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Techno-anxiety and techno-satisfaction during the COVID-19 pandemic: the case of special education teachers

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The objective of this study was to assess the levels of techno-anxiety and techno-satisfaction that special education teachers in Saudi Arabia experienced during the COVID-19 pandemic. We used a survey to gather data from 286 teachers of students with special needs across from early intervention to secondary school (5–18 years) the Kingdom, and we interviewed 23 teachers (3 early intervention, 13 primary, 2 intermediate, 5 secondary). Quantitative analysis was employed to analyze the survey responses, while qualitative thematic analysis was used for the interview data. The findings showed that the teachers experienced moderate levels of anxiety (a mean of 2.33 out of 4). On the other hand, the teachers expressed satisfaction (a mean of 2.98 of 4) with the distance learning system they used. The study highlights the benefits and challenges associated with implementing distance learning for students with special needs. These findings could help inform the design of distance learning environments and identify the factors that influence teachers' feelings of anxiety or satisfaction during the implementation of distance learning. Additionally, the study's results could encourage parents of students with special needs to foster improved collaboration and cooperation with teachers.

KEYWORDS

techno-anxiety, techno-satisfaction, distance learning environments, special education teachers, Saudi Arabia, COVID-19

1 Introduction

In the past few years, the world has faced a major health crisis with major health, economic, social, and educational consequences. This crisis was the global COVID-19 pandemic, which had and is still having negative effects on our world. The most important effect has been the increased reliance on technology in many aspects of our lives—especially education.

In the spring of 2020, most schools and universities across the world shut down, leaving over 100 million students, including students with special needs, without in-person schooling (UNESCO, 2020). Schools had to immediately transform face-to-face teaching and learning into distance learning using online devices, applications, tools, and programs to meet the academic challenges imposed by the pandemic (UNESCO, 2020).

In Saudi Arabia, the Madrasati platform was created and implemented to cater to the needs of distance education in public schools (Alubthane, 2021). The Madrasati platform serves as an online learning management system that offers a variety of electronic educational

tools to support the teaching and learning process. This platform offers over 45,000 diverse educational resources, taking into consideration the individual differences among students. It also provides planning, educational design, and evaluation tools, including electronic tests and question banks with over 100,000 rigorous questions across various subjects.

Since then, numerous studies have examined the impact of the use of remote technology in education from various perspectives worldwide. In particular, a growing body of research has examined teachers' feelings, experiences, and perspectives regarding online teaching and the challenges they face in effectively teaching students with disabilities in an online environment. These studies have documented teachers' experiences with and perceptions of online teaching, shedding light on the unique difficulties and limitations they encounter when attempting to provide quality education to students with disabilities through online platforms. These studies have highlighted the necessity of providing additional support, resources, and training to overcome the barriers to providing efficacious online education for students with special needs. The findings from these studies have improved our understanding of the challenges encountered by teachers in the online education of students with disabilities. They provide worthy insights that can help policymakers, educators, and researchers develop strategies and interventions to enhance the effectiveness and inclusivity of online education for students with disabilities (Schuck and Lambert, 2020; An et al., 2021; Faridah et al., 2021; Schuck et al., 2021; Aktan and Toraman, 2022; Nang et al., 2022; Zheng et al., 2022).

However, less research has focused on the experiences of special education teachers, who were forced to rely heavily on technology during this period while teaching students with special needs. Knowing more about the experiences of special education teachers during the pandemic would illuminate how technology can support students with special needs and the difficulties faced by teachers during this period, which could help us avoid these obstacles moving forward. In this paper, we focus on teachers' perceptions of online learning for students with special needs.

2 Study rationale

Research on technology in education has focused mainly on its unarguable benefits and affordability to improve students' learning. However, exploring the dark side of technology use by teachers and how it has affected them in their daily teaching work is scarce (Khlaif, 2018). The incorporation of technology may become a focus of tension and anxiety among teachers, influencing their daily lives (Fernández-Batanero et al., 2021). Often, the inclusion of educational technology is demanded despite the lack of technical resources and equipment necessary for its correct didactic use. These situations culminate in the emergence of COVID-19 pandemic.

The rapid transition to remote teaching and the increased reliance on technology can place additional stress on teachers, including those working with students with special needs. Those teachers, in particular, deal with a group of students who has different needs and each student is a special case. Distance learning was more of a challenge for some students with disabilities than for others (Averett, 2021). According to Tonks et al. (2021) students with special needs faced a variety of difficulties in e-learning due to their teachers' failure to provide them with the necessary assistance. All that had put more burden and pressure on those teachers and led them to be anxious of using technology.

On the other hand, e-learning has proven its efficiency in teaching students with special needs during the pandemic (Aryeh-Adjei et al., 2023), despite all the obstacles it faced, it continued after the end of the pandemic, and it is still in effect until now in many cases that prevent the student from physically attending school.

In this context, understanding the negative and positive impacts of using technology on teachers' psychological side during the pandemic is crucial for providing appropriate resources, training, and support systems to help them cope with the demands of remote teaching. Ensuring a satisfactory experience of using technology for teachers can help reducing resistance to its use, improper use of technologies, negative attitude toward it, as well as the avoidance of their use (Fernández-Batanero et al., 2021).

The lessons learned from studying the effect of technology on teachers of students with special needs during the pandemic can also inform future planning and preparedness for similar situations. It can help identify best practices and strategies for effectively integrating technology into special education instruction, whether in-person or remote, ensuring that teachers are well-equipped to navigate uncertain educational environments which in turn could lead to more satisfactory experience.

Understanding teachers' opinions on using technology in distance education is important for educational designers, as it will draw their attention when designing electronic or blended educational curricula to take into account what might lead the teacher to feel anxious about technology or what might make them feel satisfied with it while teaching using technology. The results of this study may also draw the attention of decision-makers in the educational sector to providing means that may reduce teachers' feelings of techno-anxiety or increase their satisfaction with technology by adopting appropriate training courses or modifying educational curricula to suit blended or distance learning, and provide the necessary support. This study is also useful for parents of students with special needs. Knowing how the teacher feels in the remote classroom and how much they appreciate the parents' cooperation and involvement in the learning sessions all facilitates the teacher's task in achieving educational and behavioral goals.

3 Literature review

3.1 The context of special education in Saudi Arabia

In Saudi Arabia, The Ministry of Education is responsible for providing a free and appropriate education for all students, including those with special educational needs (Alquraini, 2010). This ministry also is responsible for special education services to students with special education. Their eligibility for these services is determined and special education services are provided to help students with special needs be able to live safely and independently (Al-Mousa et al., 2006).

Special education classrooms for students with mild to moderate disabilities including intellectual disabilities, autism and hearing impairments receive their educations in mainstream classrooms with some support from special education services such as resource rooms.

With a few modifications and accommodations, these students also actively engage in the general education curriculum (Alquraini, 2010). They do share some extracurricular activities with their typically developing peers such as lunch or recess but they receive special education curriculum, which is different than the general curriculum provided their peers. Students with mild to moderate disabilities attend primary schools from ages 6 years to 12, followed by intermediate school from 13 years to 15, then secondary school from 16 until age 18. On the other hand, students with severe and multiple disabilities are still served in separate institutes (Alquraini, 2010) or special classrooms in mainstream schools.

During the global pandemic, the impact on public and special education in the Kingdom of Saudi Arabia mirrored that of other countries. To mitigate the spread of the virus, the government implemented several precautionary and restrictive measures, such as mask usage, social distancing, travel restrictions, event cancelations, school closures (beginning on August 30, 2020), and the implementation of partial curfews at different times. Special education faced unique challenges, including limited access to essential healthcare resources, communication difficulties, transportation issues, appropriate accommodations, community support, respite care, and mobility in public spaces. In response to the specific needs of students with disabilities requiring special healthcare and education, the World Health Organization emphasized the importance of inclusive measures in the pandemic response. Therefore, when the Kingdom of Saudi Arabia decided to resume in-person education for all students in both public and private schools on Sunday, January 23, 2022, they also decided to continue distance education through various platforms for students who were unable to attend due to health reasons, including certain categories of special education students such as those with Down Syndrome and specific health conditions.

In order for e-learning to effectively address the needs of students in special education, these schools must not only provide flexible learning environment, but also provide teachers who are available, capable and supportive. Teachers require training in the use of technology as well as online instruction. Online instruction requires a different skill set than in-person instruction (Ahn, 2011; Pulham and Graham, 2018). Unfortunately, there is no evidence in the literature reporting that teachers of special education had received training on teaching online during the pandemic. On contrast, many studies that carried out during the pandemic have recommended to offer support to the special education teacher including training programs such as the study of Alhamoud (2021), Gharawi and Alotaibi (2021), Al-Qahtani (2022), and Alhaythami (2022).

3.2 Techno-anxiety among special education teachers

In our digital era, technology is crucial to education. However, incorporating technology into the classroom can be difficult and disruptive for teachers of students with special needs. Research has suggested that such teachers are widely afflicted with techno-anxiety, a phrase used to describe the worry, stress, and discomfort people feel when using technology, particularly in educational settings (Rice, 2022). In this paper, techno-anxiety refers to the psychological unease and apprehension teachers face when employing technology in the setting of special education (Shannon, 2020). It encompasses emotions such as anxiety, fear, annoyance, and a lack of faith in their ability to successfully integrate technology into their teaching methods.

The COVID-19 epidemic has profoundly influenced special education teachers by necessitating a greater use of technology for remote education (Medwetz, 2021). The sudden transition to virtual teaching required special education teachers to adopt various technologies to provide instruction and support to their students online. However, this rapid change and increased reliance on technology may have caused some special education teachers to experience techno-anxiety. Potter (2021) claimed that introducing technology exacerbates special education teachers' struggles with stress, anxiety, and depression. In the context of special education teachers during the pandemic, techno-anxiety may have stemmed from several factors, including a lack of familiarity with or confidence in using digital platforms, a lack of support and training in the use of educational technologies, concerns about the effectiveness of technology in meeting the unique needs of their students, worries about technical glitches or connectivity issues during online instruction, the overall stress of adapting to a new teaching environment, and their need to keep up with the rapidly changing technological landscape (Betoncu and Ozdamli, 2019; An et al., 2021; Fernández-Batanero et al., 2021; Estrada-Muñoz et al., 2021; Ishartiwi et al., 2022; Nang et al., 2022; Rice, 2022; Zheng et al., 2022).

The effects of techno-anxiety on special education teachers and their use of technology in the classroom have been widely studied. When Rice (2022) investigated how special education instructors in the United States, whom taught kindergarten, grade 3, grade, 6, and grade 10, dealt with technology during COVID-19, she discovered that techno-anxiety impacted how they adopted and used educational tools. The study emphasized the need for professional development and assistance to reduce teachers' technological apprehension and boost their confidence in using technology successfully. In a study by Maurer et al. (2021), teachers of students with special educational needs in Germany shared their experiences with and perceived self-efficacy in distance learning. The results showed that teachers' comfort with and confidence in using distance learning methodologies were significantly impacted by their techno-anxiety. The study emphasized the value of continuing education and assistance in helping special education instructors overcome their technological apprehension and develop their digital skills. Similarly, Ishartiwi et al. (2022) examined alternative teaching resources for students with special needs taking courses online in Indonesia. This study brought attention to special education teachers' difficulties in adjusting to online platforms and the resulting technological anxiety. It emphasized the need for easily accessible digital materials that are available to all users and for focused professional development programs to reduce instructors' techno-anxiety and improve their capacity to provide effective remote learning experiences. Additionally, Nang et al. (2022) systematically reviewed teachers' technological stress and coping strategies during the COVID-19 epidemic. To ameliorate the negative effects of techno-anxiety, the study noted, organizational support, training, and resources are crucial. Techno-anxiety was also identified as a significant source of stress for instructors.

The levels of techno-anxiety experienced by special education teachers during the pandemic may have varied. Some teachers may have felt more comfortable with and adept at integrating technology into their teaching practices, while others may have faced significant challenges and anxieties. Factors such as prior experience with

technology, access to training and support, and availability of resources may have influenced the intensity of techno-anxiety among these teachers.

Understanding the techno-anxiety experienced by special education teachers during the COVID-19 pandemic is crucial for identifying areas in which support and professional development can be provided. By addressing their concerns and anxieties related to technology, we can better equip teachers to effectively navigate and leverage digital tools to support the learning and well-being of students with special needs.

3.3 Techno-satisfaction among special education teachers

Techno-satisfaction in special education refers to the level of contentedness experienced by teachers when incorporating technology into their teaching methods. It encompasses the integration and utilization of technological tools, applications, and resources within special education settings. Techno-satisfaction is a multifaceted concept that includes dimensions such as perceived usefulness, ease of use, engagement, perceived impact on teaching and learning, and overall satisfaction with technology (Abd Aziz et al., 2021).

The use of technology in special education classrooms has the potential to greatly enhance the teaching and learning experience (Ciampa, 2017; Nordström et al., 2018; Olakanmi et al., 2020; Starks and Reich, 2023). It offers customized learning opportunities, accessibility features, and assistive technologies that cater to the diverse needs of students (Atanga et al., 2019; Olakanmi et al., 2020; Molina-Vargas et al., 2021). E-learning may offer certain advantages over traditional teaching methods for students with special needs as well (Beck et al., 2014; Basham et al., 2015). It allows them to review material at their own pace and access learning resources as needed. Additionally, special needs teachers have the flexibility to work with students individually or in small groups, providing personalized attention. They can also adapt course materials to meet diverse requirements, customize instruction, and align teaching with specific standards (Geith and Vignare, 2008; De los Arcos et al., 2016). While these best practices are beneficial for all students, they can be particularly advantageous for students with disabilities.

According to Hopcan et al. (2021), students with special needs possess distinct mental, emotional, communicational, social, and physical characteristics that set them apart from their peers. As a result, these students require additional support not only in academic areas but also in social and emotional aspects. Thus, special education teachers' unique experiences with teaching such students online during the pandemic deserve to be explored. While limited research has focused on techno-satisfaction among special education teachers, some studies have explored their attitudes, perceptions, and general beliefs regarding the integration of technology into their classrooms (Siyam, 2018; Cagiltay et al., 2019; Alanazy and Alrusaiyes, 2021; Alsolami, 2022).

By comparison, more studies have examined the satisfaction of teachers from different fields regarding distance learning in general and specifically during the pandemic. For example, Alhaythami (2022) assessed the levels of satisfaction among male and female teachers in general education regarding the use of the Madrasati platform, the Saudi government official learning management system used during the lockdown time, in distance education during the pandemic. The study evaluated satisfaction levels in relation to demographic variables. A satisfaction scale was developed specifically for this study, and 300 teachers were recruited. The findings indicated a high level of satisfaction with Madrasati and its use in distance education during the pandemic among both male and female teachers. Similarly, Qaraan (2021) examined the satisfaction of Arabic language teachers in the city of Zarqa (Jordan) with distance education during the pandemic. A survey was administered to 246 teachers. The results indicated that the teachers were generally satisfied with distance education in all areas except assessment, where satisfaction levels were low.

Another study, conducted by Aburayash (2022), set out to determine the levels of satisfaction among school principals, teachers, students, and parents with distance learning during the pandemic in Jordan. The study employed a descriptive and analytical approach, and the sample consisted of 100 principals, 160 teachers, 200 students, and 200 guardians, with a mix of males and females in each category. The findings indicated that the degree of satisfaction with distance learning was generally moderate. Belabas and Bouhila (2021) evaluated the effectiveness of e-learning during the COVID-19 pandemic in the Faculty of Humanities and Social Sciences at the University of Muhammad Boudiaf, M'sila (Algeria). The study used a descriptive analytical approach and included a sample of 50 instructors who used e-learning during the pandemic. The data were collected through a questionnaire. The participants expressed moderate satisfaction with the effectiveness of e-learning during the pandemic.

Almomani (2024) employed a descriptive research approach to evaluate the satisfaction with distance learning among teachers, students, and parents in Ajloun Governorate (Jordan), discovering a low level of satisfaction. Similarly, Jarab et al. (2022) assessed the satisfaction of faculty members with distance teaching in Jordan, which became necessary during the COVID-19 pandemic. The study used an online survey to collect sociodemographic information and measure faculty members' satisfaction with distance education. The survey was completed by 286 faculty members from various fields of education across all universities in Jordan. They found that overall satisfaction with distance education was low. Other studies have tried to understand the factors that influence techno-satisfaction, such as the qualitative research by Aktan and Toraman (2022), who interviewed 30 special education teachers in Turkey about this subject. They found that access to appropriate technological tools and resources, training opportunities, technical support, and the usability of technology are key influences on techno-satisfaction. Similarly, Jarab et al. (2022) corroborated the finding that faculty members who undergo training in online teaching express higher levels of satisfaction with distance education.

Understanding techno-satisfaction and its influencing factors can inform strategies to enhance the e-learning experiences of special education teachers, especially during the COVID-19 pandemic. However, techno-satisfaction can vary among teachers based on factors such as technological proficiency, access to resources and support, training opportunities, and the compatibility of technology with instructional strategies. Challenges such as limited access to technology, inadequate training, technical difficulties, and time constraints can also impact techno-satisfaction. Therefore, a comprehensive understanding of techno-satisfaction requires

considering specific distance teaching experiences, individual needs, and the technologies used by special education teachers.

3.4 Theoretical background

3.4.1 Techno-anxiety

The existing body of literature on technological anxiety tends to confirm the transactional theory of stress and coping developed by Lazarus and Folkman (1984). According to this theory, psychological stress arises when individuals encounter environmental demands that exceed their available resources, potentially jeopardizing their well-being. The theory posits that stress is a transactional process in which stressors interact with individuals' capabilities to work and accomplish their objectives, leading to anxiety and fatigue (Cooper et al., 2001; Al Mulhim, 2023). Various environmental stressors, including general conditions, workload, demands, time, relationships, novelty, ambiguity, and uncertainty, can contribute to stress (Lazarus and Folkman, 1984; Lee et al., 2016).

The use of technology can be a significant stressor on its own; teachers may be overwhelmed by the need for excessive technology use over extended periods or at a pace beyond their capabilities, resulting in anxiety (Moore, 2000; Karr-Wisniewski and Lu, 2010; Al Mulhim, 2023). In such circumstances, anxiety can manifest as dissatisfaction, exhaustion, discomfort, and negative attitudes toward technology (Salanova et al., 2013; Fuglseth and Sorebo, 2014; Lee et al., 2016).

In the context of the COVID-19 pandemic, the abrupt shift from face-to-face to distance learning posed challenges not only for special education students but also for their teachers. The inability to physically convene for an extended period and the lack of access to the tangible tools necessary for meeting students' unique learning needs presented obstacles. Teachers had to rely on remote learning and online meetings, which were often disrupted and interrupted (Kuladinithi et al., 2020). Moreover, many teachers and students encountered various technology-related barriers during the pandemic, including limited access, technical issues, inadequate technological proficiency, and an overwhelming workload of assignments (Kartikawati, 2020; Rahayu and Fauzi, 2020). It is evident that the expanded role of technology increased the burden, giving rise to observable stressors that potentially affected the experiences of special education teachers. This situation raises a key question addressed in this study: To what extent did special education teachers who relied on distance learning experience anxiety during the pandemic?

3.4.2 Techno-satisfaction

The expectation-confirmation model, proposed by Bhattacherjee (2001), suggests that individuals form expectations about a product or service before using it based on various sources. These expectations encompass the anticipated performance, features, and benefits of the product or service. After using it, individuals compare their actual experiences with their initial expectations. The model suggests that satisfaction is influenced by the confirmation or disconfirmation of these expectations (Dai et al., 2020). Confirmation occurs when the actual performance meets or exceeds expectations, leading to satisfaction and positive attitudes. Disconfirmation occurs when the actual performance falls short, resulting in dissatisfaction and negative attitudes. In other words, when users find a product that provides greater efficiency, they will likely be more satisfied with it and willing to continue using it (Kujala et al., 2017).

The expectation-confirmation model, initially used in marketing to examine customer satisfaction and post-purchase behavior, has found applications in the e-learning domain in recent years (Chou et al., 2010; Lee, 2010; Stone and Baker-Eveleth, 2013; Chow and Shi, 2014; Huang, 2019; Persada et al., 2021; Rajeh et al., 2021), as it helps us understand and predict continued usage intentions among students and teachers. In the e-learning context, the model suggests that a user's intention to continue using technology for educational purposes is influenced by several factors. These factors include the tool's perceived usefulness, the degree to which their expectations are confirmed, and their satisfaction with the e-learning environment.

Confirmation refers to the user's perception of whether their initial expectations regarding the usefulness of the technology align with its actual performance in practice. In other words, it indicates whether the technology realizes the user's anticipated benefits and outcomes. Expectation, or perceived usefulness, refers to the user's belief that using the technology (in this case, an e-learning system) will enhance their performance and lead to favorable outcomes. This perception is crucial in shaping users' initial expectations regarding the benefits they anticipate from using the technology. Overall, the expectation-confirmation model highlights the importance of users' perceptions of usefulness, confirmation, and satisfaction in determining their intention to continue using e-learning technology.

According to the model, special education teachers' satisfaction with distance learning is determined by the confirmation of their expectations and the perceived usefulness of the distance learning. Their satisfaction, in turn, positively influences their intention to continue using it. This point gives rise to the second question of this study: to what extent were special education teachers who relied on distance learning technology satisfied with those tools during the pandemic?

4 Research questions

This paper investigates the following questions:

- To what extent were special education teachers in Saudi Arabia anxious about distance teaching during the COVID-19 pandemic?
- To what extent were special education teachers in Saudi Arabia satisfied with their distance teaching experience during the COVID-19 pandemic?

5 Materials and methods

The main objective of this research was to explore how special education teachers evaluate their experience of teaching students with special needs remotely during the COVID-19 pandemic. To achieve this objective, a mixed-method approach was used, incorporating both quantitative and qualitative data (Creswell, 2014).

To gain insight into special education teachers' perspectives on the use of technology in remote teaching, we collected quantitative data by implementing surveys based on techno-anxiety and techno-satisfaction scales. These scales provide a standardized measure of the teachers' anxiety and satisfaction related to technology use.

In addition to the quantitative data, we gathered qualitative data through individual interviews with selected teachers. These interviews offer a deeper understanding of the teachers' experiences, including their feelings of anxiety and satisfaction, as well as the virtues and challenges inherent in implementing distance learning during the pandemic. The qualitative data provide rich, detailed insights into the subjective experiences and perceptions of special education teachers in this context.

5.1 Sample

We randomly recruited 286 (108 males and 178 females) special education teachers from across Saudi Arabia, most of whom ($n = 171$) worked in primary education. They taught students with visual impairment, hearing impairment, intellectual disability, autism, and/or multiple disabilities. Their ages ranged from 25 to 50 years old, although most ($n = 177$) were between 25 and 35 years old. Of the participants, 227 had more than 5 years of teaching experience in the field. The teachers were asked to complete an online survey. Table 1 shows the demographic data of the survey sample. For the interviews, 23 teachers voluntary participated, most of whom ($n = 15$) were males and taught primary level ($n = 13$). Table 2 illustrates the demographic data of the interviewees.

TABLE 1 The demographic data of the survey sample.

Demographic data		*n*
Gender	Males	108
	Females	178
Age range	25–35 years old	177
	36–45 years old	85
	Over 45 years old	24
Level of education they teach	Early intervention	14
	Primary	171
	Intermediate	53
	Secondary	28
	Multiple levels	20
Specialization	Visual impairment	1
	Hearing impairment	78
	Intellectual disability	127
	Autism	6
	Multiple disabilities	2
	Learning difficulties	72
Teaching experience	1–3 years	44
	Over 3–5 years	15
	Over 5–10 years	124
	Over 10 years	103

TABLE 2 The demographic data of the interview sample.

Demographic data		*n*
Gender	Males	15
	Females	8
Age range	25–35 years old	13
	36–45 years old	6
	Over 45 years old	4
Level of education they teach	Early intervention	3
	Primary	13
	Intermediate	2
	Secondary	5
	Multiple levels	20
Specialization	Visual impairment	2
	Hearing impairment	5
	Intellectual disability	8
	Autism	2
	Multiple disabilities	2
	Learning difficulties	4
Teaching experience	1–3 years	2
	Over 3–5 years	11
	Over 5–10 years	7
	Over 10 years	3

5.2 Data collection

We created an online questionnaire to evaluate the extent of techno-anxiety and techno-satisfaction among the teachers. The questionnaire included 23 closed-ended questions as well as demographic inquiries. Closed-ended questions are recommended when the goal is to analyze response frequencies statistically (Cohen et al., 2007). The questions related to techno-anxiety were adjusted and revised from a computer anxiety survey developed by Setyarini (2015). Likewise, the questions concerning techno-satisfaction were adapted from a satisfaction questionnaire for an e-learning system designed by Siritongthaworn and Krairit (2006). These items were scored on a 4-point Likert scale, with responses ranging from "Strongly Agree" (4) to "Strongly Disagree" (1). The total scores for these items ranged from 23 to 92, with higher scores indicating higher levels of agreement.

To ensure the survey's validity, it was evaluated by five experts in the field of e-learning, and their feedback was used to make necessary amendments to the questions. Additionally, a pilot sample of six special education teachers completed the survey to assess its reliability through the test–retest method. The results yielded a score of 0.89 based on Spearman's coefficient, indicating a high level of reliability.

To collect deeper and richer data about the variables studied, an invitation to participate in structured interviews was included at the end of the survey. Twenty-three special education teachers volunteered to be interviewed. To evaluate the accuracy of the interview questions, the same five experts were consulted to determine whether the questions effectively measured what they were intended to measure (Cohen et al., 2007). The experts' comments and amendments helped us finalize the interview schedule. To ensure high reliability, a tightly structured interview was maintained, with the exact format and sequence of words and questions for each interviewee predetermined.

The interviews were based on four main open-ended questions that explored the participants' experiences with distance learning

TABLE 3 Frequencies and descriptive statistics of responses concerning techno-anxiety.

N	Item	Percentages		Descriptive statistics	
		Strongly agree/agree	Strongly disagree/disagree	*M*	SD
1	I feel anxious when I cannot keep up with important technological advances in distance teaching.	62.9	37.1	2.76	0.880
2	I feel anxious when I compare my distance teaching skills to the skills of others.	44.4	55.6	2.44	0.813
3	I feel anxious when someone mentions an application that I do not know.	56.3	43.7	2.60	0.831
4	I feel anxious when I learn about new distance teaching technology.	21.3	78.7	2.08	0.716
5	I feel anxious when I use new distance teaching technology.	26.2	73.8	2.14	0.781
6	I avoid using unfamiliar technology when teaching remotely.	28.0	72.0	2.21	0.735
7	I find the requirement to use distance teaching frightening.	27.3	72.7	2.12	0.781
8	I feel apprehensive about using learning management systems (LMSs) because if they fail, I will be unable to achieve teaching and learning outcomes remotely.	41.3	58.7	2.35	0.793
9	I am somewhat intimidating by the need to use LMSs in teaching.	31.5	68.5	2.24	0.730
10	I fear making mistakes that I cannot correct while teaching in a virtual classroom.	41.6	58.4	2.35	0.801

during the COVID-19 crisis. Specifically, the questions touched on their feelings of anxiety and satisfaction as well as the benefits and challenges of distance learning for students with special needs.

This study was implemented in May 2022 after obtaining the necessary approvals from the Ethics Committee at King Faisal University (Reference KFU-REC-2022-APR-EA000593). Meanwhile, the pandemic had ended and education practice had returned to traditional classrooms. On the other hand, distance education was continuing for some students who could not join their peers as a result of their health conditions, especially those with special needs. It took about 3 months to collect data for the survey, and then we conducted interviews for another 3 months.

6 Results

6.1 Survey responses

A total of 286 special education teachers from across the Kingdom of Saudi Arabia completed the online survey on techno-anxiety and -satisfaction. The survey data were analyzed quantitatively using frequencies, percentages, and descriptive statistics (mean [M] and standard deviation [SD]). The overall analysis of the survey data indicated that the teachers experienced a moderate level of anxiety (a mean of 2.33 out of 4) related to using technology when teaching remotely during the COVID-19 pandemic (Table 3).

As Table 1 indicates, Item 1 had the highest mean response ($M = 2.76$; SD = 0.880). Almost 61% of the respondents strongly agreed or agreed that they felt anxious when they could not keep up with important technological advances in distance teaching. The second highest mean ($M = 2.60$; SD = 0.831) was for Item 3, which indicates that approximately 56% of the participants strongly agreed or agreed that they felt anxious when someone mentioned an application that they did not know. Items 8 and 10 had equal means, at 2.35. Over 58% strongly disagreed or disagreed that they felt apprehensive about using learning management systems (LMSs) for the reason that if these systems failed, they would be unable to achieve teaching and learning outcomes remotely (SD = 0.793). A similar number disagreed that they feared making mistakes in virtual classrooms (SD = 0.801).

On the other hand, the lowest mean ($M = 2.08$; SD = 0.716) was for Item 4. Almost 80% of the participants confirmed that they did not feel anxious when learning about a new technology for distance teaching. The second-lowest mean was for Item 7, indicating that most of the participants (73%) did not find the requirement to use distance teaching technology frightening ($M = 2.12$; SD = 0.781). Item 5 had the third-lowest mean ($M = 2.14$; SD = 0.781), indicating that about 74% did not feel anxious when using new technology for distance teaching. Overall, the teachers were satisfied (with a total mean of 2.98 of 4) with their technological experiences when teaching remotely during the COVID-19 pandemic (Table 4).

As Table 4 illustrates, Item 2 had the highest mean ($M = 3.16$; SD = 0.758). Approximately 83% of the participants strongly agreed or agreed that LMSs usually perform well. Item 3 received the second-highest mean ($M = 3.13$; SD = 0.751), as 82.5% of the participants strongly agreed or agreed that LMSs can be used very flexibly. Items 8, 10, and 12 had equal means, at 2.93. More than 70% of the participants thought that the web page design provided in the LMS they used was attractive to students (SD = 0.796), were satisfied with the different evaluation tools available on the LMS (SD = 0.820), and believed that the LMS enabled them to control their teaching (SD = 0.794).

In contrast, the lowest mean ($M = 2.79$; SD = 0.862) was found for Item 9. Almost 67% of the participants felt that the presentation of the material provided was easy to understand. The second-lowest mean was for Item 7, where 62% of the participants confirmed that LMSs made it easy for them to communicate and interact with students ($M = 2.880$; SD = 0.868).

6.2 Interview responses

The structured interviews included four open-ended questions:

– Did you have any concerns or apprehensions about participating in distance education during the COVID-19 pandemic? If so, what were the reasons behind your worries or fears?

TABLE 4 Frequencies and descriptive statistics of responses concerning techno-satisfaction.

N	Item	Percentages		Descriptive statistics	
		Strongly agree/agree	Strongly disagree/disagree	*M*	SD
1	I am satisfied with the ease-of-use of LMSs.	80.8	19.2	3.09	0.843
2	I agree that LMSs usually perform well.	82.9	17.1	3.16	0.758
3	LMSs can be used very flexibly.	82.5	17.5	3.13	0.751
4	LMSs are user-friendly.	73.5	26.5	2.91	0.792
5	LMSs respond to my requests fast enough.	75.5	24.5	2.96	0.729
6	LMSs make it easy for me to create/upload the content I need (i.e., course titles, additional resources, materials, topics, activities, web board discussions).	77.3	22.7	3.01	0.772
7	LMSs make it easy for me to communicate and interact with students.	68.2	31.8	2.88	0.868
8	I agree that the web page design provided in the LMS I used is attractive (i.e., layout, colors, font, graphics, animation, etc.) to students.	72.4	27.6	2.93	0.796
9	I feel that the presentation of the material provided is easy to understand.	66.8	33.2	2.79	0.862
10	I am satisfied with the format (or software application) of the material provided.	80.8	19.2	3.08	0.749
11	I am satisfied with the different evaluation tools available in LMSs.	71	29.0	2.93	0.820
12	LMSs enable me to control my teaching.	73.4	26.6	2.93	0.794
13	Overall, I am satisfied with LMSs.	76.9	23.1	3.00	0.804

- How satisfied are you with the overall distance education experience during the COVID-19 pandemic? Please explain the reasons for your satisfaction or dissatisfaction.
- From your perspective, what are the advantages or positive aspects of distance education specifically for students in the special education category that you observed during the COVID-19 pandemic?
- As a special education teacher, what obstacles or difficulties did you encounter while implementing distance education during the COVID-19 pandemic?

They were designed to elicit perceptions of distance learning during the COVID-19 crisis. More specifically, the questions asked whether the teachers were anxious about or satisfied with the use of distance education during COVID-19 and the reasons for their feelings. They were also asked about their opinions on the benefits and challenges of distance education for special education students. Twenty-three special education teachers were interviewed. The responses were analyzed thematically, and the results are summarized in Tables 5–8. "*n*" in Tables refers to the number of responses.

Based on the comments of the 23 interviewees, the majority ($n=16$) felt anxious about distance learning during the COVID-19 pandemic. They gave some reasons for this feeling, including the lack of face-to-face communication with their students, the inability to practice, involvement in a new teaching modality, and the lack of concrete tools.

The inability to hold face-to-face meetings and impeded communication with students were the reasons mentioned most often ($n=8$). For example, Participant 20 said, "I believe lesson goals cannot be achieved using distance learning, especially with students with autism," whereas Participant 23 explained, "Special students need practical work with certain skills to modify their behavior; we need to meet face to face." Participants 19 and 22 thought that their students tended to respond less in the distance learning environment. Participant 21 believed that it was extremely difficult to communicate with his students online (through a screen) well enough to deliver information or practice skills.

The second reason for being anxious about distance learning, mentioned by four interviewees, was being suddenly thrown into a new experience without proper preparation. For instance, Participant 5 said, "Distance learning is new and unfamiliar for both students and teachers." Participant 1 added, "I was anxious because my students would not be able to use computers and [have] weak abilities." Participant 19 stated, "I am ignorant about distance learning." Participant 3 expressed that he was very anxious because he used to teach face-to-face for 11 years and it was not easy to shift to distance learning suddenly without adequate preparation.

The third theme revealed by the first interview question was the lack of concrete tools needed by special needs students ($n=2$). Participant 1 said, "I was anxious because my students mostly learn using tangible, concrete tools," and Participant 9 expressed, "I was afraid because special education students depend heavily on material tools to learn."

Most the interviewees ($n=15$) were satisfied with distance learning during the COVID-19 pandemic. Four teachers thought that the main reason for their feeling of satisfaction was the involvement of the parents in the sessions with their children. For example, as Participant 21 noted, "It is possible that the presence of the mother beside the student is a major factor in [the student] understanding the information, thus increasing [their] productivity and achieving the goal perfectly." Participant 18 added that "There was a great cooperation from the students' families in monitoring the student's level, benefiting from the new teaching method (i.e., distance learning), add to that they knew how to control their child during the teaching sessions which led to better results." Two participants (1 and 6) confirmed that distance education is ideal for students with special needs, as they might not implement the precautions needed for their

TABLE 5 Themes revealed by responses concerning anxiety about technology ($N = 23$).

Theme	Subtheme	Indicative excerpts from the interviews
Not anxious	None ($n = 7$)	–
Anxious	None ($n = 16$)	–
Reason for being anxious	Lack of face-to-face classes ($n = 8$)	I believe lesson's goals cannot be achieved using distance learning especially with students with autism (Participant 20)
		I think it would be completely difficult to communicate with my students online (behind a screen) and deliver information and skills (Participant 21)
		I expect that it would extremely difficult for the students to respond (Participant 22)
		I was fear that my students will not respond. (Participant 19)
		Special students need to practice some skills to modify their behavior (Participant 23)
		We need face to face classes for sure we cannot rely on distance education for long time (Participant 13)
		My students need to be in an environment where everything can be practiced physically not virtually (Participant 17)
		I cannot evaluate learning and behavior goals online. (Participant 1)
	New experience ($n = 5$)	Distance learning is a new experience for me (Participant 6 and 12)
		I am totally ignorant of distance learning (Participant 19)
		Distance learning is new and unfamiliar for both students and teachers (Participant 5)
		After all that time (11 years) teaching in the real classes, it was not easy to shift to a totally new experience with no prior notice or preparation. (Participant 3)
	Lack of tangible concrete tools ($n = 2$)	It was anxious because my students mostly learn through tangible concrete tools (Participant 1)
		It was afraid because special education students heavily need sensible tools to learn (Participant 9)

TABLE 6 Themes revealed by responses concerning satisfaction with technology ($N = 23$).

Theme	Subthemes	Indicative excerpts from the interviews
Satisfied	None ($n = 15$)	–
Reasons for being satisfied	Parental cooperation ($n = 4$)	The presence of the whole family during the online session was appreciated (Participant 17)
		There was a great cooperation from the students' families in monitoring the student's level, benefiting from the new teaching method (i.e., distance learning), add to that they knew how to control their child during the teaching sessions which led to better results (Participant 18)
		Parents' keenness and concern for their children during the pandemic was a key factor (Participant 19)
		It is likely that the presence of the mother with the student is a major factor in concentrating the information, which increases productivity and helps achieving the goal easily (Participant 21)
	Health ($n = 2$)	Because of the health conditions of students (especially those with Down Syndrome and those suffering from heart disease), and the weak health awareness among students with mental disabilities, distance education was a suitable option for them and their safety (Participant 1)
		Because it is appropriate under such abnormal circumstances (Participant 6)
	Accessibility and assistant technology ($n = 2$)	The accessibility for students and availability of various presentation methods and assistive technology (Participant 14)
		Yes, despite its difficulty in the beginning, as a language teacher, distance learning has proven its effectiveness using interactive presentations, writing boards, and educational gaming websites (Participant 21)
Not satisfied	None ($n = 8$)	–
Reasons for being dissatisfied	Lack of face-to-face communication and practice ($n = 4$)	For special education (no) because the teacher needs direct communication with the student face-to-face (Participant 7)
		Special education students usually need help with some skills, and this cannot be achieved in distance education (Participant 11)
		Because our education depends on sensory skills (Participant 13)
		There is a problem. If the cognitive goal is achieved, the behavioral goal will not be achieved due to the absence of behavior modification in distance education. Even if the teacher provides directions and instructions, the teacher's control is missing online and the parents cannot do the job as the teacher would do (Participant 20)
	Suitability ($n = 1$)	Not completely satisfied. It suits some people, but to a limited extent (Participant 23)

TABLE 7 Themes revealed by responses regarding the benefits of distance learning in teaching students with special needs ($N = 23$).

Theme	Subthemes	Indicative excerpts from the interviews
Specific features of assistive technology	Interactivity ($n = 4$)	Students were very interactive and engaging in the distance learning environment (Participant 2)
		Shy students have better interactions through distance learning (Participant 11)
		Using online games got the attention of the students and encourage them to participate (Participant 14)
		Students were interactive with the activities and electronic games (Participant 23)
	Meeting different students' needs ($n = 2$)	Luckily, I had a lot of online resource to meet every need for my students (Participant 4)
		Employing technology for special education has an effective and rich role to achieve the learning goals and meet the different needs of students (Participant 20)
	Convenience ($n = 2$)	Distance learning made students more calm and discipline (Participant 6)
		Students had a comfort learning environment at home so I believe they learned better (Participant 19)
	Joy and fun ($n = 2$)	Using technology is enjoyable for students with special needs (Participant 18)
		My students enjoyed the electronic games and stories I used online (Participant 2)
Family cooperation	None ($n = 8$)	There was good interaction between student's family and the teacher (Participant 4)
		The parents were present during the online lessons (Participants 10/12)
		The parents were very cooperative (Participant 8/18/21/22)
		Communication between the teacher and the parents was never better (Participant 7)
Skills development	Mobile learning skills ($n = 1$)	Developing students' mobile learning skills (Participant 9)
	Computer skills ($n = 2$)	Developing students' computer skills (Participants 1/17)
	e-learning skills ($n = 1$)	Developing students' e-learning skills (Participant 3)
Health	Safety of precautions ($n = 3$)	Ensuring students' safety during the pandemic (Participant 1)
		Protecting students from infection (Participant 13)
		It was very vital to keep them safe and comfortable (Participant 19)

safety on their own. Finally, two participants (14 and 21) thought that teaching online can offer students more accessibility, as they can benefit from the wide range of assistive technology available online.

When asked about their perceptions of the benefits of distance education with students who have special needs, most of the teachers interviewed ($n = 10$) endorsed assistive technology as efficacious in enhancing student interaction and engagement during online sessions, even for shy students. Participant 11 confirmed that distance learning facilitated improved interactions among shy students. Participant 2 believed that the distance learning environment encouraged greater interactivity and engagement, indicating that students enjoyed learning through technology. Similarly, Participant 23 highlighted the fun and interactive nature of using online games. Moreover, Participant 18 emphasized the joy experienced by her students during online sessions. Participant 20 raised the point that employing technology for special education plays a vital and effective role in achieving learning goals and meeting diverse student needs. Participant 14 added that this experience helped her students become more self-directed learners.

Eight teachers expressed their appreciation for the cooperation of families during the COVID-19 pandemic, recognizing how it contributed to the success of the distance education experience. Additionally, four teachers reported that their students developed computer skills (Participants 1 and 17), e-learning skills (Participant 3), and mobile learning skills (Participant 9). Finally, three teachers (Participants 1, 13, and 19) viewed distance learning as a means of protecting students with special needs, especially those who do not know how to protect themselves by taking appropriate precautions.

Despite the reported benefits of distance learning, the teachers encountered various obstacles during the pandemic. Some challenges were student-related ($n = 8$), including recurring student absences, reluctance to engage with online platforms, and a lack of responsiveness, interaction, concentration, and computer and e-learning skills. Some teachers ($n = 6$) also faced difficulties due to uncooperative parents who did not monitor their children's sleep schedules or learning sessions. Additionally, teachers ($n = 6$) encountered personal challenges in the preparation of online lessons, remote student assessment, and maintenance of control over online sessions. For example, Participant 21 highlighted the difficulty of remotely assessing certain subjects, such as sports. Participant 1 considered the inability to control the educational environment and eliminate student distractors the most significant challenge, while Participant 13 found it demanding (in terms of effort and time) to create and deliver engaging lessons that would ensure students' mental presence, capture their interest, and enhance their understanding during online sessions. Finally, five teachers mentioned technology-related challenges, including limited access, technical issues, and a lack of tangible resources.

7 Discussion

We found that the teachers were moderately anxious about distance learning during the COVID-19 pandemic, especially at the beginning. This result is consistent with the literature on techno-anxiety, emphasizing that, for teachers of students with

TABLE 8 Themes revealed by responses regarding the challenges of distance learning ($N = 23$).

Theme	Subthemes	Indicative excerpts from the interviews
Students	Behavior ($n = 7$)	Weak desire of students to use the distance learning platform (Participant 2)
		Student restlessness due to the length of the remote class (Participant 5)
		Repeated non-attendance (Participant 4)
		Some students did not want to enter the platform and engage (Participant 21)
		Some students never respond to the teacher (Participant 12)
		Some students' attention cannot be drawn by sound alone (Participant 15)
		It is difficult to ensure students concentration during class time (Participant 17)
	Lack of computer/e-learning skills of students ($n = 1$)	The weakness of the students' abilities, as they needed a long time to master computer skills, especially the students who relied on themselves and attended the online sessions alone, because their parents were busy with their other children (Participant 1)
Parents	None ($n = 6$)	Difficulty with regard to concentration and negligence on the part of the parents in organizing the sleep times of the students because they do not attend school (Participant 1)
		Some parents were neither active nor cooperative with the teachers (Participants 19/22/23)
		The absence of behavior modification. Some groups, even if their educational level was good, did not benefit the most due to the inability of the parents to fully control the situation during classes, for example. (Participant 20)
Teachers	Assessment ($n = 2$)	For some subjects, it is difficult to measure to what extent the goal has been achieved distantly, such as sports. (Participant 21)
		Difficulty in evaluating the goal. (Participant 7)
	Lesson preparation ($n = 2$)	It is difficult (in terms of effort and time) to prepare lessons and present them in an attractive way for our students to ensure the students' mental presence, attract them, and increase their understanding of the lesson during the online sessions. (Participant 1)
		Preparing various methods and digital tools to ensure students comprehension (Participant 13)
	Lack of control ($n = 2$)	Inability to control the educational environment and remove distractions for students (Participant 1)
		Sometimes, I need to teach specific goal for one student in particular but suddenly another student attends the session online so they disturb the lesson and did not benefit (Participant 9)
Technology	Lack of access to technology and technical problem ($n = 4$)	The lack of availability of devices for most students (Participant 3)
		Lack of appropriate digital content for the special education students (Participant 6)
		Internet outage (Participant 5)
	Lack of tangible concrete tools ($n = 1$)	The difficulty of presenting some academic subjects that rely heavily on sensory experiences, such as science, in theoretical form only using audio, image, and video (Participant 1)

special needs, integrating technology into teaching can induce anxiety (Betoncu and Ozdamli, 2019; An et al., 2021; Estrada-Muñoz et al., 2021; Fernández-Batanero et al., 2021; Potter, 2021; Ishartiwi et al., 2022; Nang et al., 2022; Rice, 2022; Zheng et al., 2022). This can lead to weakness in teaching students with special needs which affects students understanding of lessons. According to Tonks et al. (2021) students with special needs faced a variety of difficulties in e-learning due to their teachers' failure to provide them with the necessary assistance. One of the reasons that may cause teacher's anxious is the lack of necessary training to equip them with the talents necessary to instruct pupils with special needs (Tonks et al., 2021).

Due to the COVID-19 pandemic, special education teachers were forced to rely heavily on technology and teach their students completely online. Many were teaching in this format for the first time, with new technologies and overwhelming demands, requiring intense commitment in a limited time and with little support for special needs students. Some unresponsive students and/or non-cooperative parents induced more stress. Adopting the perspective of the transactional theory of stress and coping (Lazarus and Folkman, 1984), this can be seen as a situation that involves many psychological stressors emerging from exposure to a totally new and ambiguous experience. On one hand, the interviewees who had experienced anxiety reported as factors that made them feel unwell the lack of concrete tools, the need to find new teaching tools and methods, and the lack of face-to-face communication with their students, who need a special kind of learning environment that includes face-to-face instruction and practice. The new and unfamiliar commitments resulting from the pandemic stretched the teachers' capabilities, often increasing their anxiety and discomfort (Salanova et al., 2013; Fuglseth and Sorebo, 2014; Lee et al., 2016). On the other hand, high levels of stress can arise when individuals are overwhelmed by the excessive and prolonged use of technology, or when they are compelled to engage with it at a pace that surpasses their abilities (Moore, 2000; Karr-Wisniewski and Lu, 2010; Al Mulhim, 2023). This can lead to the kind of anxiety experienced by the teachers during the pandemic.

We also found that the special education teachers were satisfied with their technological experiences when teaching remotely during the COVID-19 pandemic. This result is consistent with those of Alhaythami (2022) and Qaraan (2021) in terms of the high level of teachers' techno-satisfaction. This finding also confirms previous results concerning the importance of technology in supporting the unique needs of special needs students (Ciampa, 2017; Nordström et al., 2018; Atanga et al., 2019; Olakanmi et al., 2020; Molina-Vargas et al., 2021; Starks and Reich, 2023). On the other hand, this finding is at odds with studies by Belabas and Bouhila (2021) and Aburayash (2022) regarding the levels of teachers' techno-satisfaction.

How can we explain this conflict? The high level of satisfaction observed in our study could be attributed to the Ministry of Education's efforts in the Kingdom of Saudi Arabia to ensure uninterrupted education for students during the total school closure period. Our respondents emphasized the practical benefits of using e-learning with their students, as it facilitates cooperation with the parents, protects students' health during dangerous times, and supports increased accessibility for special needs students.

From the perspective of the expectation-confirmation model, the teachers seemed to believe in the potential of distance learning and fully agreed that it was a viable and safe way to continue education during the pandemic. Their initial hopes and expectations were generally realized. They discovered that distance learning was effective and even advantageous in meeting the unique needs of their students. As a result, they expressed satisfaction on the questionnaire and in the interviews. In some ways, e-learning may be better suitable than traditional teaching for students with special needs (Beck et al., 2014; Basham et al., 2015). They can review material as needed, learn at their own pace. Furthermore, special needs teachers can work with students in small groups or one-on-one. They can also modify course materials to accommodate a range of requirements, differentiate training, and match standards with teaching (Geith and Vignare, 2008; De los Arcos et al., 2016). While these best practices are beneficial for all students, students with disabilities may find them particularly more helpful.

8 Limitations

Despite the interesting findings of this study concerning the teacher's anxiety in teaching students with special needs during distance learning, and satisfaction with their use of distance learning, on the other hand, this research does possess a number of limitations, as do all studies. It provides a general overview of special education without delving into specific levels or disabilities in depth. Due to the scarcity of available research on special education teachers, especially during the pandemic, the literature reviewed in this paper can be useful for both special education faculty and teachers specializing in other areas. The study primarily focuses on techno-anxiety and techno-satisfaction. The sample used in this study consisted of special education teachers from Saudi Arabia who were required to teach remotely during the COVID-19 pandemic. It's important to note that the data was collected immediately after the pandemic period, so if the circumstances had changed, the findings might have been different. Therefore, caution should be exercised when generalizing the findings of this study.

9 Conclusion

The primary objective of this paper was to explore feelings of anxiety and satisfaction among special education teachers regarding distance learning during the COVID-19 pandemic. The findings indicate that the teachers felt moderate anxiety but expressed high levels of satisfaction with distance learning. The teachers identified the benefits and challenges associated with the use of distance learning and technology to teach students with special needs. The most frequently mentioned benefit was the availability of assistive technology, which enhanced students' learning experiences and catered to their specific needs. The main challenges faced by the teachers during distance learning concerned the students themselves, including recurring absences, reluctance to engage with online platforms, lack of responsiveness, limited interaction, and difficulty maintaining concentration during virtual classes. Additionally, some teachers faced obstacles related to students' lack of computer and e-learning skills.

We hope that this research will generate insights for designers of remote learning environments by informing them about the factors that can influence teachers' feelings of anxiety or satisfaction when implementing distance learning. This information can guide the design of such environments and help decision-makers implement best practices to reduce the pressure and anxiety related to technology and enhance teacher satisfaction. The results could also be useful to parents of students with special needs by helping them understand the challenges faced by their children's teachers when required to use technology for teaching. By gaining this understanding, parents can be motivated to foster stronger cooperation with teachers.

To decrease techno-anxiety and increase techno-satisfaction among teachers of students with special needs, we may recommend first, provide thorough training programs on technology integration specifically tailored to the needs of teachers working with students with special needs. Offer hands-on workshops, online courses, and resources that cover both technical skills and strategies for effective instructional use. Additionally, establish ongoing support systems, such as a dedicated technology support team or peer mentoring, to address any concerns or challenges that arise. Second, ensure that the technology tools and platforms used in special education settings are accessible and user-friendly. Consider the specific needs and abilities of teachers and students with special needs when selecting technology solutions. Prioritize tools with intuitive interfaces, customizable features, and built-in accessibility options to facilitate ease of use and reduce frustration. Third, involve teachers in the decision-making process when selecting and implementing technology in special education classrooms. Seek their input and feedback to understand their needs, preferences, and concerns. Collaborative planning allows for a sense of ownership and empowers teachers to select technologies that align with their teaching styles and the unique requirements of their students.

By implementing these recommendations, you can create a supportive and empowering environment for teachers of students with special needs, reducing techno-anxiety and increasing techno-satisfaction. Ultimately, this will contribute to enhanced teaching experiences, improved student outcomes, and a positive integration of technology in special education classrooms.

We emphasize that this study focused solely on special education teachers. Therefore, we encourage future researchers to assemble a more diverse sample of teachers to gain further insights into their experiences with distance learning. Additionally, exploring the relationship between technological anxiety, technological satisfaction, and specific teacher characteristics would be beneficial. Future research could involve different types of teachers with diverse personal characteristics and investigate the role of various psychological and emotional variables.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Committee of Research Ethics at King Faisal University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

EA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. FA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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