COVID-19 and Distance Education: Evaluation in the Context of Twenty-first Century Skills

Kayhan Bozgun · Ayse Gul Ozaskin-Arslan · Safak Ulucinar-Sagir

Accepted: 29 April 2022 / Published online: 18 May 2022
© De La Salle University 2022

Abstract In this study, we aimed to investigate the prospective primary school teachers’ opinions about their experiences in distance education within the scope of twenty-first century skills during COVID-19 pandemic. The phenomenological research method was used for the purpose of enlightening this specific context. The study group involved 16 prospective primary school teachers. Data were collected through semi-structured interviews. The credibility of the data were provided by obtaining the consent of the participants and by comparing the consistency of codes and themes created by experts in accordance with the twenty-first century skills. The key findings were: (1) no opinion is expressed on information and media literacy; also, participants were not aware of the importance of technology literacy. (2) Emergency remote education cannot provide effective learning and teaching. Participants’ awareness of collaboration and communication skills was insufficient. (3) There were positive and negative aspects of emergency distance education towards face-to-face one. The educational environment, which has become digitalized with distance education, shows that there are changes in the views of the participants about the technology competence that they should have in their careers. As a result, remote education does not cause a significant difference in 21st century skills of participants. But the importance and need of twenty-first century skills in the distance education process become more apparent.

Keywords Twenty-first century skills · Pandemic · Remote education · Online education · Distance education

Introduction

Statement of the Problem

Education has been one of the sectors mostly affected by the COVID-19 outbreak. Universities and schools have been caught unprepared for this case (Lin, 2021). Although people are not ready for online training, the transition process to online training has been started in order not to interrupt the training (Azhari & Fajri, 2021; Erkut, 2020; Lin, 2021; Ozalkan, 2021; Tay et al., 2021). It has been observed that students and adults can carry out some of their work from home. UNESCO emphasizes that in this period all over the world, teachers and educators should teach students through distance courses with educational practical content (Chang & Yano, 2020).

The pandemic has enabled people to find solutions on how to cope with the difficult conditions brought by the trauma. In the middle of the spring semester of 2020, many universities started to conduct their courses online using Zoom, Perculus, Google Classroom, Microsoft Team and similar platforms. Children and teenagers at high schools started to follow their lessons from home. Many families have witnessed their children being educated at home for the first time. The twenty-first century has brought many similar innovations and changes. Although online training prevents the disruption of education, it is not a permanent solution. From now on, the important point is to use face-to-face education and online education in a blended way (Erkut, 2020; Ozalkan, 2021).
The COVID-19 pandemic has led to new trends in learning environments. For example, the issues of redesigning education systems including learning/teaching process, educational environment and assessment approaches have come to the fore. International cooperation, sharing experiences, supporting different learning environments, and ensuring the sustainability of learning have become a necessity (Al Ansi & Al-Ansi, 2020). During the pandemic, many studies have been carried out on innovations in online learning and education (Arslan, 2020; Bao, 2020, Chang & Yano, 2020; Gonzalez et al., 2020; Erkut, 2020; Lin, 2021; Ozalkan, 2021; Tay et al., 2021). For example, Bao (2020) determined that students have problems with permanence of learning and participation in the course in distance education. However, Gonzalez et al. (2020) found that there was an increase in the performance of students with the epidemic process. The existence of different findings shows that cultural factors also play a role in Sect. 11, learning environments, and adapting to changing conditions in the online learning process (Lin, 2021). In general, besides the advantages of the COVID-19 epidemic in many countries of the world, such as providing the opportunity to work from home, the internet being effective in using online course platforms as a communication and learning tool; it seems to bring along many difficulties such as the lack of internet, internet disconnection, the lack of ability to use technology, the lack of family support and economic factors (Al-Ansi et al., 2021; Azhari & Fajri, 2021; Gonzalez et al., 2020; Tay et al., 2021).

The epidemic pushes the education system in the world towards the requirements of the twenty-first century. It is important for students to gain twenty-first century skills to avoid the stress and anxiety experienced due to this epidemic and not be negatively affected by the process and to have the self-regulation skills necessary for online learning. Gaining these skills should be a priority for educators when practicing in such situations (Bozkurt & Sharma, 2020; Lin, 2021).

The twentieth century skills are built in relation to each other, which shows that developing only some skills alone will not be enough. (Van Laar et al., 2019). One of the measures that can affect this readiness the most is to have twenty-first century skills. The Education 4.0 movement, which points out that focusing only on cognitive development in education is not enough, and the Education 5.0 movement which points out the importance of using technology together with education, show how great it will be to bring twenty-first century skills to the attention of individuals.

### 21st Century Skills

Twenty-first century skills are simply the competencies, knowledge, and experiences necessary for students to be successful in their jobs and life in the future. Twenty-first century competencies were first introduced in the Wagner’s (2008) study. In 2013, P-21 platform has worked to build the skills needed in education and learning for the new century (Partnership for 21st Century Skills, 2019).

As seen Fig. 1, twenty-first Century Skills include information, media and technology skills. Information literacy is the ability to allocate sufficient time and access to effective resources. It allows to evaluate information critically and adequately. In a way, it reflects metacognitive skills. Media literacy is the skill that enables critical interpretation of a content encountered and how and for what purpose the messages are given. Technology literacy includes the skills to understand, use, manage and evaluate technology (Partnership for 21st Century Skills, 2019).

Life and professional skills are defined under five different headings. Resilience/tolerance and adaptability allow someone to stop and try new ways when it is understood that an ongoing job or project will not work. Adaptation refers to the harmony shown in the working environment by deferring one’s own priorities when necessary. Entrepreneurship and self-orientation are the skills to work independently and to manage oneself. It encompasses the skills of setting reasonable goals and taking steps to mastery. Social and intercultural skills are the ability to work effectively with others, approach different cultures tolerantly, to be open-minded towards values, to listen and to know when to speak. Productivity and responsibility include the ability to set and achieve goals in order to get a job done. Resistance or resilience to the difficulties encountered in this process will also increase the capacity of being productive and responsible. Leadership is composed of the ability to inspire oneself and then others to achieve a common goal, to lead effectively to the goal, and to be honest and fair (Partnership for 21st Century Skills, 2019).

### The Present Study

Epidemic conditions cause individuals to be isolated from their environment (Van Bavel et al., 2020). In this process, prospective teachers who can exhibit the twenty-first century skills of being tolerant and adapting and the ability to cope with obstacles will be able to adapt to the process quickly. What is important is that prospective teachers gain awareness of twenty-first century skills.

Teachers play a critical role in the effectiveness of the training program. Determining whether there is an awareness of twenty-first century skills is important for them to be successful both in their student life, in their future professional life and in their efforts to raise individuals equipped with twenty-first century skills. This study, hereby, aims to examine the views of prospective teachers about emergency remote education according to twenty-first century skills.
COVID-19 and Distance Education: Evaluation in the Context of Twenty-first Century Skills

during the pandemic process. The main research question is “What participants experienced during the remote education in the pandemic in the frame of twenty-first century skills? Research sub-questions are as followed:

1. How is remote education evaluated by participants according to literacy skills in terms of their experiences?
2. How is remote education evaluated according to learning skills in terms of their experiences?
3. How is remote education evaluated according to life skills in terms of their experiences?

Method

This research aims to determine the views of prospective primary school teachers about online education and to putting these skills into practice when they start their professional life within the scope of twenty-first century skills. It is a qualitative study conducted in the phenomenology design (Cohen et al., 2018). This design seeks answers to two questions: What are the experiences related to the phenomenon? What are the contexts and conditions in which experiences of this phenomenon occur? (Creswell, 2020). In this study, it was studied with pre-service teachers who completed one semester with emergency distance education and continued distance education. Since it is aimed to describe the perceptions of emergency distance education of them, within the scope of twenty-first century skills, this design has been preferred. The research was conducted with 16 prospective teachers studying at the department of primary education at the faculty of education of a state university in Turkey.

Figure 2 shows the information about the participants in the study group. The study group included prospective teachers from the 1st, 2nd, 3rd and 4th grades studying at the primary school teacher education department. As seen in Fig. 2, 6 of the participants were males and 10 were females. Participants were coded as P1, P2,... to be used in the analysis of the data.

Data Collection Process and Instruments

The data of the research were collected with a semi-structured interview form prepared by the researchers. While preparing the semi-structured interview form, first, the literature on the twenty-first century skills was reviewed, and some questions were prepared based on the studies on this subject. The research was on a voluntary basis and prospective teachers were informed about this fact before each interview. Turkey was one of the countries lock down because of pandemic, so we collected the data using online meeting platforms. The data were first transcribed verbatim. The data
collection process took approximately 7 weeks and an average of 40 min per person was allocated. Some examples of interview questions are listed below.

- What were the positive and negative experiences you had in distance education?
- When you reviewed your experiences in this new process, what kind of skills did you need to use?
- What difficulties did you encounter in distance education compared to face-to-face education and what did you do to overcome these difficulties?
- Which of your skills were more effective when completing your group or individual tasks during the distance education period?
- Within this period, what skills do you think you should have in the future as a prospective teacher?

Analysis of Data

Because we focus on the remote education phenomenon during COVID-19 pandemic by framing the variety in experiences by twenty-first century skills, the data analysis process holds a descriptive characteristic naturally. Experiences of participants were coded by the guiding of twenty-first century skills and those skills that become evident were grouped by the aid of literature about twenty-first century skills.

Technology literacy, cooperation and communication skills, critical thinking and problem-solving skills, self-guided learning and personal management skills, career awareness and flexibility-tolerance skill emerged as the codes in terms of attribution of interview questions. Literacy skills, learning skills and life skills were chosen as themes in accordance with the classification of twenty-first century skills based on the codes. A basic thematic analysis was made progressing in steps as can be seen in the diagram below (Fig. 3).
Qualitative data are analyzed through in-depth interviews or taking important parts from observations (Cohen et al., 2018). In order to ensure the validity of the data, the answers of the participants and the related codes were compared by researchers. In the data analysis, no software was used for data analysis.

**Plausibility**

In a qualitative research, credibility is a stage in which appropriate and determined codes are evaluated as good for the interpretation of data (Miles et al., 2018). In order to ensure plausibility, approval of participants regarding the interview forms was obtained from the prospective teachers. The codes and themes created by the researchers in the context of twenty-first century skills were evaluated by referring to expert opinions.

**Findings**

**Literacy Skills**

Based on these statements, it was understood that answers of participants generally focused on technology literacy (see Table 1). It can be stated that this situation was related to the current issue on technology use with the transition to online distance education. Most of the participants explained that they used cell phone and computer as communication tools. While Office programs were frequently used for homework preparation tasks; applications such as Zoom and Skype were used for video calls.

As of sociality, social media applications such as WhatsApp, Twitter, and Instagram were preferred more frequently by the participants. Some of the participants pointed out that some of their skills improved during the pandemic process, but these skills were the ones that facilitated their activities.
Furthermore, some participants expressed that the distance education process provided more free time to focus on their hobbies and to prepare for exams such as KPSS (Public Personnel Selection Examination in Turkey).

**Learning Skills**

It was found that distance education caused some problems in carrying out the collaborative work of the participants (see Table 2). Participants generally stated that they had difficulties in-group assignments, that task sharing, and execution process were not fair, and that distance education made this process difficult in terms of communication between them.

The participants were asked to examine the positive and negative aspects of their experiences with the distance education system, and they were asked questions about how they solved the problems they encountered. From this point of view, it was aimed to reveal the current situation regarding critical thinking and problem-solving skills. Below are the views of the participants on the code of critical thinking and problem-solving skills under the theme of learning skills (Table 3).

---

**Table 1** Statements related to the technology literacy code under the theme of the literacy skill

| Technology literacy | P3: I started to use the computer more frequently during the pandemic process. There was no change in my computer skills. There was no new program that I learned. I continued to use the programs I normally used |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | P4: I started to use the computer more practically during this period. But I didn’t learn a new program                                                                                      |
|                     | P6: The pandemic did not cause any changes on me. I struggled more for KPSS. I watched online lecture videos and topics. I mean, I didn’t learn a new program                                           |
|                     | P9: … I didn’t want to come together with people. I generally downloaded video chat programs. But I usually spent time studying, discovering new music and reading books |
|                     | P10: Actually, I don’t have much computer skills, it still doesn’t exist, I know how to prepare slides more or less, I generally continued my research on a cell phone or tablet. In fact, I was using the technology less during the pandemic process than at the moment. I was preparing for the exams as if I was preparing for the university exam, so there was not much improvement |

**Table 2** Statements related to the code of cooperation and communication skills under the theme of learning skills

| Cooperation and communication skills | P4: No one showed the same dedication as we did in our group work in face-to-face education. It was very difficult to argue about the subject or to correct the mistakes. There was no fair share |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | P8: We did our homework with the group by creating a group on WhatsApp. However, the fact that some of our friends were irresponsible and didn’t do the work on time demotivated me |
|                                     | P12: I had a hard time preparing the common parts while doing group assignments. For example, I had to wait for someone to finish the task before another person could continue. Some had parts that only one person had to do. This was not fair. I had difficulties meeting with the group as we did in face-to-face education |
|                                     | P13: I was always informed at the last moment when group assignments were given, and I always had timing problems. I could not concentrate on because I had to catch up with assignments |

**Table 3** Statements related to the code of critical thinking and problem-solving skills under the theme of learning skills

| Critical thinking and problem-solving skills | P1: If we were in school, we would have only notes that we took in the classroom. In this system, I think it was a great luxury to be able to access the materials whenever we wanted. So, we could save time |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | P2: It was very useful for us that the system was active, it was very good that they responded to e-mails immediately. Thus, the problems were solved in a very short time. They didn’t victimize me … We had not been at loose ends due to UZEM (Distance Education Application and Research Center) and knowing that a lesson was on air there with us made me even more excited |
|                                            | P5: At UZEM, students could study more and master the subject, so we were also encouraged to do more research in this system. At school time, we were asking questions to the teacher directly and we could reach the information faster. But now we reach the information as a result of our own research |
|                                            | P14: System in UZEM reduced the student’s chances of failure. A student could not make up excuses for failure. The only reason for the failure could be the lack of effort |
COVID-19 and Distance Education: Evaluation in the Context of Twenty-first Century Skills

It was understood that most of the participants critically approached face-to-face and distance education systems even though they had a new experience. In this process, regarding their positive experiences in terms of learning skills; the most outstanding answers of the participants were that they had an easy access to the course videos and the content whenever they wanted. In addition, the other advantages were self-learning centeredness, the chance of watching the videos again, reaching the distance education center and solving the problems easily and quickly, the publication of the guidelines for the use of the system and self-responsibility of the students.

On the other hand, the outstanding negative statements of distance education were lack of interaction, not being able to ask questions instantly, not being able to discuss in class, being exposed to excessive content, boring videos due to lack of interaction, problems arising from the internet infrastructure, and the low motivation to study due to lack of a friendly environment. A code of self-guided learning and personal management skills was created under the theme of learning skills. Some sample answers were given below (Table 4).

The responsibility of learning was mentioned above as one of the positive aspects of distance education. The answers given by the participants who talked about the negativities of distance education revealed that they needed external motivation for learning. For this reason, they stated that they preferred face-to-face education. One of the remarkable answers given in the theme of critical thinking skills was about transferring the responsibility of learning to the student. It can be pointed out that similar answers were given under the theme of self-guided learning. Because it was understood that those who had deficiencies in self-guided learning skills did not want to take responsibility for learning and stated that the problem was resulted from the learning environment.

Life Skills

It was found that distance education had a technology-oriented effect on the career awareness of the participants (see Table 5). The fact that the distance education, which became a part of our lives with the pandemic, created a perception on the participants that the teachers should have the competence for the integration of technology into education.

The ability to be flexibility/tolerant requires adapting to new situations, identifying the difficulties experienced, developing, and trying new ways to overcome them. It was revealed that most of the participants were not satisfied with online education, and they had difficulties due to lack of

---

Table 4 Statements related to the code of self-guided learning and personal management skills under the theme of learning skills

| Self-guided learning and personal management skills | P3: Being in the same classroom environment with my peers increased my motivation for the lesson much more. We could instantly ask questions about the lesson. Even our teachers asked better questions in the lesson. The conversations we had with our friends at the break time made us happier. However, UZEM did not offer these advantages, we just listened to the lessons, and they ended. It was boring |
|---|---|
| | P8: I could be easily distracted in UZEM. I did not think there were enough remarkable stimuli to motivate me. The limitations of UZEM were too many. Learning in the classroom was easier... Knowing that we could cheat during the exam via UZEM actually caused me to skip classes a bit. Living with my family is another problem |
| | P9: In face-to-face education, our teacher's facial expressions, her/his way of speaking, her/his communication with us and her/his ability to give instant feedback made me learn easier. In UZEM, I just listened and sometimes I fell asleep while listening |

Table 5 Statements related to the career awareness code under the theme of life skills

| Career awareness | P3: We must turn all these difficulties we face into opportunities during this period. I think that technology should be learned better and necessary training should be given to all teachers. As a prospective teacher, I realize that I need to use technology better and to plan appropriately for any situation by foreseeing one step ahead |
|---|---|
| | P5: I think it is necessary to know how to code. I do not know, but I really want to learn. I believe it is necessary for teachers to be skilled in technology in detail, to be competent in communication and to be knowledgeable |
| | P8: I realized that I need to be a well-trained teacher who can adapt to any situations especially with advanced computer skills |
| | P11 I think that teachers' computer skills and competencies should be improved |
| | P13: I need to train my students with the skills that will enable them to continue the education process, even if they are far away from me, and I think that I should have all the necessary qualifications to achieve this |
| | P14: If I were exposed to such a period again, I think that I would have the necessary skills to sustain distance education. Teachers definitely need to have high-level knowledge on subjects such as computers and software |
supervision and communication (see Table 6). However, it was noteworthy that they did not take any initiative to overcome these difficulties and adapt to the new situation.

**Discussion**

**Literacy Skills**

As a result of the distance education process with the pandemic, it was expected that the skills for the use of technology would develop, but it is understood that participants are not aware of the importance of these skills, and the distance education system is not challenging for the participants. However, Information and Communication Technologies (ICT) refers to Partnership for twenty-first century skills (P21), EnGauge, Assessment and Teaching of 21st Century Skills (ATCS) and ICT documents and these references highlight that distance education with technology is a tool supporting twenty-first century skill (Voogt & Pareja Roblin, 2012).

Although the participants believed in the necessity of technology, it was understood that they could not analyze the situation in terms of their own skills and literacy levels and they were far from self-regulating in this regard. Participants did not attempt to learn what the technological tools that had the potential to facilitate their education could be and how they could be used during the pandemic process; there was no change in their literacy skills other than the acceleration in the use of some programs before and during the pandemic. They also stated face-to-face education is more effective compared to online education. But these arguments may be about the lack of literacy skills and ICT knowledge. Because according to research of Al-Ansi et al. (2019), learning effectiveness increases by using ICT and especially in undergraduate and post graduate levels, ICT usage increases. Being aware of the value of ICT and having literacy skills may change the perspective and this can pave the way for increasing the quality of distance education and delivering education more effectively. Young (2012) states that the teachers who educate twenty-first century students by focusing on solely cognitive skills, can cause generational conflict with their students and fail to acquire life, learning and literacy skills. Arslan (2020) also stated that prospective teachers’ level of using twenty-first century skills during the pandemic period was low, which was similar to the findings of present study.

The qualifications for the technology-based information society require some changes in the structure of both education and business life. According to Autor et al. (2003), there were great changes in the structure of the workforce between the 1960s and 2000s, and the new information society led to a decrease in routine and manual tasks but an increase in abstract tasks. In the current study, it has been observed that prospective teachers have deficiencies in subjects such as analyzing and developing abstract qualities such as literacy, apart from mastering routine tasks such as speeding up the use of some computer programs.

**Learning Skills**

Collaborative problem-solving skills require both social and cognitive skills. Griffin et al. (2010) state that collaborative problem-solving requires social skills such as participation, perspective, social regulation, and cognitive skills such as task organization and knowledge building. Based on the statements of the participants, it is noteworthy that there are some problems in communication, especially in-group assignments. The fact that the participants blame each other on issues such as task distribution and task awareness, and that some group members are not informed about the content of the assignments show that there is a communication problem. Most of the participants did not express their views on issues such as goal setting, the steps to be followed for this goal and the distribution of tasks in the context of the competencies of the group members. Although some stated that there were some unfairnesses, no steps were taken towards
a solution. In this case, it can be understood that the level of awareness of the cooperation and communication skills of the participants is low.

The new perspective in the education policy of the OECD (2016) is based on the motto that the future is unpredictable and uncontrollable. This shows that metacognitive skills such as critical thinking and complex skills such as problem solving are needed in the new era. Since there is an uncertainty about what skills will be needed in preparation for an uncontrollable future, the role of educational institutions is to provide students with skills that will enable them to adapt to new situations (Kirschner & Stoyanov, 2020). Critical thinking makes it easier to offer various viewpoints in different situations to solve the problems in daily life and to make analytical decisions (Butler et al., 2012). Other skills required for critical thinking and problem-solving skills are the ones as facing the new information quickly, being resilient and adapting to the new situation. It is not possible to deal with skills completely apart from each other. Van Laar et al. (2019) confirmed that information and communication skills, collaboration, critical thinking and creative thinking, digital skills were intertwined, and all these skills improved problem-solving skills. In the current study, the learning skills of the participants who evaluated face-to-face learning and distance education changed according to self-regulation and motivation tools. Those who critically evaluated their experiences and searched for solutions to their problems expressed the positive aspects of the distance education system. When materials and videos were not sufficient, participants searched for different sources and thus took over their own learning. This reveals that participants can adapt to a new situation and show tolerance by thinking critically. These participants think that in this system, they assume the responsibility because such a system eliminates human errors. It can be stated that the views of the participants about the responsibility of learning are noteworthy. In fact, these answers related to face-to-face education leads to the conception that the teacher is the only source of information, has a prescriptive structure, strictly adheres to the curriculum, lacks flexibility, and therefore does not seek enrichment and new connections. For this reason, the participants perceive distance education as a system that the responsibility of learning is delegated to the students. It is concluded that the participants, who can self-regulate, observe themselves, specifically solve problems and use their metacognitive skills. Self-regulation is a metacognitive skill and has social affective components stemming from executive functions as well (Sylva et al., 2020) and therefore, it appears together with the motivation code. These participants do not have any ideas on how the content, materials and course formats are prepared. This proves that they do not consider the system as a whole and ignore the information and application types that come from the source. The task of preparing and presenting suitable environment for the development of these learning skills required by the information society should not be overlooked, and it should be ensured that those who prepare these tools have the necessary qualifications. It is crucial that teachers encourage students to apply knowledge, analyze it in multiple ways, synthesize, create, and continually evaluate new knowledge (Larson & Northern Miller, 2011).

Some of the participants stated that they could not learn better in distance education compared to face-to-face due to their lack of social milieu. The participants, who consider the teacher as the only source of information, study with friends and organize their routine, accordingly, think that the autonomy and environmental change brought about by distance education have negative effects on their learning. Considering that distance education has an effect on the decrease in their performance, these participants reveal that they have an external locus of control regarding learning. The fact that they cannot create the intrinsic motivation for doing research and self-learning causes some deficiencies in distance education and face-to-face education. For example, some participants stated that thanks to face-to-face education, there are stricter rules and a curriculum, thus they can motivate better. This situation implies that it is related to the inability to analyze and adapt what the new process requires, and that more importance is given to extrinsic motivation. The request for the environment in face-to-face education and a disciplined curriculum shows that there are problems in providing self-guided learning and personal management in learning. Self-regulation is a construct that mediates the transformation of mental abilities into academic skills and is a proactive activity of self-centeredness, such as applying a strategy, rather than a passive reaction such as receiving information from an instructor (Zimmerman & Labuhn, 2012). This state of autonomy helps to manage strategic learning. It enables to use a systematic approach in learning, to manage time, to use an instrumental approach in seeking help and to manage motivation in learning (Weinstein et al., 2011). Also, because of improper use of ICT tools or maybe not using them in distance education made participants not to adapt and utilize of the benefits of distance education. Proper use of ICT has many advantages like making online education possible, saving time and money, using it as both a motivation and a communication tool, enabling mobility, accessing to information quickly, sharing any kind of information by social media, sharing knowledge and improving the quality of education (Al-Ansi et al., 2021).

Responses of the participants on learning skills implied that immediate distance education couldn’t provide effective learning and teaching. The process could not go beyond watching videos of the course content for many participants. Ozalkan (2021) found that the attendance rate of the students decreased in half, and they followed the lessons
from the documents. In addition to the lack of technological infrastructure, it was also understood that the instructors had deficiencies in terms of technological pedagogical content knowledge. Since the teaching environment consists of instruction-based asynchronous videos, this case eliminates the interaction and causes monologue. The fact that the students do not have further demands other than watching the content videos prepared by the instructors may be due to their unwillingness to go out of their comfort zone. The critical thinking of the participants leads to the emergence of some deficiencies; however, the problem is not in distance education, but the necessity of developing the distance education system and using this system effectively by teachers. According to the study conducted by Garad et al. (2021) at 3 major universities in Indonesia, effectiveness of a distance learning is related to e-learning infrastructure and the cognitive competence or abilities of the students, the faculty, and administrative staff such as previous knowledge and experience on online learning, skills to use these systems. This shows that not only students but also instructors are unaware of online education practices and have limited ability to use them.

Life Skills

Life skills can be described as continuous participation in lifelong learning opportunities, regardless of circumstances or context (Scardamalia et al., 2012). In the current study, it was found that almost all the participants thought that teachers should have competence for the integration of technology into education with the pandemic process and the transition to distance education.

Career skills in the twenty-first century include developing skills to adapt to changes, creating and managing projects, taking responsibility, leading, reaching results, being self-managed, autonomous learners and employees (Beers, 2011). Participants stated that although they could figure out the qualifications they needed in their profession in the context of technology, they did not give detailed explanation about what actions they would take individually, but only focused on the result.

Regarding the flexibility/tolerance skill code, which is one of the life skills, it was found that they were not satisfied with the online education, they had problems with supervision and communication, but they did not attempt to overcome these problems. It is understood that there is no gain in terms of flexibility/tolerance skills in most of the participants during this process. According to the study of Al Ansi and Al-Ansi (2020), social networking applications is crucial in modern era, and this enhances the learning. But one of the results of this study, communication was so problematic because of not using social networking applications both between the students-students and students-instructors. Regarding the code of critical thinking and problem-solving under the theme of learning skills, it is perceived that the responsibility of learning is transferred to the student. However, it can be stated that the participants have some difficulties in adapting to this new situation and being tolerant in acquiring a new learning habit.

Teachers, who will work with students and colleagues with different characteristics in daily life, need to develop tolerance and adaptability skills so that they can work effectively with these people, be productive, and create different solutions by keeping up with new and unexpected situations. It is understood that the participants in this study are not adapted to the new process well during the pandemic, and they constantly express their desire for face-to-face education. In order to manage this uncertainty well, prospective teachers, trainers and administrators need to make comprehensive plans for possible situations and take responsibility. The twenty-first century is the information age. To be successful in this age, it should be known that diversity among people is important, and this diversity is the greatest opportunity for the creation of new ideas, solutions, and concepts (Kivunja, 2015).

Conclusion, Implications and Recommendations for Further Research

It has been a new experience for everyone as the COVID-19 pandemic has caused curfews to begin and educational institutions to close to face-to-face education. This situation has led to the transformation of teaching into an online environment. It has been revealed how important twenty-first century skills are in order to adapt to changing conditions. twenty-first century skills such as flexibility, adaptability, collaborative work, and technology literacy are very important for pre-service teachers to adapt to new situations and overcome the difficulties they face, as it is for every individual.

The findings include the opinions of pre-service teachers explaining the necessity and importance of using twenty-first century skills in distance education courses. It was revealed that the participants could not define some skills and used some of them limitedly. In addition, the research also includes the experiences of the teacher candidates in this process. Pre-service teachers emphasize that they generally prefer to take the courses they have taken during the COVID-19 process through face-to-face education rather than distance education. The rapid transition to remote education leads to the conclusion that changes are not made
in education environments suitable for distance education, contents and materials prepared by instructor may not be sufficient to employ the necessary twenty-first century skills of the pre-service teachers and that the instructors may have deficiencies in this regard. The failure of traditional learning systems due to the pandemic has revealed the importance of distance education, designing learning environments suitable for distance education, e-learning experience, the ability to use e-learning tools, access to ICT and adapting to changing roles in this new system. Also, communication and cooperation are so limited because of the social distancing, and it was revealed that pre-service teachers were complained a lot about this problem. It also reveals the importance of properly using social media, instant messaging applications and online meeting platforms not only by students, but also by instructors and staff to be informed of all developments.

This study is limited by the small sample size of sixteen prospective teachers. The intent is not to make generalizations but to provide initial understandings of how using twenty-first century skills was conducted during the pandemic. Another limitation is that findings only included prospective teachers’ perspectives. It would be meaningful to include lecturers to have a holistic understanding of student engagement and challenges during the distance education in the context of twenty-first century skills.

We would like to make some suggestions in the context of the results of the study. Although the COVID-19 pandemic is unexpected, many similar emergencies are possible in today’s world. This situation has made it necessary for students to have and use twenty-first century skills in order to adapt changes and cope with difficulties. Therefore, these skills should be integrated into teacher education programs. In such emergencies, we suggest that the learning environments used in face-to-face education do not work in distance education, therefore, distance education theories should be adopted and used by the instructors to make the learning environments more effective for students.

**Author Contributions** Bozgun and Ozaskin-Arslan carried out designing of the study, data collection, analyzing and interpreting the data, searching the literature, writing the manuscript process. Ulucinar-Sagir carried out designing of the study and supervising overall the study, critically revising the manuscript process.

**Funding** The authors report no funding.

**Declarations**

**Conflict of Interest** The authors report no declarations of interest.

**References**

Al Ansi, A. M., & Al-Ansi, A. (2020). Future of education post COVID-19 pandemic: Reviewing changes in learning environments and latest trends. *Solid State Technology*, 63(6), 201584–201600.

Al-Ansi, A. M., Garad, A., & Al-Ansi, A. (2021). ICT-based learning during COVID-19 outbreak: Advantages, opportunities and challenges. *Gagasan Pendidikan Indonesia*, 2(1), 10–26. https://doi.org/10.30870/gpi.v2i1.10176

Al-Ansi, A. M., Suprayogo, I., & Abidin, M. (2019). Impact of information and communication technology (ICT) on different settings of learning process in developing countries. *Science and Technology*, 9(2), 19–28. https://doi.org/10.5923/j.scit.20190902.01

Arslan, A. (2020). Determining the 21st century skills that should be instilled to students from the perspective of pre-service teachers before and after the pandemic. *The Journal of National Education (Turkey)*, 49(1), 553–571. https://doi.org/10.37669/milliegitim.779446

Autor, D. H., Levy, F., & Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics*, 118(4), 1279–1333.

Azhari, B., & Fajri, I. (2021). Distance learning during the COVID-19 pandemic: School closure in Indonesia. *International Journal of Mathematical Education in Science and Technology (in Press)*. https://doi.org/10.1080/0020739X.2021.1875072

Bao, W. (2020). COVID-19 and online teaching in higher education: A case study of Peking University. *Human Behavior and Emerging Technologies*, 2(2), 113–115. https://doi.org/10.1002/hbe2.191

Beers, S. Z. (2011). 21st century skills: Preparing students for their future. Retrieved from: https://cosee.umaine.edu/files/coseeos/21st_century_skills.pdf

Bozkurt, A., & Sharma, R. C. (2020). Emergency remote teaching in a time of global crisis due to Corona Virus pandemic. *Asian Journal of Distance Education*, 15(1), 1–vi. https://doi.org/10.5281/zenodo.3778083

Butler, H., Dwyer, C., Hogan, M., Franco, A., & Almeida, F. L. (2012). Halpern critical thinking assessments: Cross-national applications. *Thinking Skills and Creativity*, 7, 112–121. https://doi.org/10.1016/j.tsc.2012.04.001

Chang, G. C., & Yano, S. (2020). How are countries addressing the COVID-19 challenges in education? A snapshot of policy measures. *World Educ. Blog*, 1–3.

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Creswell, J. W. (2020). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE.

Erkut, E. (2020). Higher education after COVID-19. *Journal of Higher Education (turkey)*, 10(2), 125–133. https://doi.org/10.2399/yod.20.002

Garad, A., Al-Ansi, A. M., & Qamari, I. N. (2021). The role of e-learning infrastructure and cognitive competence in distance learning effectiveness during the COVID-19 pandemic. *Cakrawala Pendidikan*, 40(1), 81–91. https://doi.org/10.21831/cp.v40i1.33474

Gonzalez, T., De La Rubia, M. A., Hincz, K. P., Comas-Lopez, M., Subirats, L., Fort, S., & Sacha, G. M. (2020). Influence of COVID-19 confinement on students’ performance in higher education. *PLoS ONE*, 15(10), e0239490. https://doi.org/10.1371/journal.pone.0239490

Griffin, P., Murray, L., Care, E., Thomas, A., & Perri, P. (2010). Developmental assessment: Lifting literacy through professional learning teams. *Assessment in Education: Principles, Policy and Practice*, 17(4), 383–397. https://doi.org/10.1080/0969594X.2010.516628
Kirschner, P. A., & Stoyanov, S. (2020). Educating youth for nonexistent/not yet existing professions. *Educational Policy, 34*(3), 477–517. https://doi.org/10.1177/0895904818802086

Kivunja, C. (2015). Teaching students to learn and to work well with 21st century skills: Unpacking the career and life skills domain of the new learning paradigm. *International Journal of Higher Education, 4*(1), 1–11. https://doi.org/10.5430/ijhe.v4n1p1

Larson, L. C., & Northern Miller, T. (2011). 21st Century skills: Prepare students for the future. *Kappa Delta Pi Record, 47*(3), 121–123. https://doi.org/10.1080/00228958.2011.10516575

Lin, T. J. (2021). Exploring the differences in Taiwanese university students’ online learning task value, goal orientation, and self-efficacy before and after the COVID-19 outbreak. *The Asia-Pacific Education Researcher, 30*(3), 191–203. https://doi.org/10.1007/s40299-021-00553-1

Miles, M. B., Huberman, A. M., & Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook*. SAGE.

Ozalkan, G. Ş. (2021). Measurement and evaluation in distance education: Rethinking social sciences education during the pandemic. *International Journal of Economics Administrative and Social Sciences, 4*, 18–26.

Partnership for 21st Century Skills. (2019). Framework for 21st century learning definitions. Partnership for 21st century learning. Retrieved from: [http://static.battleforkids.org/documents/p21/P21_Framework_DefinitionsBFK.pdf](http://static.battleforkids.org/documents/p21/P21_Framework_DefinitionsBFK.pdf)

Scardamalia, M., Bransford, J., Kozma, B., & Quellmalz, E. (2012). New assessments and environments for knowledge building. In P. Griffin, B. McGaw, & E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 231–300). Springer.

Sylva, K., Sammons, P., Melhuish, E., Siraj, I., & Taggart, B. (2020). Developing 21st century skills in early childhood: The contribution of process quality to self-regulation and pro-social behaviour. *Zeitschrift Fur Erziehungswissenschaft, 23*, 465–484. [https://doi.org/10.1007/s11618-020-00945-x](https://doi.org/10.1007/s11618-020-00945-x)

Tay, L. Y., Lee, S. S., & Ramachandran, K. (2021). Implementation of online home-based learning and students’ engagement during the COVID-19 pandemic: A case study of Singapore mathematics teachers. *The Asia-Pacific Education Researcher, 30*(3), 299–310. [https://doi.org/10.1007/s40299-021-00572-y](https://doi.org/10.1007/s40299-021-00572-y)

Van Bavel, J. J., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M. J., Crum, A. J., Douglas, K. M., Druckman, J. N., Drury, J., Dube, O., Ellemers, N., Finkel, E. J., Fowler, J. H., Gelfand, M., Han, S., Haslam, S. A., Jetten, J., & Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour, 4*(5), 460–471. [https://doi.org/10.1038/s41562-020-0884-z](https://doi.org/10.1038/s41562-020-0884-z)

Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., & De Haan, J. (2019). The sequential and conditional nature of 21st-century digital skills. *International Journal of Communication, 13*, 3462–3487.

Voogt, J., & Pareja Roblin, N. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies, 44*(3), 299–321. [https://doi.org/10.1080/00220272.2012.668938](https://doi.org/10.1080/00220272.2012.668938)

Wagner, T. (2008). *The global achievement gap: Why even our best schools don’t teach the new survival skills our children need—and what we can do about it*. Basic Books.

Weinstein, C. E., Acee, T. W., Jung, J., & Dearman, J. K. (2011). Strategic and self-regulated learning for the 21st century: The merging of skill, will and self-regulation. In B. Morrison (Ed.), *Independent language learning: Building on experience, seeking new perspectives* (pp. 41–54). Hong Kong University Press.

Young, J. S. (2012). Linking learning: Connecting traditional and media literacies in 21st century learning. *Journal of Media Literacy Education, 4*(1), 70–81.

Zimmerman, B. J., & Labuhn, A. S. (2012). Self-regulation of learning: Process approaches to personal development. In K. R. Harris, S. Graham, T. Urdan, C. B. McCormick, G. M. Sinatra, & J. Sweller (Eds.), *APA educational psychology handbook, Vol. 1. Theories, constructs, and critical issues* (pp. 399–425). American Psychological Association.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.