, the date-gathering process began. We contacted 603 professors through video calls, voice calls, and emails containing opinions from the members. To maintain the authenticity of the statements given by the interviewees and to avoid author-triggered bias, three main preconditions were assumed: (1) Participants freely expressed their opinions through direct speech; (2) attempts were made to make sufficiently consistent notes at all stages of data analysis; (3) the Interview scripts were emailed to faculty members of all UT departments for additional remarks and recommendations. Each interview—conducted mainly through voice and video calls—lasted about 20 min. Respondents demographic profiles are classified by gender, academic level taught, type of classes, and academic rank.

The demographic questionnaire was applied to collect information on variables such as gender, level taught (teaching degree), how classes were held (types of classes), and the academic ranks of faculty members, as indicated in Tables 1, 2, 3, and 4.

## Analysis

What components do you think have the highest significance for e-learning in UT during the COVID-19 pandemic?

**Table 3** Composition of issues (respondents) based on types of classes

| | Types of classes | Frequency | Percent |
|---|---|---|---|
| 1 | Online | 211 | 35 |
| 2 | Offline | 206 | 34/16 |
| 3 | Both | 167 | 27/69 |
| 4 | Unknown | 19 | 3/15 |
| 5 | Total | 603 | 100 |

**Table 4** Composition of issues (respondents) based on academic ranks

| | Academic ranks | Frequency | Percent |
|---|---|---|---|
| 1 | Instructor | 6 | 1 |
| 2 | Assistant Professor | 291 | 48/26 |
| 3 | Associate Professor | 163 | 27/03 |
| 4 | Professor | 133 | 22/05 |
| 5 | Unknown | 10 | 1/66 |
| 6 | Total | 603 | 100 |

Based on the findings of the study presented in Table 5 and as a finding of data analysis, four major overlapping themes emerged: (1) sociocultural readiness, (2) pedagogical readiness, (3) organizational readiness, and (4) technological readiness.

## Theme 1: sociocultural readiness

### First component: enhancing social responsibility in the university

The most crucial point to note is to prevent the spread of COVID-19 explicitly expressed by the faculty members. That can be done by following the WHO protocols in connection with the COVID-19 pandemic. Many participants believed that undertaking quarantine protocols by universities (as instructed by the WHO for people dealing with COVID-19) is a step forward toward the social responsibility of universities. Additionally, during the pandemic, academics face significant challenges such as fear, anxiety, isolation, obsession, limited communication, prominent presence in cyberspace, ambiguity, a disordered biological clock, physical problems caused by sedentary life, and psychological circumstances, threatening psychological health of people and can unfavorably influence their ability to learn. During this time, most academics and society in general redirect their activities toward remote working.

According to the finding from accomplished interviews, the COVID-19 pandemic delivers possibilities for e-learning that should be used to the most elevated extent possible for learning and teaching purposes by turning the threats at national and international levels into constructive opportunities.

Some of the interviewed faculty members believed that the current defeat in resources is more than ever, and that requires necessary actions to save these

**Table 5** Research findings

| Main components | Subcomponents | Source |
|---|---|---|
| Sociocultural Readiness | Enhancing social responsibility in university | Preventing the Outbreak of COVID-19 |
| | | The implementation of quarantine protocols |
| | | The safeguarding psychological health of society at the time of crisis |
| | | Meeting the requirements for remote job |
| | | The setting culture for remote work |
| | | To turn national and international threats into constructive opportunities |
| | | The reduced energy consumption |
| | | Reducing air pollution and better protecting the environment |
| | | The openness to the culture of e-learning and e-teaching |
| | Establishing educational justice | To lift spatial and temporal restrictions |
| | | The possibility of equal access to educational content |
| | | Affordable access to education |

**Table 5** (continued)

| Main components | Subcomponents | Source |
|---|---|---|
| Pedagogical Readiness | Developing learning–teaching processes | To present topics, questions, and assignments in an integrated manner over an interactive technique |
| | | The potential, diverse applications of stored knowledge |
| | | To increase the assortment of ways that can engage students in education |
| | | The question/answer processes |
| | | The improved processes used in Q/A sessions |
| | | To improve the learning experience by reviewing and replaying the videos from e-learning classes |
| | | Systematic access to educational content |
| | | Student–teacher networking over communication channels |
| | | The systematic documentation and storing of educational content |
| | Enriching educational content | The sharing of additional and diverse educational content |
| | | The simultaneous use of different sources while teaching |
| | | The ongoing process of interactive updating of educational content |
| | | The interactive reviewing and monitoring of educational content |
| | | The diversity in the methods of teaching and knowledge transfer |
| | Continuity of learning | The continuity of learning and teaching in a time of crisis |
| | | The continuous process of learning and teaching on holidays |
| | | The continuous process of learning and teaching on holidays |
| | | Maintaining fast and flexible connections with students |

**Table 5** (continued)

| Main components | Subcomponents | Source |
|---|---|---|
| Organizational Readiness | Continuation and development of e-learning | Improving and enhancing the existing infrastructure based on the feedback |
| | | The enhanced e-learning for teachers |
| | | The enhanced e-learning skills among students |
| | | The motivation and increased belief in information and communication technologies |
| | | The reinforcement of autonomy and self-paced learning among learners |
| | Time management | Saving transportation time |
| | | The flexible timing of e-learning classes |
| | | Focused, briefed teaching |
| | | The possibility of re-accessing recorded content at a convenient time |
| | | Turning in assignments online and on time |
| | Improved assessment and supervision over the class | The continuously monitor and assess the classes by universities |
| | | Continuous monitoring and assess the classes by universities |
| | | The possibility of automatic rollcall |
| | | Enhanced assessment of teachers |
| | | The improved process of evaluating and rating students |

**Table 5** (continued)

| Main components | Subcomponents | Source |
|---|---|---|
| Technological Readiness | Hardware | The reinforcement of the tools and resources needed for teaching in e-learning classes |
| | | Offering support to students with financial difficulty to assist them in buying a smartphone or a laptop computer |
| | Software | To develop educational multimedia content for every class |
| | | To have a platform that allows teachers to upload multimedia content |
| | | The heightened speed of delivering and conveying educational content |
| | | The diversity in multimedia content |
| | | The possibility to record |

resources. Some faculty members also pointed to the constant disinfection of places and streets against this highly undesirable virus and called for greater attention to the environment to reduce pollution and provide enhanced environmental protection. Issues such as students' discipline and responsibility, individual and communal identities, and educators' role in flourishing students' dexterities have faced substantial challenges and can be convalesced to some extent by promoting an educational culture based on e-learning methods.

#### Second component: establishing educational justice

Some of the interviewed faculty members pointed to e-learning as a model of acquiring knowledge, attitudes, and skills using such tools as mobile technologies that can facilitate the development of educational justice. Within the e-learning method, despite geographical locations, both local and international students have equal access to educational and academic resources without any limit on place and time.

Another point stressed by some of the interviewed educators is the possibility of equal access to educational content. Recording and keeping educational content allows learners to equally access the contents of each course, which does not happen by default in face-to-face or physical classrooms. The third issue is affordability and less expensive access to education with e-learning methods. Since attending in actual classes is occasionally costly for many students who cannot afford these classes because of financial difficulties.

### Theme 2: pedagogical readiness

#### First component: developing learning–teaching processes

Concerning pedagogical readiness, it is essential to suggest topics, questions, and assignments in an integrated manner over an interactive system that provides e-learning platforms for visual, audio, and written feedback by students and professors. The participants stated that this creates an environment of increasing learning in classes.

The faculty members noted that diverse application of stored knowledge facilitates teaching–learning processes. On the one hand, delivering a competitive academic environment over e-learning platforms can reinforce learning and enhance creativity in teaching methods, as confirmed by the participants. And on the other hand, e-learning platforms are designed based on three forms: engagement, student–professor interaction, and sharing educational content.

As pointed out by professors, students can facilitate learning by asking questions and receiving answers, as an essential issue in classrooms.

E-learning classes incorporate different parts for improved question-answered sessions operated by professors and instructors to support students and answer their inquiries. Some faculty members acknowledged that e-learning methods allow students to learn more satisfactorily, working as a platform where professors launch

their classes and supervise the education process. Students explore the course content, and professor assistants can help students and professors.

Another exclusive feature of e-learning classes is auto-archiving which suggests an unprecedented technique for archiving class content by supplying students with a chance to review/replay recorded learning materials such as videos, slide presentations, and notes.

Systematic access to educational content is another noteworthy point noted by the faculty members. In addition, student–professor networking over communication channels helps develop and facilitate learning processes. Systematic recording of course contents affects transparency in students' learning and faculty members' teaching methods.

#### Second component: enriching educational content

By sharing additional and diverse educational content, professors, professor assistants, and students can enhance the academic content. Concurrent usage of different sources and media in education can lead to considerably efficacious e-learning university courses.

In addition, some professors noted that continuous interactive reviewing and monitoring of educational content is essential in demonstrating the importance of educational goals. Furthermore, bringing diversity into teaching methods can heighten learning quality in students with different educational needs. That requires a constantly updated and interactive process of educational content, as stated by the faculty members.

#### Third component: continuity of learning

A point noted by the faculty members in this regard was the continuity of learning and teaching in times of crisis when some students or their families may struggle with COVID-19, which directly affects their ability to learn. That is why the respondents stated that these individuals' learning and teaching processes should not be stopped and education should continue by providing special conditions and resources. Other points to note include the continuous process of learning and teaching on holidays, facilitating the organization of reparative classes under these conditions, and maintaining fast and flexible connections with students.

### Theme 3: organizational readiness

#### First component: continuance and development of e-learning

It is paramount to improve and enhance the existing infrastructure based on the feedback provided. Some participants emphasized factors such as technical talents and self-paced learning skills, stating that each feature consists of particular habits, skills, attitudes, and knowledge. While enhanced teaching skills for e-learning

were stressed, some professors still preferred traditional teaching methods because of insufficient e-teaching skills. Improving e-learning skills for students was pointed out following the same approach. Also, many professors pointed to the motivation and increased belief in information and communication technologies and reinforcement of autonomy and self-paced learning among learners as essential qualities contributing to successful e-learning.

#### Second component: time management

One advantage of e-learning noted by multiple faculty is the possibility of saving the time that had to be spent on transportation and travel to reach class locations. Unlike physical classes, which require on-time presence of students and professors, e-learning offers a much more flexible schedule for both students and professors.

The faculty members mentioned their efforts to teach briefly and to the point while involving students, up to the highest levels of learning, in different processes to help them actively feel their role in the learning–teaching process.

Eventually, the chance of re-accessing recorded content at a convenient time was the last factor noted by the faculty members in the interviews.

Some faculty described how they maintained the agenda of the course, using deadlines for assignments and exams.

#### Third component: improved assessment and supervision

In this regard, two components were identified: (1) the possibility of continuous observing and assessing the classes and (2) performing self-assessments by reviewing the contents and surveys.

### Theme 4: technological readiness

#### First component: hardware

The first issue suggested by most of the interviewed faculty members, especially those with backgrounds in applied science, was the status and availability of the devices and tools needed for teaching in e-learning classes.

They asserted that tools like light pens could enhance teaching effectiveness. They also pointed out the necessity of offering aid to students with financial hardship to help them buy smartphones or laptops since many professors were concerned about students who did not have access to these tools.

#### Second component: software

Many professors pointed out the essentials of designing educational multimedia content for each course. They explained how creating multimedia learning environments must incorporate educational design principles and learners' cognitive and

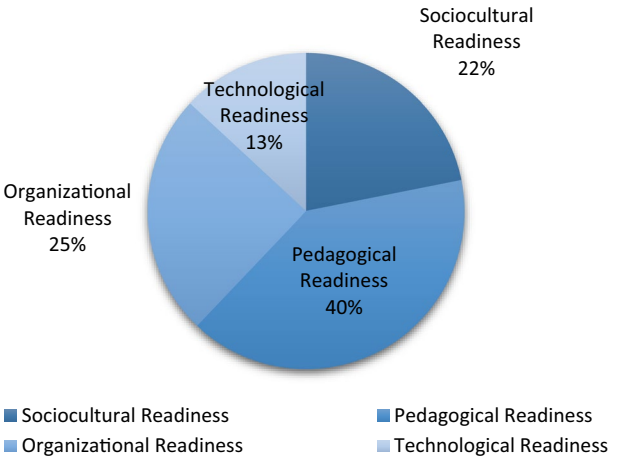



**Fig. 4** Model of university readiness to tackle COVID-19

metacognitive abilities. Representation of appropriate student-paced knowledge based on learner's ability can reduce the cognitive load and enhance their learning discipline by integrating the presented materials and lowering the amount of information that needs to be memorized and processed.

On the other hand, the respondents mentioned their concerns about choosing high-quality content for e-learning and creating diversity in multimedia content due to the abundance of educational content. The last point to express in this respect is the possibility of capturing lessons and class information that allows absent students to catch up with the course process.

### How can the model for the university e-learning system during the COVID-19 pandemic be formed?

According to the research findings, four topics: Sociocultural readiness with code 522 (21.85%), pedagogical readiness with code 960 (40.20%), organizational readiness with code 594 (24.78%), and technological readiness with code 312 (13.6%) were identified (Fig. 4).

## Discussion

The COVID-19 outbreak and shutdown of Iranian universities and higher education institutions on March 2, 2020, following the COVID-19 pandemic, presented an opportunity to revisit the essential role of investing in e-learning systems. The opportunity can be used to fill the digital gap more seriously and professionally.

The findings of this study led us to four overlapping themes which, in order of importance, are: (1) sociocultural readiness, (2) pedagogical readiness, (3)

organizational readiness, and (4) technological readiness. As noted earlier in the discussion presented in the theoretical foundations of the study, these four themes represent the basic requirements of e-learning during the COVID-19 pandemic. The factors noted in this section can be authentic under standard conditions based on an optimistic view, while attempting to bypass the conventional structures and explain the e-learning experience in UT requires serious attention to these themes because of the context it is located.

Pedagogical readiness is the first important point to note. *Development of teaching–learning processes* may encompass such factors as presenting topics, questions, and assignments in an integrated way over an interactive system, applying the stored knowledge in various ways, enhancing and diversifying student participation modes, improving QA processes, reinforcing learning through reviewing and replaying the videos recorded during a class, student–professor networking through communication channels, and systematically documenting and storing educational content. The evolution of teaching–learning methods requires establishing a network-based platform in which students hold access to the latest published ideas, data mining networks, and validated articles. This helps students in building a database linked to their areas of professional interest. Something new could happen when these data are integrated into one's database. Communication of this type among students enables a university to keep these assets at a certain level. Major studies have confirmed the positive role of social networks in developing social capital, interactive learning, academic advancements, development of professional identity, and academic adherence among students (Harris 2013; Hommes et al. 2012). Previous studies have revealed the connection between the applications of social networks and the enhanced and facilitated teaching–learning process. Freigang et al. (2018) found that intelligent learning environments need further systematization. The link between these two factors was assessed based on a general view and regardless of the unique characteristics of students and the academic environment. Furthermore, the dynamicity and elegance of learning processes in social networks can enhance several advantageous qualities. As Wang et al. (2019) discovered, modeling student behaviors are an essential factor that facilitates learning.

The second component here is optimizing educational content. Features such as sharing content with others and concurrent application of unique resources can bring significant advantages in learning and education and act as a powerful instrument in improving university productivity and survival. According to Hau et al. (2013), trust is a significant factor in sharing information. In addition, Schauer et al. (2015) showed that the qualities and views held by sharers, relationships among sharers, universities, institutions, and personal knowledge are among the primary factors contributing to knowledge sharing. Razmerita et al. (2016) classified the factors involved in knowledge sharing into individual, organizational, and technological dimensions. Inherently, through interactive, continuous updating of educational content, improved agility, and constant monitoring of educational content, these factors can better explain the importance and priority of educational goals. Variety in forms of teaching facilitates the exchange of information and inspires students to track the content. There is no standard teaching method to conform in every class and meet all

students' educational necessities. Techniques such as group presentations, question-and-answer sessions, and lectures have existed for events of various majors.

Our findings are consistent with Dron's (2018) results, as he underlined the adaptability of intelligent agents to their environment and generally the enrichment of opportunities to create an interactive environment. In contrast, Tanak (2020) found that only pedagogical readiness had a more influential impact on TPACK, while teachers employed all three TPACK segments.

However, in further explaining the issue of pedagogical readiness, the faculty members believed that despite the university shutdowns during the pandemic, education must persist, even stronger than before. Under these conditions, potential personal, family, or organizational issues may hinder the organization of these classes in terms of quality and quantity. Therefore, facilitations are required to organize remedial classes by maintaining a sharp, flexible line of connection to students. Undoubtedly, e-learning classes experience more problems than traditional classes, including fast, on-time feedback to students. Professors' increased flexibility in responding to students can facilitate their learning. Al-Hamad et al. (2020) pointed out the application of e-learning tools to address potential problems in this style of education (Such as the distraction of focus, misuse, disordered classes, ineffectiveness in achieving class objectives, oversimplification of the young generation's efforts, lack of trust in technology, and absence of required skills).

Organizational readiness diverges into three components: continuation and development of e-learning, time management, and improved assessment and supervision over the class. Academic education should shift individuals toward self-discipline, self-management, and self-determination. According to the faculty members, there are three levels of assessments: "assessment of learning, assessment for learning, and assessment as learning." The first two levels of assessments are determined to be accomplished by the professor, while the third level is needed to be conducted by the students. That indicates the students should continuously monitor themself. Accordingly, the respondents noted such factors as enhancing the existing infrastructures based on the available feedback, improving professors' e-teaching skills, improving students' e-learning skills, and strengthening students' self-directing and self-determination capabilities.

We found that learning is a process that takes place in an environment beyond controlling the student and leads to an encompassing experience or interaction with other individuals. Al-Hamad et al. (2020) emphasized the necessity of a skill-learning process. In addition, Martens et al. (2019) underlined the approaches taken within new contexts and described how to generalize them into educational contexts. Moreover, our respondents pointed to increased motivation and trust in information and communication technology. In this respect, Ausubel (1968) referred to "cognitive drive" as the most significant motivational factor contributing to meaningful learning. The factors identified under time management include saving transportation time, flexible timing, focused and brief teaching, re-accessibility of recorded contents at any time, and timely and online delivery of assignments. The point indicated here was confirmed by Dhawan (2020). He demonstrated that e-learning processes and techniques are practical and properties of online learning can protect society from adverse circumstances carried by COVID-19 by presenting some

appropriate student-based strategies that should offer a significant capacity for flexibility in terms of place and time.

Constant monitoring and assessment of classes by the university and professors' self-assessment through reviewing the content facilitate improved monitoring and appraisal of courses. According to the faculty members, greater attention paid to this point can directly influence the quality of their teaching and learning. In other words, assessment of the teaching performance of faculty members through self-assessment and evaluations by students is among the most productive ways to identify strengths and weaknesses in educational performance, preparing the ground for enhanced teaching quality. The third point noted by the participants is the possibility of automatic roll calls. Unlike classes where professors must directly check for attendance by calling out names, e-learning enables automatic attendance checks. The fourth point is enhanced assessment of professors. Most participants argued that the e-learning context provides an inclusive evaluation of professors, students, and professors' assistants. And finally, the respondents also pointed to the improved process of evaluating and rating students. The transparency offered by this type of learning enables students and learners to estimate their potential scores in any course. According to Absari et al. (2020), teachers need to have a reasonable proficiency in knowledge constituents to be qualified to realize the educational goal and enhance performance. Since administrative support positively affects technology integration by teachers (Saeed Al-Maroof et al. 2021), organizational readiness can extend similar models including those containing TCK, TPK, CK, PK, and TK. It is also important to mention that this model has skipped organizational readiness to confront sudden shifts toward e-learning.

Concerning the points mentioned above and completing our findings, Rouhani and Mirhosseini (2020) showed that having an intelligent assistant and emphasis on artificial intelligence in e-learning portals run by universities play a vital role in the effectiveness of e-learning.

Another theme noted in different studies, sociocultural readiness, identified factors that enhance the university's social responsibility to set educational justice. The preconditions underlined in connection to those factors include preventing the spread of COVID-19, implementing quarantine protocols by universities, securing the psychological health of society at the time of crisis, and protecting the environment. That is not entirely consistent with other studies. One part of the studies concentrated on how cultural beliefs may influence misinformation about preventing COVID-19 (Adom 2020).

At the beginning of the COVID-19 pandemic, numerous efforts done, while many lacked sound scientific grounds. UT faced ambiguity regarding its social responsibility and establishing educational justice. The issue was influenced by seeking help from global, local, public, and private institutions, particularly the measures adopted by the WHO. Another part of this issue concerned remote work for academics. Scardamalia pointed out the necessity of having a scientific forum working on health issues. University established itself as the most dominant player when it recognized remote work as a competitive investment or a resource to achieve a competitive advantage, especially in times of HR-based support.

However, it is essential to promote the pedagogical culture and e-learning practices needed during the COVID-19 exposure and focus on other critical factors like providing equal access to instructional content by eliminating temporal and spatial limitations (Zhang et al. 2007). That stands in line with Scardamalia's opinion, which examined cognitive responsibility in schools and how it contributes to and facilitates learning. The study asserted the essential role of Knowledge Forum in health, epistemological agency, and mental responsibility. Universities became more effective when they regarded remote work as a competitive asset or a source of competitive advantage, particularly one rooted in human resources.

In addition, remote work allowed university professors to deliver more flexibility in gathering the highest talents globally. That enabled attempts to turn national and international threats into constructive opportunities. However, under these conditions, greater attention to be paid to other factors involved in university openness to e-learning during the COVID-19 pandemic.

Likewise, Zhang et al. (2007) examined socio-cognitive dimensions of knowledge building through a knowledge production project intended to create a collective public space for this purpose. Their findings suggest that in an environment properly reinforced for knowledge building, students could improve their learning toward a "knowledge-building discourse" by managing the link between their existing knowledge and what they are required to know. Equal access to educational content and more affordable education indicate the importance of educational justice. Currently, educational inequalities represent a critical issue in educational planning that immensely contributes to improvements in higher education. Educational planners play an outstanding role in facilitating the route for developing all talents existing in students and providing all students with continuous and equal opportunities based on capabilities. That was also confirmed by Ma et al. (2016), who studied rotational leadership models in elementary schools and their role in social networks and discursive shifts. The method employed by their study to map collective cognitive responsibility can provide students and professors with proper analytical tools used in knowledge-building classes and in providing continuous feedback. Here, further cooperation among students in new groups helps them advance opportunistic ideas to develop their knowledge.

The last theme, namely technological readiness, emphasized software and hardware components. Confirming the role of technology, Ayebi-Arthur (2017) found that technology helps students overcome obstacles at difficult times. However, appropriate technological infrastructure is a prerequisite for online learning. Infrastructures must be strong enough to enable continuity of service during and after the crisis. That is in line with Dhawan (2020). Various studies have shown that technology integration needs systematic training to enhance teaching based on a proper understanding of learning theories (Choi and Young 2021; Tanak 2020). Most teachers use technology for motivation or in word processing or data retrieval applications (Choi and Young 2021; Tanak 2020). But during COVID-19, it is necessary to note that technological readiness is not just a motivational context, and disguised characteristics such as the emotional status of students should also be measured and taken into account accordingly.

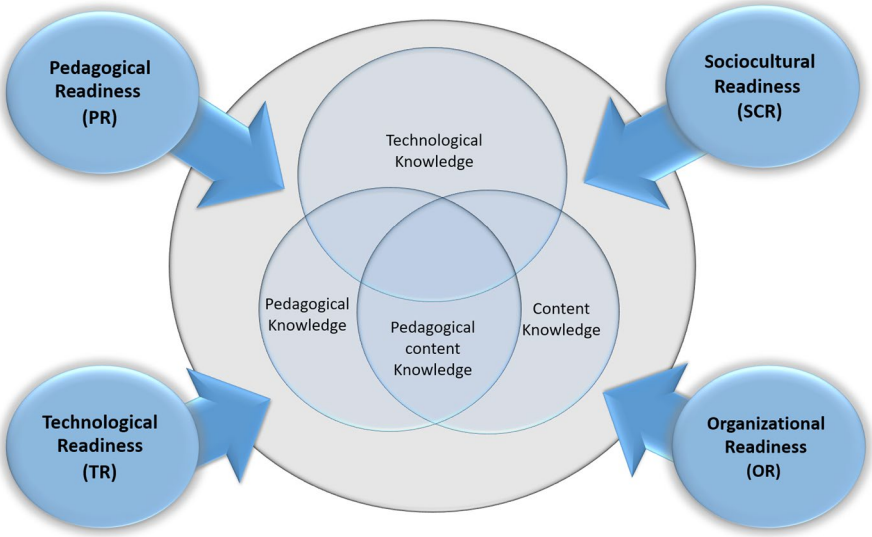



**Fig. 5** Final research model

Although direct teaching experience will improve the effectiveness of technology integration, it is essential to remember that youthful instructors with sufficient knowledge of technology can complete the work of elder professors lacking expected proficiency in working with related tools. A recurring theme in the interviews was the class duration and how various factors could affect efficient class time. Fair education and appropriate technological readiness are achievable by taking the points noted before into account. Thus, the final research model for this study can be illustrated in the design shown in Fig. 5.

## Limitations and future research

This study had several limitations including the process for implementing the SCPOT-R model that was designed only for UT. It is important to note that most of UT's professors are aged professors who mainly concentrated on pedagogical and technological readiness, while the remaining relatively younger teachers emphasized the importance of sociocultural and organizational readiness. Therefore, factors such as academic rank, program and degree taught, gender, and field of study influenced the process of model identification. Although we tried to implement the study in all UT departments and faculties, the factors noted above might have shifted the focus to more or less different issues. Therefore, the analysis was duplicated by considering the opinions of university directors, graduates, staff, students, parents, and even members of the wider society. Another limitation concerned the data collection method. We focused on a phenomenological interpretive approach. Due to the lockdowns, we could not interview in person

with all the 603 faculty members. So other means of communication like video calls, voice calls, emails, and phone calls have been used for data gathering in an attempt to address this problem. In addition, the second coder reviewed the extracted themes and the concepts to validate the identification of the content.

## Conclusions

The case study of this research is the e-learning medium used by the University of Tehran. A platform rendered has carried several problems for users in the initial stage of the COVID-19 outbreak, while its improvement process has continued through readiness on various fronts. A proposed model is designated to enhance readiness on diverse fronts. We proposed a model formed to enhance readiness on various fronts. The level of preparation is supposed as the context for the imprint of the TPACK approach. We drew on previous studies to address the existing gap by identifying two research questions. First, the faculty members requested their opinions on what e-learning components should be given higher priority by UT during the COVID-19 outbreak. Then, we asked them to propose a final model for university readiness to confront COVID-19. The phenomenological approach prompted a description of the major component involved in the phenomenon before we could properly understand the final model for university readiness to encounter COVID-19. We assessed all the themes mentioned earlier through Bloom's revised taxonomy and the TPACK model for e-learning in UT. A focused emphasis on all these factors can represent a strategy for learning during the COVID-19 pandemic. As mentioned in the discussion of two Bloom's models, the highest level in Bloom's revised taxonomy was metacognition prerequisites which are explained based on TPACK. Given our findings, the model needed further modification to apply within the UT. Thus, we attempted to identify a four-factor model, i.e., SCPOT-R, for e-learning readiness. The TPACK implementation within the UT needs to focus on SCPOT-R. That is to say, the performance of this model at UT should rely on the model identified in this study. The ambiguities involved in this model can also be clarified using these four types of readiness. Modeling is not necessarily a means of clarifying ideas. Instead, it seeks to identify what something means in connection to other things. Therefore, the robustness of elements points to a whole that defines or redefines these elements. Indeed, neglecting any of these four themes in the time of COVID-19 means a mere focus on e-learning with no consideration of context, situations, or threats involved. Thus, we can claim that our proposed method is a more interpretive approach than an optimistic view. So, the final research model (SCPOT-R) can lay the groundwork for TPACK implementation during the outbreak of COVID-19.

In addition, the four identified themes regarding preparation, i.e., sociocultural readiness, pedagogical readiness, organizational readiness, and technological readiness, may interact within an integrated framework. In this logic, we cannot ignore the interconnectedness of these factors when it comes to e-learning during the COVID-19 pandemic, and teachers and professors must have sufficient preparation in all four identified themes to fulfill academic objectives and improve university performance.

## Recommendations

A set of recommendations can be listed based on the findings of the present study:

- In line with their social responsibilities, universities should develop protocols and create conditions under which people can maintain their access to education with the least financial, safety, and social expenses.
- University shutdowns during the pandemic do not mean stopping the learning and teaching process. Applying specific tools and resources across the academic community can help educational institutes and universities to sustain the educative process.
- Within an e-learning environment, the simple presentation of content, knowledge, and information to students in a linear sequential way can return a rich set of tools and information resources that learners can use to develop their learning trajectories.
- Ongoing and sufficient supervision and assessment by professors and students over educational, research, and technological activities lead to further effectiveness and increasing success in turning potential threats into desirable opportunities.
- By enhancing capabilities, insights, mindsets, and skills for both educators and students, universities play a vital role in using e-learning platforms.
- Selecting educational content that fits e-learning classes is a big step toward realizing learning objectives and facilitating the learning process in the lack of other drivers. Thus, students and professors should continuously review the educational content presented in the classes.
- Universities should consider structural changes in the development of their academic programs to provide the required base.
- By determining the factors involved in time wasting and learning the techniques for efficiency in time management, the e-learning methods will be more straightforward for students and professors. That can lead to desirable modifications in personal and organizational practices when working in such contexts.
- Within an e-learning platform, individuals should be motivated to find new skills and bring innovation and creativity or change their habits depending on the conditions experienced by users.
- The e-learning classes should be formed into student-centered sessions as much as possible.
- To maximize efficiency, e-learning classes should benefit from the capability of teaching assistants. That will also enrich their educational experience.
- Providing tutorials and applied instructions for professors and students on how to use the e-learning platforms is critically essential.
- All e-learning materials should be appropriately in line with course materials.
- Blended methods (e-learning, physical classes, and self-study) should be incorporated into teaching.
- The university e-learning program can be augmented using the features offered by other learning platforms.

- Supplying the equipment and facilities can lead to effective participation of students and professors in e-learning platforms (presenting assignments, facilitating Q/A sessions, encouraging active participation in the class, providing professors with simultaneous access to the system for courses with multiple professors, providing laptops, microphones, webcams, whiteboards, light pens, practical sessions, grants, and preparing slides).
- E-learning platforms can be developed and optimized with the support of relevant student-oriented startups within universities.
- Both students and professors should have constant access to a high-speed internet connection with suitable bandwidth.
- Using attractive visual features could improve the quality of e-learning platforms.
- It would be much more satisfactory to organize the classes during off-peak hours at a time agreed upon by students and the professor.
- Students and professors should have reliable access to supportive experts within e-learning platforms to ask for assistance with potential problems.
- Incentives and promotional directions for professors and students regarding e-learning platforms can improve the popularity of such systems.
- Dedicated professors and instructors who prepare electronic content should be offered rewards and incentives.

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**Data availability** All data generated or analyzed during this study are included in this article.

## Declarations

**Conflict of interest** The authors of the present manuscript declare that there are no conflict of interest.

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