Emergency remote teaching during COVID-19: traits and constraints that arise when teaching computer skills to Saudi preparatory year students

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Abstract This study aimed to identify the traits and implications of teaching an online computer skills course to Preparatory Year students at a university in Saudi Arabia. For the purposes of this study, mixed methods were used. Focus groups were therefore conducted with 15 students to identify the advantages and disadvantages of an online course to develop students’ computer skills. Based on an analysis of the focus group interviews, a self-developed closed-ended survey was conducted amongst a sample of 112 students. This survey was validated and piloted to ensure its fitness for use. The survey results were then triangulated by interviewing 10 of the sampled students. The results of this study revealed five traits that promoted students’ positive perceptions of learning computer skills online: ownership of a computer device, knowledge of the availability of the required apps free of charge, practice during lectures, the course instructor, and factors of e-learning. However, numerous challenges were also identified as eliciting negative perceptions amongst the students, with regard to learning computer skills online. These included large class sizes, lack of opportunity to practice during sessions, technical issues, limited opportunities to interact with peers, and personal factors. This study therefore recommends various design principles to be followed by online teachers when teaching practical skills online.

Keywords Computer skills · Traits · Challenges · Online learning · Perception · Large classes
**Introduction**

The coronavirus (COVID-19) pandemic has had an undeniable impact on global health, the world’s economy, and every area of human activity, including education. During the pandemic, remote teaching was implemented to ensure continuity of learning. In Saudi Arabia, in response to the recommendations of the Saudi Ministry of Health, the Ministry of Education suspended classroom learning in all schools and universities on 11 March 2020, in order to limit the spread of COVID-19. Classroom learning was therefore replaced by online learning, with students studying from home and teachers working from home until the end of the semester. During the following academic year (2020/2021), university teaching and learning also took place online, but exams were held on campus. Subsequently, in the academic year 2021/2022, due to a drop in COVID-19 cases, learning returned to the classroom with health restrictions imposed. However, computer skills courses for Preparatory Year students continued to be taught online, as during the previous year. Specifically, Imam Abdulrahman Bin Faisal University (IAU) made this decision due to high student numbers (around 1400 students), the limited number of computer labs (7), and a shortage of faculty staff, as many had completed their contracts or retired.

Numerous studies have investigated the challenges faced by students whilst taking practical courses online, such as medical and computer science courses on topics like programming and design (Bączek et al., 2021; Elhaty et al., 2020; Gulatee & Combes, 2006; Laar et al., 2021; Nalova, 2021; O’Doherty et al., 2018). However, no study to date appears to have explored the benefits or shortcomings of emergency remote teaching, as implemented in Saudi Arabia during the pandemic to teach practical computer skills (i.e. Windows, MS Office). Consequently, this study aims to explain the advantages and obstacles encountered by students when taking an online course to enhance their practical computer skills. To achieve this, it examined online students’ perceptions of undertaking a computer skills course online. The study considered many of the variables that could affect students’ perceptions, for example, the students’ self-evaluated computer skills, access to a computer device, the students’ awareness of the availability of the required apps free of charge, class size, and in-class practice.

**Literature review**

**Online learning during COVID-19**

In the literature, numerous studies have investigated online learning during the pandemic, identifying challenges and obstacles that may be classified as: (1) personal factors, such as students’ lack of time management skills (inability to balance education, work, and family responsibilities), students’ difficulties in understanding the material, poor concentration, and loss of motivation (Akhter, 2020;
Kara et al., 2019), (2) technical factors, including a lack of Internet access, technical issues, low computer literacy, lack of training and resources, and barriers to lab work (Adnan & Anwar, 2020; Anwar et al., 2020; Hafeez et al., 2021a, 2021b; Kaisara & Bwalya, 2021). Moreover, most of the students accessed the online classes via their smartphones and were unable to receive as much of the content as those who used a computer (Adnan & Anwar, 2020; Kaisara & Bwalya, 2021), and (3) communication factors, like limited interaction with tutors and peers, and social isolation (Adnan & Anwar, 2020; Anwar et al., 2020; Hafeez et al., 2021a; Kara et al., 2019).

To shed more light on these challenges, Hafeez et al. (2021a) surveyed 50 university students, determining that 56% of the sample faced login problems, whilst 78% faced audio-visual problems. Based on these findings, 72% of the students were dissatisfied. Similarly, Hamid et al. (2020) found that 64% of their sampled students were somewhat dissatisfied with online learning during COVID-19. The challenges encountered caused dissatisfaction with the online experience amongst 68% of the students, who considered it less effective and less motivating for their learning, as reported by Hamid et al. (2020). However, none of these studies examined the challenges faced by students whilst taking a computer skills course that required learning practical skills.

There are three types of interaction: learner-learner, instructor-learner, and learner-content (Moore, 1989). The students sampled by Bailey (2021) found instructor-learner interaction more influential than learner-learner or learner-content interaction, particularly in the online learning that was necessary during the COVID-19 pandemic. In online learning, instructors can interact with learners in diverse ways, like encouraging them to participate in class discussion, providing feedback on assignments and tests, and giving students feedback on their progress (Bailey, 2021). Learner-instructor interactions play an important role in developing students’ satisfaction with their courses (Bailey, 2021). The instructor’s role includes creating learning materials or providing learners with suitable resources for constructive learning. It also involves guiding students in the assessment of their own learning (Alkhatib, 2018). Instructors should use a variety of learning activities that require students to use their high-order thinking and socialisation skills (Shi et al., 2020). To date in the literature, although instructor-learner interaction has been investigated on a practical course, namely, an online engineering course (Alkhatib, 2018), it has never been investigated on an online computer skills course.

Shifting teaching from face-to-face to online mode requires significant investment in the requisite tools and equipment, as well as investing in the training of teachers and students. For example, it requires the development of online-learning content in a variety of formats such as video, audio-, and text, in order to foster an efficient and effective education system (Aliyyah et al., 2020; Hafeez et al., 2021b). It also requires lecturers to adjust their teaching strategies and modify the learning materials (Hamid et al., 2020). Moreover, it should be noted that not all learners have access to computer devices. Thus, it is essential to ensure that the necessary learning app is appropriate for smartphones, and that the students have Wi-Fi and Internet access (Hafeez et al., 2021b). Another essential component of online learning is support from teachers and parents through the provision of a suitable learning
environment, encouragement of peer collaboration, and availability of educational resources (Aliyyah et al., 2020). To sum up, universities are recommended to establish a broad mechanism for dealing with the anticipated barriers or challenges. Additionally, efforts should be made at an individual (student, teacher) and institutional (university and school management) level (Anwar et al., 2020).

Teaching practical skills online

Online teaching has been beneficial for certain disciplines, but its effectiveness for physical education has been limited, as found by Laar et al. (2021). This was justified as the effect of online learning in reducing students’ motivation and engagement in productive discussion. Moreover, it was found to be distracting to students. Similarly, Nalova (2021) found, through a survey of the opinions of 47 teachers and 258 students in different higher education institutions, that teaching practical skills online was ineffective, due to constraints like electricity cuts, lack of stable Internet, poor resources, and lack of competence amongst teachers. Other identified constraints consisted of a failure to take home-based study seriously, practical skills requiring supervision/directives and hands-on experience, and low interest as a result of distance. In the same vein, Elhaty et al. (2020) found that 53.4% of a sample of students believed practical skills to have been affected by the lockdown during the COVID-19 pandemic. Thus, the goal of the educational process is not fulfilled until learners can practice what they have learned. However, online courses do not necessarily provide students with opportunities for practice, as in the case of medical courses (Hafeez et al., 2021a). Instead, the best way to teach practical skills is through blended learning, as recommended by Nalova (2021). It is also important to manage collaborative learning online by providing appropriate content and suitable alternative tools (Gulatee & Combes, 2006).

The essential challenge in teaching computer science topics online is the application and practice of theory in the online environment (Gulatee & Combes, 2006). Furthermore, the teaching of computer science topics requires a high level of tutor–student interaction (Gulatee & Combes, 2006). This requires the teacher to use synchronous communication technologies that enable real-time interaction (for example, the Zoom meeting application, which allows video-sharing and video-recording between participants, chat, and whiteboard work via a cloud-based software platform). However, online teachers also need asynchronous communication tools, such as a discussion board or email, thereby allowing students to interact at their convenience (Gulatee & Combes, 2006; Hafeez et al., 2021b). Crick et al. (2020) identified inequity in accessing online-learning resources, a lack of lab facilities and suitable software, and inflexibility with regard to students as challenges to studying computer science online.

Teaching large classes online

What do we mean by a large online class? Elison-Bowers et al. (2011) consider an online class of 30–59 students as medium-sized, whilst an online class of 60–149
students is considered as a large class. To teach large classes online, teachers should move towards providing a learning environment, rather than attempting to teach in a traditional manner (Berry, 2009). The problems caused by large class sizes do not relate purely to the number of students, but rather to the pedagogical approaches adopted, as Hornsby (2020) argues. Under normal conditions, students in large synchronous classes suffer due to low engagement, poor performance, and few opportunities to develop their skills. During the pandemic, this applied to online learning and was exaggerated by the fact that nothing was ‘normal’ (Hornsby, 2020). For instance, class size affects the teacher’s capacity to respond to students and monitor their learning (Gulatee & Combes, 2006).

In the literature, numerous studies suggest designing teaching strategies and guidelines for large groups of students online, in order to maximise the online-learning experience. In particular, Hornsby (2020) proposes six principles for more effective teaching in the case of large online classes: (1) engaging students in active learning through synchronous and asynchronous activities, (2) providing equity, flexibility, and inclusion, (3) enabling students to make and rectify mistakes, (4) adopting an ethos of care, (5) developing the idea that learning is not just for assessment, but also about developing skills, attributes, and proficiencies, and (6) using alternative grading approaches.

In the same vein, Elison-Bowers et al. (2011) present guidelines for managing heavily subscribed online courses: (1) ensuring effective communication via various communication tools, and building a personal trust relationship between the teacher and students, (2) using teaching assistants to hold virtual office hours, monitor online discussions and chat, and identify students who are experiencing academic difficulties, (3) using suitable teaching techniques, such as active and collaborative learning, and (4) engaging in sound professional practices.

Berry (2009) highlighted similar design elements to improve students’ perceptions of online learning in large classes, providing timeframes and deadlines, reducing exam stress by resolving technical issues, providing different student–teacher and student–student communication channels, providing a teaching assistant to help respond to students’ questions, and developing a trust relationship between the students and their teacher, so that students are confident that any problem can be addressed with their teacher on a one-to-one basis.

The theoretical framework of the current study is based on e-Learning Theory (Haythornthwaite & Andrews, 2011), which contains some of the principles bearing upon the barriers to online education: the pre-training principle, redundancy principle, and expertise effect. In particular, these principles concern technical problems, a lack of training, and the skills shortage in online education (Haythornthwaite & Andrews, 2011). This Theory also comprises other principles that refer to instructional design: the principles of multimedia, coherence, segmenting, personalisation, and learner control. These principles relate to designing an effective online learning environment with more than one format to explain the content, whilst at the same time avoiding irrelevant media. In addition, the content should be broken into segments and presented in a conversational style. Moreover, the learner should be able to control the pace of their learning.
From the literature reviewed, it is clear that numerous challenges and obstacles beset online learning during the pandemic. However, few studies have endeavoured to identify these challenges and obstacles in relation to teaching computer skills topics, particularly in Saudi Arabia. Students’ perceptions of online learning on computer skills courses consequently need to be investigated in respect of a number of essential variables. Firstly, class size is one of the keys to successful online learning. Secondly, personal factors, including students’ self-evaluation of their computer skills, need to be considered. Thirdly, technical factors, like the availability of a computer device, training, and students’ knowledge of the existence of the required apps free of charge, bear heavily on the positive outcomes of online learning.

Significance of the study

From a review of the literature on teaching practical skills, it is clear that practical skills include teaching physical education, medical, and computer science topics. However, the teaching of what could be considered as fundamental skills in computer science does not appear to have received adequate academic attention. Moreover, certain variables have not been studied in relation to the effectiveness of online teaching, like students’ practice during lectures, the course instructor, and the size of the online class.

Hence, the aim of this study is to identify the benefits and challenges facing online students when studying the practical aspects of a computer skills course. It also seeks to provide teachers with the design elements to be considered whilst teaching these practical components of an online course in computer skills. This study also aims to inform policymakers of the appropriateness of teaching a computer skills course online, making recommendations accordingly. As a result, this study attempts to answer the following research questions:

1. What are online students’ perceptions of undertaking a computer skills course online?
2. Are there any significant differences in students’ perceptions of undertaking an online computer skills course, according to their self-evaluated computer skills?
3. Are there any significant differences in students’ perceptions of undertaking an online computer skills course, based on the availability of a computer device?
4. Are there any significant differences in students’ perceptions of undertaking an online computer skills course, based on their knowledge of the availability of the required apps free of charge?
5. What are the challenges facing students whilst undertaking a computer skills course online?

Methodology

Mixed methods were applied in this study, according to a sequential transformative design (Creswell et al., 2003), whereby data collection started with qualitative data collection and analysis. This involved a focus group, conducted to discover the traits and
challenges faced by participants whilst undertaking a computer skills course. The focus group method was used to encourage the participants to express their ideas and explain their views, as this may have been their first time to be interviewed. The use of a survey to collect data also helped the researcher gather comprehensive information from a large number of participants, in order to answer the research questions. An analysis of the survey responses then formed part of the research results. Finally, qualitative data collection (interviews) was carried out with 10 students to gather their views in detail, in reference to the survey results. The interviews enabled the researcher to gain access to the participants’ rich experiences. The reason for only conducting interviews with 10 interviewees was because the interviews coincided with the end of the semester when the students were busy with their final exams. The aim of adopting these methods was to triangulate the students’ views and collect more details of their experiences.

The sample

The study sample consisted of Preparatory Year students on the Humanities track at Imam Abdulrahman Bin Faisal University. In the academic year 2021/2022, the University’s Preparatory Year programme had a student intake of 1400, divided into 56 classes of around 25 students each. For this study, six classes were randomly selected, but participation was purely voluntary. The students read the informed consent form and were notified of their rights to confidentiality and anonymity, as well as their freedom to withdraw from the study at any time. The sample consisted of female students, ranging in age from 18 to 20 years, with varying levels of computer skills. This variation in the level of computer skills can be explained by the type of secondary school attended. Twelve per cent of the students attended a private secondary school, whilst 88% attended a public-sector school. For this reason, 15% of the students rated themselves as having a high level of computer skill because they had studied in a private school or developed their skills another way, whilst the students who had studied in public-sector schools had moderate or low computer skill levels, and the computer skills course was not a core course for them. The students also came from different economic backgrounds. Thus, some had easy access to computer devices and the Internet, whilst others did not. For instance, 87% of the students owned a computer and 92% of those had MS Office installed on their devices. Moreover, 87.5% were aware that they could download MS Office freely from their University accounts. The sample size for each research instrument was as follows:

1. Focus group = 15 students
2. Survey = 112 students
3. Interview = 10 students.
The instruments

Focus group

A focus group was conducted to identify the benefits and challenges facing the students on an online computer skills course during the COVID-19 pandemic. The interview focussed on the following questions, using probes as required:

1. What are the benefits of undertaking an online computer skills course?
2. What difficulties did you face whilst undertaking an online computer skills course?
3. Did you encounter any technical problems whilst undertaking this course? Please elaborate.
4. Is there a relationship between any of your personal issues and the difficulties that you faced? Please explain your response.
5. What about the teachers’ explanation and support for your online learning? Were they helpful? Please explain your response.
6. How much did you interact with your peers whilst undertaking the online course? How was this interaction if there was any?

Students’ perceptions of taking a practical course online, as gathered in the COVID-19 survey

The survey on remote learning during the pandemic (COVID-19 Survey) was in three parts: Part One was designed to reveal the students’ self-evaluation of their computer skills, possession of a computer device, and knowledge of how to download the required apps free of charge, Part Two was designed to ascertain the advantages and difficulties of acquiring computer skills on an online course, and Part Three was incorporated into Part Two of the Survey, but analysed separately to measure the challenges facing students on an online computer skills course. Thus, negative experiences and the technical barrier construct were investigated in this survey. In total, the survey consisted of 55 items, measured on a 5-point Likert scale. The analysis of the focus group results subsequently informed the quantitative data collection tool, resulting in the formulation of the survey items. The survey constructs and statements were also formed based on two surveys in the literature that had examined online students’ perceptions of learning during the COVID-19 pandemic (Bączek et al., 2021; Xhelili et al., 2021). The scale constructs and items (statements) are presented in Table 2.

Validity and reliability of the scale

The scale’s validity was verified in different ways. First, content validity was verified by sending the scale’s constructs and items in their preliminary form to five specialists in educational technology, curricula, and teaching methods, so that
they could evaluate the accuracy of the 55 statements and their appropriateness to the constructs. The percentage agreement between the opinions of these specialists ranged from 80 to 100%. All items except for five scored 80%. Consequently, one of these items was moved to another construct. Meanwhile, the wording of the other four items was modified.

Second, the scale’s construct validity was examined. Consequently, a pilot study was conducted, using a small sample (34) of female students who would not be participating in the main study. The survey’s internal consistency was verified by calculating the correlation coefficient between each item and the total degree of the construct to which it referred. The correlation coefficient values are presented in Table 1.

It is clear from Table 1 that the correlation coefficients of all the items, with the total score of the constructs to which they belong, are statistically significant at the level of 0.01, except for two items: 33 and 42. These two items were therefore deleted from the survey in its final form, which then consisted of 53 items. The correlation coefficients were calculated for the constructs, along with the total score for the scale, as shown in Table 2.

It is clear from Table 2 that the scale had a high degree of internal consistency in the measurement of students’ views of learning computer skills online, as the correlation coefficients were significant at the level of 0.01.

To measure the challenges facing the students whilst studying computer skills online, both negative statements and technical barriers were collected. This part of the survey consisted of 25 items. The internal consistency of this scale was verified by calculating the correlation coefficients between the items and the total score for the scale, as shown in Table 3.

It is clear from Table 3 that for all the items, the correlation coefficients and the total score for the scale are statistically significant at the level of 0.01, except for item 23, which was deleted. The scale in its final form consisted of 24 items, whilst the students’ scale of perceptions contained 52 items.

To compute the scale’s reliability, Cronbach’s alpha and split half were applied. Split half reliability was computed after the scale was divided into two equal parts. The reliability values are reported in Table 4.

Table 4 shows the reliability values, ranging between 0.742 and 0.933. The reliability coefficient for the Cronbach’s alpha and split half of all the constructs amounted to 0.933 and 0.875, respectively. The reliability coefficient for the Cronbach’s alpha and split half of the barriers/challenges consisted of 0.929 and 0.879, respectively. These results confirm the acceptable reliability of the scales, as defined by Fisher (2007).

The interview

Semi-structured interview questions were formulated after analysing the results of the scales, in order to obtain more information about the results. The interview guide contained the following questions, with probes used as required:
| Construct                          | Item                                                                 | Correlation Coefficient |
|----------------------------------|----------------------------------------------------------------------|-------------------------|
| Factors related to e-learning    | Studying on an online computer skills course helped increase my knowledge        | .702**                  |
|                                  | Studying on an online computer skills course helped develop my skills           | .687**                  |
|                                  | The learning process was more interesting                                   | .679**                  |
|                                  | I enjoyed learning on an online computer skills course during COVID-19         | .749**                  |
|                                  | Online learning has had a positive impact on my performance on this course     | .807**                  |
|                                  | Technology brings large benefits to education                                | .645**                  |
|                                  | Online exams cause me more anxiety than exams in the classroom               | .418*                   |
|                                  | The learning process increases my understanding more effortlessly in an online class | .658**                  |
|                                  | It is difficult to use technology for learning purposes                      | .452**                  |
|                                  | Online learning is a positive experience, despite being introduced as a result of the pandemic | .782**                  |
|                                  | Online learning enabled me to learn at a pace I found suitable               | .671**                  |
|                                  | One of the merits of online learning is that it enables me to stay at home    | .560**                  |
|                                  | One of the merits of online learning is that it enables me to study in comfortable surroundings | .580**                  |
| Technical barriers               | I find it difficult to access and process the course materials, due to having to use technological devices | .699**                  |
|                                  | I have encountered technical problems whilst e-learning                      | .707**                  |
|                                  | A lot of the time, the microphone was not working                           | .743**                  |
|                                  | The teacher’s voice was often unclear                                        | .710**                  |
|                                  | The part that the professor was explaining and working on was not clear to me on the screen | .791**                  |
|                                  | The Internet connection was not stable at home                               | .716**                  |
|                                  | It was difficult to use Zoom                                                | .616**                  |
|                                  | It was difficult to use Blackboard                                          | .539**                  |
| Construct                  | Item                                                                 | Correlation Coefficient |
|----------------------------|----------------------------------------------------------------------|-------------------------|
| **Personal factors**       | I have adapted easily to online learning                             | .854**                  |
|                            | I am more productive and committed in my studies                     | .731**                  |
|                            | I have changed my method of learning                                 | .615**                  |
|                            | I have felt tired of learning via technological devices for a long time | .678**                  |
|                            | It is easier for me to concentrate                                  | .494**                  |
|                            | I will achieve my academic goals through online learning             | .704**                  |
|                            | My technology skills have improved during online learning            | .776**                  |
|                            | I have reduced my use of the Internet for entertainment              | .677**                  |
|                            | I attend classes more often                                          | .496**                  |
| **Practice during sessions**| I have not been adequately trained to use Zoom                       | .643**                  |
|                            | I have not been adequately trained to use Blackboard                 | .668**                  |
|                            | My technical computer skills were limited                            | .219                    |
|                            | I used a smartphone to access the classroom, which made training difficult | .648**                  |
|                            | It is difficult to use technology for learning purposes              | .667**                  |
|                            | I was unable to focus                                                | .838**                  |
|                            | I have unsuitable conditions for learning at home                    | .807**                  |
|                            | I was unable to develop self-learning skills                          | .670**                  |
| Construct           | Item                                                                 | Correlation Coefficient |
|---------------------|----------------------------------------------------------------------|--------------------------|
| Course teacher      | The teacher’s explanation was clear                                  | .744**                   |
|                     | The professor did not give us enough time to implement what she had explained | .825**                   |
|                     | The professor did not answer any of our questions                     | .664**                   |
|                     | The instructor gave us feedback                                       | .314                     |
|                     | The professor did not give us an opportunity for cooperative learning | .739**                   |
|                     | The teacher helped to simplify the information                         | .673**                   |
| Interaction factor  | I am more communicative                                               | .533**                   |
|                     | I prefer face-to-face interaction                                      | .464**                   |
|                     | I spend more time studying                                            | .681**                   |
|                     | Traditional on-campus learning increases student engagement more than e-learning | .703**                   |
|                     | Technology enables good cooperation between students                  | .716**                   |
|                     | During e-learning, I feel isolated                                     | .727**                   |
| No. of students     | The presence of a large number of students in the virtual classroom was an obstacle to my understanding of some of the information | .673**                   |
|                     | The large number of students in the group prevented me from asking the professor any questions | .501**                   |
|                     | The large number of students increased my chances of interacting with my colleagues | .634**                   |
|                     | Having a large number of students in the class made learning fun       | .858**                   |
|                     | The presence of a large number of students in the class encouraged me to interact with the instructor | .828**                   |

** 0.01 level
Table 2  Correlation coefficients for the constructs, with the total score

| Constructs                  | Factors related to e-learning | Technical barriers | Personal factors | Practice during sessions | Course teacher | Interaction factor | No. of students |
|-----------------------------|-------------------------------|-------------------|------------------|--------------------------|----------------|--------------------|-----------------|
| Correlation coefficient    | .877**                        | .710**            | .654**           | .743**                   | .633**         | .623**             | .877**          |
Table 3 Correlation coefficients for the items relating to challenges and the total degree of the scale

| Item no | Correlation coefficient |
|---------|------------------------|
| 1       | .521**                 |
| 2       | .740**                 |
| 3       | .707**                 |
| 4       | .600**                 |
| 5       | .587**                 |
| 6       | .540**                 |
| 7       | .706**                 |
| 8       | .617**                 |
| 9       | .667**                 |
| 10      | .606**                 |
| 11      | .670**                 |
| 12      | .609**                 |
| 13      | .669**                 |
| 14      | .683**                 |
| 15      | .782**                 |
| 16      | .750**                 |
| 17      | .585**                 |
| 18      | .697**                 |
| 19      | .494**                 |
| 20      | .444**                 |
| 21      | .514**                 |
| 22      | .493**                 |
| 23      | .297                   |
| 24      | .607**                 |
| 25      | .682**                 |

Table 4 Reliability of the scale (n = 34)

| Sub-scales                  | Cronbach’s alpha | Split half |
|-----------------------------|------------------|------------|
| Factors related to e-learning | .881             | .874       |
| Technical barriers          | .850             | .886       |
| Personal factors            | .782             | .865       |
| Practice during sessions    | .849             | .883       |
| Course teacher              | .809             | .861       |
| Interaction factor          | .812             | .880       |
| No. of students              | .742             | .838       |
| All factors                 | .933             | .875       |
| All barriers/challenges     | .929             | .879       |
1. Amongst the factors with a significant impact on students’ perceptions of undertaking an online computer skills course were those related to e-learning, such as the ease of submitting assignments, and personal factors, namely, the students’ understanding and their ability to use a computer, as well as the opportunity to practice during sessions. How would you explain this?

2. Please try and explain this result: ‘The students who evaluated themselves as having a high level of computer skills had a higher degree of acceptance of online learning.’

3. Please try and explain this result: ‘The students who owned a computer had a higher degree of acceptance of online learning.’

4. The most highly rated difficulties faced by the students included ‘traditional on-campus learning increasing student engagement more effectively than e-learning’, with one student stating: ‘A lot of the time, the microphone was not working, and I encountered technical problems during e-learning.’ What do you think about this statement?

5. The lowest rated difficulties faced by the students were as follows: ‘The professor did not give us enough time to implement what she explained’, ‘The professor did not give us an opportunity for cooperative learning’, and ‘The professor did not answer any of our questions.’ What are your opinions of these statements?

Analysis

To analyse the focus group and interview data, thematic analysis was used. This was performed by applying descriptive codes to the data, after which general themes were extracted. Meanwhile, an independent researcher coded the interviews separately. Inter-rater reliability was then assessed using Cohen’s Kappa statistic to estimate the degree of agreement between the raters. The Kappa value was 0.84, which Landis & Koch (1977) claim to be substantial.

To analyse the results of the scales, internal consistency and factorial analysis were used to verify the scale’s validity. Cronbach’s alpha and split half were also applied to compute the scale’s reliability. In order to answer the research questions, the mean, median, standard deviation, kurtosis and skewness values, and a t-test were implemented to answer the research questions.

Results

Focus group results

To answer the first and fifth research questions, concerning the students’ perceptions of undertaking a computer skills course online, along with the challenges that they faced in the process, a focus group was conducted. The analysis of the focus group results revealed five main themes. The first theme consisted of the difficulties encountered when learning computer skills online. These difficulties included technical issues such as a weak Internet connection, computer devices failing to
function as expected, and the Zoom application’s microphone ‘hanging’ (becoming unresponsive). The students also complained that they faced difficulties with learning computer skills online because they were unable to practice what learned in the lessons, given that they did not have their own computers. Other students attributed their difficulties to having other versions of the apps. Moreover, one of the interviewees reported that she was unfamiliar with Blackboard, whilst another stated that she was unfamiliar with Zoom, especially the Zoom mobile app.

The second theme was the students’ need for direct support from their teacher. However, the sound was sometimes poor, and the students could not hear their teacher properly. Moreover, two students reported that the teacher did not give them enough time to practice during the online sessions. Another student claimed that her teacher did not answer her questions in class, and she attributed this to the large number of students constantly asking questions. Conversely, most of the interviewees emphasised the important role of the teacher in explaining and facilitating lessons.

The third theme concerned personal matters. Many students highlighted the difficulty of focusing on multiple things at once, as the teacher gave explanations via Zoom whilst the students engaged in practice using MS Office or Windows. The students found it difficult to focus using these different apps. It also appeared to be difficult for them to learn practical skills online. A few of the interviewees (three students) specified that what made it difficult to learn online from home was their family responsibilities, whilst others claimed that they were distracted at home. Overall, many of the students declared their need for face-to-face practical classes. Moreover, it was no longer a novelty for them to use technology in their learning, as they had done so previously during the pandemic. In contrast, five of the interviewees reported that it was easy for them to concentrate in an online environment and for them, it had developed skills like self-learning and time management.

The fourth theme related to the large class sizes in the online sessions. This limited the students’ chances of asking a question or interacting with their teacher and peers. Only one student declared that she did not find this to be an obstacle to learning. This final theme concerned the limited opportunities for peer interaction in the online sessions, due to the students being occupied with practicing what the teacher explained to them. Thus, the students used other apps for communication when necessary. They consequently stated that if it was not for the group work, they would have felt even more isolated.

The students’ perceptions of taking a practical course online, in reference to the COVID-19 survey results

To answer the first research question, which was intended to determine the students’ perceptions of undertaking a computer skills course online; the mean, standard deviation, and weighted mean were calculated for the results of a survey on undertaking a computer skills course online, as illustrated in Table 5.

From Table 5, it would appear that the students’ perceptions of undertaking an online computer skills course was high, as the total weighted mean for the scale’s
constructs was 3.54. In particular, the weighted mean of the following constructs was high: e-learning, personal factors, practice during sessions, and the course instructor. However, the weighted mean of the following constructs was ‘medium’: technical factors, the interaction factor, and number of students. This indicates that the latter group of constructs had a moderate impact on the students’ perceptions of undertaking a computer skills course online.

One-way analysis of variance was calculated to answer the second research question, which was designed to identify any significant differences in students’ perceptions of undertaking a computer skills course online, based on the students’ self-evaluation of their computer skills, as presented in Table 6.

In Table 6, differences may be noted between the three levels of the constructs: high, medium, and low—the constructs being the factors of e-learning, technical factors, personal factors, practice during sessions—and the total score. In order to discover the differences between the means, a Scheffe test was computed to determine the significance of the differences, as illustrated in Table 7.

Table 7 reveals differences in students’ perceptions of undertaking a computer skills course online, based on the students’ self-evaluation of their computer skills. The comparison was between high, medium, and low perceptions of the online computer skills course in relation to students’ self-evaluated computer skills, with results in favour of a high level. This indicates that the students who evaluated their computer skills highly had more positive perceptions of undertaking a computer skills course online, compared to their peers with a medium or low self-evaluation.

To answer the third question, concerning whether there were any significant differences in students’ perceptions of taking a computer skills course online, based on the availability of a computer device, a t-test was computed to detect the significance of that difference, as illustrated in Table 8.

It was found that 87% of the students owned a computer. Table 8 shows differences between the students’ perceptions of undertaking a computer skills course online, based on the availability of a computer device and in relation to the constructs (e-learning, personal factors, practice during sessions) and the total score, in favour of students who owned a computer. Conversely, no differences were found between the participants in relation to the constructs (technical factors,

| Dimensions                  | M    | SD   | Weighted Mean | Ranking | Level  |
|-----------------------------|------|------|---------------|---------|--------|
| E-learning                  | 47.25| 9.73 | 3.63          | 3       | High   |
| Technical factors           | 25.58| 6.07 | 3.20          | 6       | Medium |
| Personal factors            | 33.45| 4.81 | 3.72          | 2       | High   |
| Practice during sessions    | 23.88| 6.08 | 3.41          | 4       | High   |
| Course instructor           | 21.63| 2.89 | 4.33          | 1       | High   |
| Interaction factor          | 15.71| 3.70 | 3.14          | 7       | Medium |
| No. of students             | 16.49| 4.82 | 3.30          | 5       | Medium |
| Total                       | 183.98| 27.92| 3.54          |         | High   |
course instructor, interaction factor, number of students), meaning that the students who owned a computer had more positive perceptions of undertaking a computer skills course online, compared to those who did not own such a device, specifically in terms of e-learning, personal factors, and opportunities to practice during sessions. However, no differences were found between the groups for the remaining constructs.

To answer the fourth question, concerning whether there were any significant differences in students’ perceptions of undertaking a computer skills course online, based on the availability of the required apps, a t-test was computed to detect the significance of that difference, as presented in Table 9.

It is clear from Table 9 that there were differences between the students’ perceptions of undertaking a computer skills course online, based on them knowing how to download the required apps free of charge, specifically with regard to the constructs (e-learning, personal factors, practice during sessions, the interaction factor) and the total score, in favour of those who possessed this information. In contrast, no differences were found between the participants in the constructs: technical factors,

| Table 6 | One-way analysis of variance of students’ self-evaluation of their computer skills |
|---------|----------------------------------|-----|----------------|-----|------------|
| Variables                     | Sum of Squares | df | Mean Square | F   | Sig        |
| E-learning                     |                  |    |             |     |            |
| Between groups                 | 1061.509        | 2  | 530.754     | 6.126 | 0.003     |
| Within groups                  | 9443.491        | 109| 86.638      |      |            |
| Total                          | 10,505.000      | 111|             |      |            |
| Technical factors              |                  |    |             |     |            |
| Between groups                 | 498.992         | 2  | 249.496     | 7.575 | 0.001     |
| Within groups                  | 3590.285        | 109| 32.938      |      |            |
| Total                          | 4089.277        | 111|             |      |            |
| Personal factors               |                  |    |             |     |            |
| Between groups                 | 193.629         | 2  | 96.815      | 4.438 | 0.014     |
| Within groups                  | 2378.049        | 109| 21.817      |      |            |
| Total                          | 2571.679        | 111|             |      |            |
| Practice during sessions       |                  |    |             |     |            |
| Between groups                 | 532.007         | 2  | 266.003     | 8.127 | 0.001     |
| Within groups                  | 3567.484        | 109| 32.729      |      |            |
| Total                          | 4099.491        | 111|             |      |            |
| Course instructor              |                  |    |             |     |            |
| Between groups                 | 48.398          | 2  | 24.199      | 3.005 | 0.054     |
| Within groups                  | 877.852         | 109| 8.054       |      |            |
| Total                          | 926.250         | 111|             |      |            |
| Interaction factor             |                  |    |             |     |            |
| Between groups                 | 75.569          | 2  | 37.784      | 2.849 | 0.062     |
| Within groups                  | 1445.708        | 109| 13.263      |      |            |
| Total                          | 1521.277        | 111|             |      |            |
| No. of students                |                  |    |             |     |            |
| Between groups                 | 127.169         | 2  | 63.584      | 2.826 | 0.064     |
| Within groups                  | 2452.822        | 109| 22.503      |      |            |
| Total                          | 2579.991        | 111|             |      |            |
| Total                          |                  |    |             |     |            |
| Between groups                 | 13,864.654      | 2  | 6932.327    | 10.396 | 0.000     |
| Within groups                  | 72,687.310      | 109| 666.856     |      |            |
| Total                          | 86,551.964      | 111|             |      |            |
the course instructor, number of students. This indicates that students who were aware of the free availability of the required apps had more positive perceptions of undertaking the online computer skills course, in terms of the constructs (e-learning, personal factors, practice during sessions, the interaction factor) and the total score, compared those who did not have this information.

To answer the fifth research question, related to identifying the challenges facing students on an online computer skills course, the mean and standard deviation were computed for the challenges, as presented in Table 10 in descending order of mean values.

In Table 10, the total mean indicates a medium level of challenge facing students on an online computer skills course (2.65). The statement, ‘Traditional on-campus learning increases student engagement more than e-learning’ was the only statement to elicit a high challenge response (4.06). However, the statements: ‘The professor did not give us an opportunity for cooperative learning’, and ‘The professor did not answer any of our questions’, presented the lowest level of challenge (1.78, 1.51, respectively).

Table 7: Scheffe test to identify the significance of differences between means

| Difference | Factors of e-learning | Technical factors | Personal factors | Practice during sessions | Total |
|------------|-----------------------|-------------------|------------------|--------------------------|-------|
| Weak       | Medium                | −1.43             | −3.05            | −0.62                    | −2.85 |
| High       | −9.80*                | −8.18*            | −4.90*           | −8.26*                   | −38.42*|
| Medium     | Weak                  | 1.43              | 3.05             | 0.62                     | 2.85  |
| High       | −8.38*                | −5.13*            | −3.58*           | −5.42*                   | −29.40*|
| High       | Weak                  | 9.80*             | 8.18*            | 4.90*                    | 8.26* |
| Medium     | 8.38*                 | 5.13*             | 3.58*            | 5.42*                    | 29.40*|

Table 8: T-test results of the difference in students’ perceptions of undertaking a computer skills course online, based on the availability of a computer device

| Variables                  | Yes   |       | No    |       | t     | Sig  |
|----------------------------|-------|-------|-------|-------|-------|------|
|                            | M     | SD    | M     | SD    |       |      |
| E-learning                 | 48.46 | 8.95  | 39.40 | 11.17 | 3.53  | 0.001|
| Technical factors          | 25.90 | 6.01  | 23.53 | 6.25  | 1.41  | 0.161|
| Personal factors           | 33.89 | 4.50  | 30.60 | 5.90  | 2.52  | 0.013|
| Practice during sessions   | 24.46 | 5.61  | 20.13 | 7.70  | 2.64  | 0.010|
| Course instructor          | 21.77 | 2.80  | 20.67 | 3.35  | 1.39  | 0.168|
| Interaction factor         | 15.92 | 3.47  | 14.33 | 4.86  | 1.55  | 0.124|
| No. of students            | 16.69 | 4.56  | 15.20 | 6.29  | 1.12  | 0.267|
| Total                      | 187.09| 25.47 | 163.87| 35.10 | 3.11  | 0.002|
Interviews

To triangulate the survey findings and obtain more detail, semi-structured interviews were carried out. Many of the interviewees expressed their perceptions and described their experience of taking a computer skills course online as ‘good’, reporting that:

the online environment made many things easy, like submitting assignments and doing exams. Learning online increased my knowledge and skills.

Regarding the advantages of online learning on a computer skills course, three of the students interviewed declared that online learning had given them the chance to learn at their own pace, whilst two interviewees stated that they were more confident about online learning as a result, since they were no longer shy about asking questions or making mistakes.

Online learning appeared to have developed the students’ self-learning skills, with one student declaring:

This is because during class, if any information was difficult to understand, I Googled it quickly and I was able to keep up with the lesson.

Most of the interviewees reported that commitment to the online class schedule and timely submission of their assignments was helpful and made online learning easier and more interesting. This developed both their time management and self-learning skills. In contrast, other interviewees found that online learning impaired their focus, and using the Internet and computers for long periods caused them fatigue.

Online learning where students can study at home seemed to suit some of the participants. For example, three of the students explained that learning at home was comfortable, as they had quiet and relaxed environments in which to study. However, five students stated that studying at home was not a good option, as they were distracted by their younger siblings, or even by their own children.

Table 9  T-test results for the difference in students’ perceptions of undertaking a computer skills course online, based on the availability of the required apps

| Variables           | Yes | No        | t   | Sig  |
|---------------------|-----|-----------|-----|------|
|                     | M   | SD        | M   | SD   |       |
| E-learning          | 48.17 | 9.07    | 36.78 | 11.38 | 3.54  | 0.001 |
| Technical factors   | 25.82 | 6.20    | 22.89 | 3.44  | 1.39  | 0.166 |
| Personal factors    | 33.83 | 4.67    | 29.00 | 4.36  | 2.99  | 0.003 |
| Practice during sessions | 24.38 | 5.82    | 18.22 | 6.38  | 3.02  | 0.003 |
| Course instructor   | 21.72 | 2.93    | 20.56 | 2.19  | 1.16  | 0.249 |
| Interaction factor  | 15.93 | 3.61    | 13.11 | 3.95  | 2.23  | 0.028 |
| No. of students     | 16.73 | 4.78    | 13.78 | 4.68  | 1.78  | 0.078 |
| Total               | 186.57 | 26.74  | 154.33 | 25.06 | 3.48  | 0.001 |
Table 10  Mean and standard deviations for the challenges facing students whilst undertaking a computer skills course online

| Item                                                                 | M    | SD   | Level*  |
|---------------------------------------------------------------------|------|------|---------|
| Traditional on-campus learning increases student engagement more than e-learning | 4.06 | 1.06 | High    |
| A lot of the time, the microphone was not working                   | 3.55 | 1.31 | Medium  |
| I encountered technical problems whilst e-learning                   | 3.46 | 1.22 | Medium  |
| During e-learning, I feel isolated                                  | 3.41 | 1.4  | Medium  |
| The Internet connection was not stable at home                       | 3.14 | 1.33 | Medium  |
| I was unable to focus                                                | 3.12 | 1.29 | Medium  |
| I used a smartphone to access the classroom, which made training difficult | 2.79 | 1.25 | Medium  |
| The large number of students in the group prevented me from asking the professor any questions | 2.75 | 1.33 | Medium  |
| I find it difficult to access and process the course materials, due to having to use technological devices | 2.72 | 1.13 | Medium  |
| I have not been adequately trained to use Blackboard                 | 2.69 | 1.28 | Medium  |
| I was unable to develop self-learning skills                          | 2.66 | 1.17 | Medium  |
| The teacher’s voice was often unclear                               | 2.65 | 1.26 | Medium  |
| The presence of a large number of students in the virtual classroom was an obstacle to my understanding of some of the information | 2.65 | 1.31 | Medium  |
| Online exams cause me more anxiety than exams in the classroom       | 2.63 | 1.42 | Medium  |
| It was difficult to use Blackboard                                   | 2.63 | 1.34 | Medium  |
| I have unsuitable conditions for learning at home                    | 2.54 | 1.3  | Low     |
| It is difficult to use technology for learning purposes              | 2.35 | 1.02 | Low     |
| I did not apply what I had learned when the professor asked me to    | 2.21 | 1.16 | Low     |
| The part that the professor was explaining and working on was not clear to me on the screen | 2.18 | 1.03 | Low     |
| I have not been adequately trained to use Zoom                       | 2.12 | 1.12 | Low     |
| It was difficult to use Zoom                                         | 2.07 | 1.03 | Low     |
| The professor did not give us enough time to implement what she had explained | 1.81 | 0.87 | Low     |
| The professor did not give us an opportunity for cooperative learning | 1.78 | 0.94 | Very low |

*Level: Very low, Low, Medium, High
| Item                                           | M     | SD  | Level*       |
|------------------------------------------------|-------|-----|--------------|
| The professor did not answer any of our questions | 1.51  | 0.84| Very low     |
| Challenges                                     | 2.65  | 1.18| Medium       |

*aNote level: Average value very high from 4.19 to 5; high from 3.39 to 4.19; medium from 2.59 to less than 3.39; low from 1.79 to less than 2.59, and very low from 1 to less than 1.79*
Regarding practice with their instructor during the synchronous online sessions, five of the students claimed that they had such opportunities to practice, which helped them to understand and remember their lessons. Conversely, the students who did not have this chance to practice during the sessions found their lessons boring and were unable to focus.

The interviewees with a high degree of acceptance of learning computer skills online attributed this acceptance to their high self-evaluation of their computer skills, given that they had sound basic knowledge of using a computer. Similarly, a high degree of acceptance of the online computer skills course amongst those who owned a computer could be attributed to those students being able to practice during class. They were also able to learn after class, complete their assignments, and explore the lesson topics further. In contrast, those who did not own a computer were unable to practice during or after class, which could have impeded their understanding of the lessons. Moreover, to complete their assignments, they were obliged to borrow computers from relatives or friends, which was an additional difficulty for them.

For the final interview question, the students rated the following difficulty highest: ‘Traditional on-campus learning increases student engagement more than e-learning.’ Thus, online learning appeared to reduce peer engagement more than face-to-face learning, whilst increasing the sense of social isolation. For example, peers in practical, face-to-face classes support and explain points to each other. In addition, group work is easier in traditional learning than it is via online apps. Technical issues were the second most highly rated difficulty faced by the students as these caused them anxiety and distracted their thinking, thereby interrupting their understanding. In contrast, the lowest rated difficulties faced by the students related to their course instructors, as the professors gave them enough time to practice, as well as answering students’ questions and giving them opportunities to collaborate.

Discussion

This study aims to identify online students’ perceptions of undertaking a computer skills course, identifying the merits and challenges faced by the students during this experience, especially with regard to specific variables: (1) the students’ self-evaluation of their computer skills, (2) the availability of computer devices, and (3) knowledge of the availability of the required apps, free of charge. This aim refers to expertise effect, which is one of the principles of e-Learning Theory. The expertise effect principle measures the effect of design principles on learners, based on their diverse prior knowledge and skills. To achieve this aim, the focus group results identified the difficulties encountered by the students when striving to learn computer skills online. The difficulties consisted of technical issues, the student’s need for direct support from the teacher, personal matters, large class sizes, and limited opportunities for peer interaction. These themes helped form the scale constructs and statements, which measured whether students’ perceptions of taking a practical course online would be affected. The themes included e-learning advantages, technical factors, personal factors, practice during sessions, the course instructor, the interaction...
factor, and the number of students. The semi-structured interview questions were formulated after analysing the results of the scales, and the interviews were conducted to obtain more information about the results.

Five traits promoted positive perceptions amongst the students, with regard to learning computer skills online. First, the focus groups and survey results showed that the possession of a computer device enabled the students to experience the advantages of e-learning and to practice during class. This is echoed by (Hafeez et al., 2021a, 2021b) who found that possession of a device promoted students’ online learning. Personal factors, like the ability to understand the lessons and study at home, were also rated higher by those who owned their own computer. This was emphasised by some of the interviewees, who declared that studying at home suited them, as they had quiet and relaxed home environments. Students from families with limited resources and little or no technology could therefore miss the online classes (Hafeez et al., 2021a, 2021b). Second, knowing about the free availability of the required apps to download enabled the students to experience the benefits of e-learning and practice during sessions. This is in contrast to Kaisara & Bwalya (2021), who found that most of a sample from a Saudi university lacked resources like their own computer device, Internet access, and having the required apps. Personal and interaction factors were more highly rated by those who knew about the availability of these apps, as they were able to communicate with peers and discuss the lessons, leading to collaborative tasks. Third, being able practice during sessions promoted positive perceptions of online learning, as these students owned a computer and had the required apps, as mentioned above. This emphasises that training is essential when teaching practical courses online (Anwar et al., 2020; Hafeez et al., 2021a, 2021b). Fourth, the course instructor was a highly rated factor, leading to positive perceptions amongst the students. This is in line with Bailey’s (2021) finding that an instructor performing a positive role can encourage students to perceive a course positively. Meanwhile, the lowest rated challenges in the survey related to the professor providing opportunities for cooperative learning. In the interviews, the students clarified the professors’ help in answering their questions during the synchronous online sessions; the professors’ explanations apparently helped them to understand and remember their lessons. Fifth, e-learning factors were highly rated by the students, as these factors were thought to promote positive perceptions of online learning. The students acknowledged the advantages of the online environment, as it facilitated tasks such as the submission of assignments and administering exams. Overall, it increased the students’ knowledge and skills.

On the other hand, five challenges led to negative perceptions of learning computer skills online amongst the sampled students. First, the issue of large class sizes was mentioned in the focus group and identified as a medium-rated factor in the survey. This was attributed to the large student numbers attending the synchronous sessions, which limited students’ chances to ask their teacher questions or to interact with others, as revealed in the interviews. It should be noted here that the main reason for teaching computer skills online was the lack of adequate lab space for the Preparatory Year students, as echoed by Crick et al. (2020). Facing challenges in online learning reduces students’ satisfaction with the online experience, as they will consider it to be less effective and be less motivated as a result (Adnan
Moreover, teaching large classes online needs adapted pedagogical approaches, particularly in the case of COVID-19 (Hornsby, 2020). In this study, different elements were considered, like engaging students in active learning, using alternative grading approaches, communicating effectively via different tools, building personal relationships of trust between teachers and students, and providing timeframes and deadlines (Berry, 2009; Elison-Bowers et al., 2011; Hornsby, 2020).

Secondly, opportunities to practice during lectures represented another challenge when learning computer skills online, especially for those who did not have a computer device or the required apps, as found by Nalova (2021), Adnan & Anwar (2020), and Kaisara & Bwalya (2021). Third, the technical factor was a medium-rated challenge in the survey. In fact, it was the second most highly rated difficulty faced by the students, as it made them anxious, and interrupted their thinking and understanding. In particular, the students faced issues with Internet access, the Zoom microphone, the virtual learning environment, their devices, and the confusing array of available versions of the apps. This was emphasised by those interviewees who expressed a low degree of acceptance of learning computer skills. The above participants attributed this acceptance to their practice during class. However, they were unable to learn after class, complete their assignments, or explore the lesson topics any further. These issues are reported in the literature as factors that affect students’ perceptions of online learning on practical courses (Adnan & Anwar, 2020; Anwar et al., 2020; Hafeez et al., 2021a, 2021b; Kaisara & Bwalya, 2021; Nalova, 2021). These technical issues reduced the students’ satisfaction with online learning during the COVID-19 pandemic, thereby corroborating Hamid et al. (2020) and Hafeez et al. (2021a).

Fourth, interaction with peers was a medium-rated challenge in the survey. This was confirmed by the students’ most highly rated difficulties, which were ‘Traditional on-campus learning increases student engagement more than e-learning’, as online learning reduced peer engagement, in comparison with face-to-face learning, and increased students’ sense of social isolation, thereby echoing the findings in the literature (Adnan & Anwar, 2020; Anwar et al., 2020; Hafeez et al., 2021; Kara et al., 2019). The interviewees suggested that online learning might reduce peer engagement, peer support, and students’ explanation of points to each other. Teaching computer science topics online requires a high level of interaction between the teacher and students, using synchronous and asynchronous communication tools and suitable collaborative tasks (Gulatee & Combes, 2006). Instructor-learner interaction is inherent within the ‘course teacher’ construct. This interaction will demonstrate whether the teacher answers the student’s questions, gives feedback, provides an opportunity for cooperative learning, or allows enough time for practice. In this study, the instructor-learner interaction was a factor of high effect in terms of the students’ perceptions, in comparison to the students’ peer-interaction, which was a factor of medium effect, as affirmed by Bailey (2021). This was confirmed by the survey findings, which identified the challenges facing the students as they strived to learn computer skills online, with statements related to the teacher’s role in providing time for practice and cooperation. Meanwhile, answering students’ questions presented the lowest level of challenge. This was confirmed by the interviewees,
who mentioned that the teacher’s role was important for developing their satisfaction with their courses, as found by Bailey (2021).

Fifth, personal factors were highly rated by those participants who had positive perceptions of learning computer skills online. This result is in line with the findings of Nalova (2021), Akhter (2020), and Kara et al. (2019). It was difficult for the students to achieve a balance and manage their time between education, work, and family responsibilities. They explained this by stating that they were unable to concentrate on the teacher’s explanations via Zoom whilst at the same time practicing use of MS Office or Windows and understanding the material.

It is important to recommend different elements when planning to teach computer skills online. Most of the design elements echo the principles of e-Learning Theory. These elements consist of training teachers and students (the pre-training principle), adjusting teaching and assessment strategies, providing a variety of formats for learning content, whilst at the same time avoiding irrelevant material (the multimedia and coherence principles), and enabling students with no Internet access or computers of their own to study at their own pace (the learner control principle), using the institution’s labs (Adnan & Anwar, 2020; Aliyyah et al., 2020; Hafeez et al., 2021b; Hamid et al., 2020). Besides, teachers should present the learning material in small segments and write it in a conversational style (segmenting and personalisation principles). Teaching online can be effective for some courses, as claimed by Laar et al. (2021), but teaching practical skills online during the COVID-19 pandemic revealed certain limitations (Elhaty et al., 2020) because students need opportunities to practice. If this is difficult, it is recommended to teach a course using a blended learning approach (Nalova, 2021).

Conclusion and limitations

This study aimed to identify the perceptions of online students with regard to taking a computer skills course online. The findings of this study may be summarised into two main sections. First, the traits that promoted students’ positive perceptions of learning computer skills online were (1) ownership of a computer device, (2) knowledge of the free availability of the required apps, (3) practice during sessions, (4) the course instructor, and (5) e-learning factors. Second, the challenges that elicited the students negative perceptions of learning computer skills online were: (1) large class sizes, (2) no practice during sessions, (3) technical issues, (4) limited opportunities to communicate with peers, and (5) personal factors.

This study has thrown up various questions in need of further investigation. For instance, the study participants were female freshmen, and this raises the issue of whether senior or male students would have had the same perceptions of taking practical courses online. Moreover, further research is recommended to explore other factors that might affect students’ perceptions of learning practical skills online, relating to the students’ characteristics, for example, their previous learning scores, background (sciences or humanities), economic situation, and state of health.

To summarise, the recommendations and implications derived from the main findings in this study are as follows:
1. It is important to provide practice opportunities for students who do not own a
computer device by organising safe access to university labs.
2. Teachers of practical courses may scaffold their students, provide opportunities
for practice during online classes, and enhance collaboration between students
using different apps to eliminate the sense of isolation that can develop in e-learn-
ing.
3. Teachers should consider the design principles of e-Learning Theory, particularly
those related to adjusting teaching and assessment strategies, thereby providing
a variety of formats for the learning content, and dividing it into small segments
to enable students to study at their own pace. The material should also be written
in a conversational style.
4. Universities may reduce the number of students in online classes to provide
opportunities for instructor-student and student-student interactions.
5. Teachers may inform students of the free availability of MS Office to download,
and provide the necessary IT support.
6. Students should practice during online classes and ask the instructor questions if
necessary.
7. Students should spend more time studying on their online courses and be more
committed to their studies.

Finally, a number of important limitations need to be considered. First, the small
sample size used in this study represents a limitation that could be attributed to the
accessibility issues encountered during this study. Second, the study participants
were from a single university in Saudi Arabia. Lastly, the research period coincided
with the first semester of the academic year 2021/2022, which was when computer
skills and certain other courses were still being taught online, whilst other courses
such as English language were once again being taught on campus. Therefore, this
phase of the pandemic was not characterised by all courses being taught online, and
was consequently not typical of the full COVID-19 measures.

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author on reasonable request.

Declarations

Conflict of interest The authors declare that they have no competing interests.

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