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How physical pain, social factors, anxiety, and insomnia impact e-learning adoption? Health lessons from a cross-sectional study

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ABSTRACT

This study investigates the relationship between e-learning adoption in a developing country, Palestine, that had very little experience with it, and the impact of anxiety rates, insomnia, physical pain, and social factors on both student and staff levels. The final analysis included 1116 participants (103 staff and 1013 students). 45.7% of the total sample had moderately severe insomnia, who are predominantly females. 40.6% of the total sample showed signs of severe anxiety, but students showed higher anxiety levels compared to staff, reaching 71.8%. In terms of physical pain, both students and staff scored similarly, indicating a high effect (2.49 ± 0.56), but the effect was more significant among female students (p-value $= 0.000$), and higher Body Mass Index levels (p-value $= 0.01$). However, the effect of e-learning on social impact was not consistent. The findings of this study can contribute to the literature by highlighting the need for various policies, beyond the pedagogical perspective, to support the effective adoption of e-learning.

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Introduction

The world was confronted with the largest global pandemic in nearly a century in December 2019 as a result of the COVID-19 outbreak, which impacted the health, economic, cultural, scientific, and social aspects of life. On the 30th of January 2021, the World Health Organization (WHO) declared it an international concern, and then a global pandemic on the 11th of March of the same year (WHO, 2021), triggering a series of extensive measures by many countries around the world to control the virus's spread. Some of these measures included mandatory total lockdowns, social distancing, the closure of all levels of academic institutions, and the transition to electronic learning. These measures had an impact on people's normal daily activities, which many were unprepared for, resulting in higher levels of anxiety, burnout, and sleeping disorders (Kwan, 2022; Wang et al., 2020). In addition, many universities encountered several challenges in treating such a high level of disorders (Alterri et al., 2020).

On one hand, the pandemic crisis has encouraged innovation in the education sector, with innovative approaches seen to support the continuity of education and training. Rapid responses from governments and partners around the world in support of the continuity of the education process, including the Global Education Coalition called for by UNESCO (2021), have resulted in the development of solutions ranging from using television channels to home educational packages and solutions based on distance learning. t.

On the other hand, the COVID-19 pandemic has revealed disparities in many countries' educational systems, including Palestine. Where education is no longer available to all in a fair and equal manner, students from less privileged groups struggled to continue learning from a distance due to lower family income, high internet connection costs and access, lack of devices to access online learning resources,

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and a lack of study spaces within their homes (Alsoud & Harasis, 2021). Furthermore, it has been noted that some countries lack official programs, particularly for learners with learning disabilities and those with special needs (UNESCO, 2021). Whereas distance e-learning has become a major concern for the elements of the educational process, beginning with teachers and students, passing through parents, and ending with educational institution administrations.

Although e-learning provides a unique opportunity to continue learning in a relatively flexible way and prevent it from being completely disrupted or stopped, many challenges are identified when adopted, especially in regard to the physical and mental well-being of both students and staff. According to a study published in the United States (Barkley et al., 2020), the lack of physical activity caused by e-learning may result in muscle weakness and decreased efficiency, as well as muscle spasms, particularly in the neck. Aside from the body weight changes caused by lack of movement and possibly a change in eating habits and patterns, it also causes some postural problems, vision problems, and disrupted sleep, as well as some social influences, such as a desire for loneliness and a lack of communication and social interaction with both family and peers (Banerjee & Rai, 2020).

Lim (2020) and Zhai and Du (2020) have emphasized the high level of tension caused by e-learning among students, as well as the effects on students' psychological health, such as sadness, frustration, and anger, which increased students' anxiety among other feelings. In addition, Marelli et al. (2021) showed that levels of sleep quality have significantly worsened. Moreover, Mulrooney and Kelly (2020) revealed that the COVID-19 lockdown reduced the feeling of belonging among students and teachers.

Based on the above background, this study aims to investigate the effect of using e-learning during the COVID-19 pandemic on university students and staff in regards to anxiety levels, sleep-related issues, as well as physical and social indicators. .

The stress and coping theory could be one of the frameworks of this research as it focuses on how people manage the adverse effects of stress (Lazarus & Folkman, 1984). This theory emphasizes the importance of coping in the development of poor health (Milas et al., 2021). Ali et al. (2021) indicated that stress and coping theory aims at the prevention and reduction of fear and anxiety. Additionally, Karos et al. (2018) argued that physical pain is modulated by psychosocial factors, such as fears and the social context.

To sum up, the present study addresses the following research questions:

RQ1. How does physical pain impact e-learning adoption?

RQ2. How do social factors impact e-learning adoption?

RQ3. How does anxiety impact e-learning adoption?

RQ4. How does insomnia impact e-learning adoption?

COVID-19-engineered e-learning and learner anxiety

Technology anxiety is one of the daunting challenges to overcome in teaching and learning (Alqabbani et al., 2021). A specific example of technology anxiety is computer anxiety (the fear of using a computer), which was recorded among university students during the COVID-19 pandemic (Trotter & Qureshi, 2023; Weerathunga et al., 2021). E-learning implies the application of technology for educational purposes. The e-learning practices and satisfaction during the pandemic had an interplay with several factors, such as learner anxiety (Yekefallah et al., 2021). The emergent transition to exclusive e-learning approaches significantly had a negative impact on the well-being of students, such as anxiety disorders and depression (Fawaz & Samaha, 2021; Hawley et al., 2021). Students' anxiety levels were worsened by the sudden conversion of all face-to-face teaching to e-learning as well as the uncertainties brought by COVID-19 (Moy & Ng, 2021).

Several studies have reported how COVID-19-engineered e-learning triggered and worsened the anxiety levels of students. For instance, it was found that variations and academic activity delay had a positive correlation with anxiety symptoms in higher education students during the COVID-19 pandemic (Raccanello et al., 2022). Thus, the e-learning prompted by COVID-19 is regarded as anxiety-provoking among teaching staff and students (Othman & Mahmood, 2021). It was identified that the academic and

financial burdens, which were a spillover effect of COVID-19-related e-learning, made college students anxious (Lee, 2020). The study of Kapasia et al. (2020) revealed that 42% of students suffered from anxiety, stress, and depression due to COVID-19-related e-learning. Cao et al. (2020) found that out of 7143 students, 24.9% suffered from anxiety as a result of the challenges associated with the pandemic-born e-learning.

A study conducted in Spain discovered that the anxiety of students as a result of COVID-19-related e-learning was intensified during the fourth week compared to the first week (García-González et al., 2021). Hasan and Bao (2020) reported that students exhibited a higher level of psychological anxiety as a result of 'e-learning crack up'. The anxiety was linked to the repercussions of ineffective study plans and professional development. The anxiety of students was positively correlated to the fear of academic year loss and triggered by the lack of interpersonal communication with their peers and teachers. Multiple stressors were identified to contribute to increased anxiety and depressive symptoms among students during COVID-19-related e-learning, such as the lack of concentration during class hours (Son et al., 2020). Specifically, in their study, Son et al. revealed that 138 (71%) students out of 195 experienced severe stress and anxiety, with 16 (8%) stating that they experienced mild to moderate suicidal thoughts. In Bangladesh, a study reported that about 82.5% of undergraduate students experienced mild to extreme anxiety, while 14.08% experienced extreme anxiety during the e-learning triggered by COVID-19 (Hoque et al., 2021).

Demographic factors, such as a student's gender, family size, academic year, residential area, accommodation, etc., were all underscored as affecting the students' level of anxiety (Hoque et al., 2021). Age, level of education, and ethnicity were also found to be determinants of students' levels of stress (Moy & Ng, 2021). In the study by García-González et al. (2021), being a female and in the final year of a degree program was found to be a predictor of anxiety among nursing students.

COVID-19-engineered e-learning and learner sleeping disorder

Exposure to unfamiliar learning environments can result in insomnia or sleeping disorders (Fatima et al., 2023). Also, one of the general technostress symptoms is insomnia (Govender & Mpungose, 2022). The shift to e-learning requires excessive internet use, which may disturb the sleeping pattern of university students during the pandemic (Abiddine et al., 2022). Prolonged screen time has been found to be associated with insomnia and bedtime procrastination among university students during the COVID-19 pandemic (Hammoudi et al., 2021). The use of social media, such as WhatsApp, for e-learning also has the power to result in addiction and result in sleeping disorders among students (Enyama et al., 2021). Additionally, the lack of readiness to participate in forced-e-learning caused students to develop depressive symptoms, which can lead to low sleep quality (Jafar et al., 2023). Insomnia has been identified as one of the psychological impacts of online lectures during quarantine due to COVID-19 (De Michele, 2020; Kulikowski et al., 2022). Alam (2022) also identified insomnia as a mental health challenge brought by e-learning during the pandemic. Particularly, university students in Brunei experienced altered sleeping patterns.

A study that looked at the consequences of the pure online learning during the COVID-19 quarantine found that 31.1% of students suffered from insomnia (Mosleh et al., 2022). Ramane et al. (2021) also found that the online-based instruction has led to sleeplessness among students. The forced e-learning as a result of COVID-19 brought changes to academic schedules, and as a result, students stayed up late and woke up at in different times, while others became insomniacs. University students in Bangladesh suffered from insomnia due to unsatisfactory e-learning and future insecurity regarding academic and career trajectories (Hossain et al., 2021). A negative impact of insomnia generated by the forced-e-learning was due to the lack of concentration and meaningful interaction between teacher and students during classroom instruction (Kulikowski et al., 2022) and poor physical and mental health (Alam, 2022). According to Abiddine et al. (2022), the insomnia that university students suffered from during online instructions plays an integral role in their subjective well-being. As a result, Alyoubi et al. (2021) called for psychological interventions, such as cognitive behavioral therapy (CBT), to promote sleep among university students. Apart from students, teachers also suffered from insomnia during the first weeks of

e-learning. Thus, insomnia, as a symptom of technostress, was experienced by both teachers and students. Notwithstanding, some participants in De Michele's (2020), study opined that the benefit of e-learning during the pandemic is that they had additional time to sleep.

Socio-demographic factors, such as gender and age, were found to be related to mental health and resilience which dictates the sleeping quality of undergraduates (Alyoubi et al., 2021). Alyoubi et al. further add that students who enrolled in the final year were more likely to experience short sleep durations (<6 h per night). In the study by Hammoudi et al. (2021), among female students, the duration of smartphone use, physical activity levels, BMI, and insomnia were all found to be significantly higher than male students.

COVID-19-engineered e-learning and learner physical health

Past studies have revealed that technology use has a devastating effect on physical health (Ramane et al., 2021; Zheng et al., 2016). For example, problematic social media use negatively affects physical health among students (Abiddine et al., 2022). Zheng et al. (2016) also discovered that the frequency of internet use caused physical pain, such as decreased vision, dry eyes, and cervical pain. E-learning during the pandemic made use of the internet, social media, and digital tools for education delivery (Enyama et al., 2021) and as a result, brought physical discomfort to students (Gumasing & Castro, 2023). The pandemic-born e-learning exposed learners to physical pain (Ramane et al., 2021). According to Ramane et al. (2021), the use of digital technologies, such as mobile phones, desktop computers, and laptops, has a harmful effect on the physical health of learners (e.g., eyesight). They found that the severe physical harm electronic devices had on learners included headache, backache, neck pain, and shoulder pain.

Govender and Mpungose (2022) add that physical technostress symptoms associated with COVID-19 e-learning include headache, backache, and general body pains. When enumerating health issues brought about by e-learning during the pandemic, Alam (2022) mentioned physical health symptoms, such as eye strain and backaches. Thus, staring continuously at the computer for about 6 h caused some learners to experience dry eyes and carpal tunnel syndrome and also resulted in Zoom fatigue. The two symptoms were linked with prolonged participation in e-learning. Key findings from the study by Paradina and Prasetyo (2023) indicated that learners experienced physical pain (musculoskeletal disorder) in their lower back, upper back, and hips/buttocks because they had to sit for long hours (between 7–8 and 9–10 h) when participating in online classes. Exploring the ergonomic perceptions and practices of students in e-learning during COVID-19, Bakry et al. (2022) highlighted that 80.7% of desktop-users in their study applied good ergonomic practices to avoid musculoskeletal disorders, such as persistent pain in the joints, muscles, and soft body parts, while 50.5% of laptop-without-desk users and tablet/smartphone users engaged in bad ergonomic practices.

In another study, e-learning during the pandemic resulted in students experiencing moderate fatigue (Mosleh et al., 2022). In the same study, it was mentioned that new assessment methods brought about by e-learning affected the physical health of over a quarter (27.8%) of the students. The study by Alyoubi et al. (2021) revealed that 115 students (20% of the participants) suffered from physical health conditions. Jafar et al. (2023) found that a group of students who experienced e-learning during the pandemic suffered from physical health disorders, such as lethargy, obesity, eye fatigue, blurred vision, and headaches.

Physical pain prompted by COVID-19-forced e-learning also varied among learners in terms of demographic factors. For example, in the study by Mosleh et al. (2022), male students experienced significantly lower fatigue when compared to their female counterparts. In the study by Hammoudi et al. (2021), which concluded that the COVID-19 pandemic that triggered abrupt e-learning had a deleterious effect on learners' physical health, the proportion of female students who exhibited physical inactivity and increased BMI due to frequent screen time was found to be higher than males. Age and educational level were also found to be associated with the level of musculoskeletal disorder in students during the COVID-19-inspired e-learning (Paradina & Prasetyo, 2023).

COVID-19-engineered e-learning and learner socialization

E-learning can provide a stimulating virtual classroom (Fawaz & Samaha, 2021), an accessible, personalized, and flexible platform for students (Kabir et al., 2021), and offer them opportunities for self-assessment methods through digital technologies but there is a minimal level of interaction and feedback (Yekefallah et al., 2021). Kabir et al. (2021) mentioned that e-learning has several obstacles, such as less non-verbal interaction or communication problems that deter comprehensive learning practices. Jafar et al. (2023) declared that e-learning deprives learners of interactions and consequently causes them to experience social isolation. Learners do not get a private space to interact with peers during e-learning and hence may affect social interaction and cause boredom (Baber, 2022). E-learning that transpired during the COVID-19 era decreased the social dimensions of work (Kulikowski et al., 2022), resulted in social isolation and psychological pressures (Hossain et al., 2021; Youssef & Richer, 2022) and the lack of social interactions between students and their peers and students and their teachers (Adarkwah, 2021).

Kamysbayeva et al. (2021) stated that limited social interactions with peers and teachers as one of the key challenges that students experienced with e-learning during COVID-19. There were teachers who uploaded their slides to learning management software and offered no additional interactivity, while others had live-streaming sessions that created room for interactive queries (Ebner et al., 2020). Findings from De Michele's (2020) study showed that students declared that social interaction was more difficult during online lectures. Haider and Al-Salman (2020) identified the prolonged use of digital tools, such as mobile phones, iPads, and laptops during the COVID-19 pandemic as a probable cause of the social isolation students experienced. The main dissatisfaction among students in the use of e-learning systems during the pandemic was found to include a lack of socialization with colleagues and limited student-student interaction (Ionescu et al., 2020).

One identified negative outcome of the lack of direct interaction with teachers is academic stress (Hassan et al., 2021). The lack of social interactions in e-learning also causes students to develop less motivation and develop feelings of loneliness and social isolation (Jafar et al., 2023). Alam (2022) revealed that one of the negative effects of e-learning during the pandemic was that students at Brunei University were isolated for long hours in their rooms and experienced a lack of motivation to attend online classes, low moods, anxiety, loneliness, and decreased appetite.

Nonetheless, e-learning can make interactive learning a possibility and facilitate social interactions through instructors initiating chat sessions, sending e-mails, and posting online discussions as was witnessed in a higher education institution in the Philippines (Irie et al., 2021). Baber (2022) also found that learners did not perceive social interactions as important in e-learning during COVID-19 because they were happy to continue studying online, saving time and staying safe at home. In gender-segregated cultures, such as Saudi Arabia, women favor the asynchronous method of e-learning which limits direct human interaction with teachers and/or students (Alyahya et al., 2022).

Methods

Study design and participants

The data was collected between April and May of 2021 at An Najah National University (ANNU), which is one of the major universities in terms of number of students enrolled. ANNU is located in the northern part of the West Bank-Palestine. The participants of this study used e-learning platforms and systems, such as Zoom and Moodle for more than 18 months. The purposes of using the e-learning platforms and systems were teaching, learning, training, evaluation, and assessment. The research used a cross-sectional survey approach. Students and academic staff from all faculties were invited to participate in the present study. An access link to the study survey was sent via the official university portal, alongside with an explanation of the study's purpose. There were no exclusion criteria.

A stratified random sample based on gender, role, and faculty was recruited in this study. The sample consisted of 1116 total respondents who agreed to participate in the study, with 1012 being students and 104 being academic staff. Kolmogorov-Smirnov Test for normality was used to investigate the

normal distribution of physical pain and social impact over the variables of gender and the role (staff and students). All the statistical significance values were set at a p-value of >0.05.

Instruments

This study used an anonymous and structured online self-reporting survey created with Google Forms. This was to ensure more privacy and, as a result, a greater willingness to engage in the research. Participants acknowledge their consent to take part in this study by completing the survey and clicking the submit button, which was stated at the beginning of the survey.

There were five main sections of the survey, including (1) Demographic and socioeconomic data (i.e., gender, age, place of living, number of people living in the household, level of education, and type of technology used in e-learning during the lockdown); (2) Using the GAD-7 screening tool to identify generalized anxiety (Spitzer et al., 2006); (3) Questions about sleep quality using the Insomnia Severity Index (ISI) (ONS, 2022); (4) Questions about physical pain and weight changes; and (5) Questions about social factors like solitude and the desire to communicate with others.

All instruments were adopted and validated (Sawaya et al., 2016; Suleiman & Yates, 2011). The GAD-7 is a seven-point scale that assesses how frequently a person has had an anxiety symptom in the last two weeks (Spitzer et al., 2006). It then assigns a degree to each, ranging from 0 to 4, based on how frequently they occur, with 0 indicating 'never' and 4 indicating 'almost every day'. Cut-off points were chosen to categorize each answer as minimum anxiety (0–4), mild anxiety (5–9), moderate anxiety (10–14), and severe anxiety (15–21). The validity coefficients of GAD-7 scale ranged between 0.31 and 0.78. All the correlation coefficients were significant.

Similarly, the ISI is a 7-scale screening instrument that is used to evaluate several sleep-related concerns, such as difficulty sleeping, sleep pattern satisfaction, sleep problem interference with everyday functioning, and sleep problem noticeability to others. The participants were asked to rate their level of sleeplessness on a five-point Likert scale ranging from 0 to 4, with higher scores indicating more severe insomnia. Respondents were classified as having no clinically significant insomnia (0–7), subthreshold insomnia (8–14), moderate severity (15–21), or severe insomnia (22–28). The ISI was shown to have a 0.74 internal consistency, 0.87 sensitivity, and 0.75 specificity (Veqar & Hussain, 2017), while the validity coefficients of ISI scale ranged between 0.42 and 0.81. All the correlation coefficients were significant.

The portion on physical pain elements was divided into six paragraphs, each of which featured questions about pain in various bodily areas. 'Headache, neck and shoulder pain, tired eyes, and overall physical exhaustion, while social Impact included five paragraphs that questioned the tendency to loneliness and the desire to communicate with others, such as family, friends, and colleagues, and whether or not they have time for any type of communication at all. Both portions were rated on a three-point Likert scale, and the scores for each paragraph were summed up to determine the mean and standard deviation (Table 1). The responses were then divided into three categories based on the severity of the problem, with scores ranging from 1 to 1.66 indicating a low effect, 1.67–2.33 indicating no change, and 2.43–3 indicating a high effect. The reason behind using three categories is to focus the analysis on broader trends and satisfy assumptions of statistical tests (Koo & Yang, 2025).

Statistical analysis

The data was analyzed and checked for normal distribution using the Statistical Package for Social Science (SPSS) software version 21.0. Descriptive analysis was used for categorical data as frequencies and percentages, while continuous data was analyzed using mean and standard deviation. The association between physical and social elements in relation to gender, student/staff, BMI (The BMI is calculated by dividing the weight in kilograms by the height in meters squared), anxiety, and insomnia were investigated using the Pearson correlation coefficient. For all tests performed in this study, statistical significance was set at a p-value of <0.05.

Table 1. Insomnia rates by gender and staff and students.

Categories			%*N*
Insomnia (*N* = 1116)	NCSI	Female	8.5 (64)
		Male	13.1 (48)
		Student	9 (91)
		Staff	20.4 (21)
	Subthreshold	Female	26.7 (200)
		Male	31.3 (115)
		Student	28 (184)
		Staff	30.1 (31)
	Moderate severity	Female	46.9 (351)
		Male	43.3 (159)
		Student	46.1 (467)
		Staff	41.7 (43)
	Severe	Female	17.9 (134)
		Male	12.3 (45)
		Student	16.9 (141)
		Staff	7.8 (8)

NCSI: no clinically significant insomnia.

Table 2. Basic characteristics participants; staff and students.

		Staff	Students
Gender % (*N*)	Female	33 (34)	70.6 (715)
	Male	67 (69)	29.4 (298)
Age mean (*SD*)		42.71 (11.11)	20.10 (2.69)
Place of living % (*N*)	City	54.4 (56)	48.1 (487)
	Village	40.8 (42)	49.6 (502)
	Refugee camp	4.9 (5)	2.4 (24)
Body mass index (BMI)	Underweight	4.9 (5)	7.2 (73)
	Normal	49.5 (51)	55.8 (565)
	Overweight	27.2 (28)	26.7 (270)
	Obesity	18.5 (19)	9.4 (95)
Type of technology used % (N)	Mobile	14.6 (15)	38 (385)
	Laptop	82.5 (85)	59.3 (601)
	Other	2.9 (3)	2.7 (27)

Ethical approval

The study was conducted in accordance with the regulations and ethics followed at ANNU and in compliance with the Declaration of Helsinki. The study received ethical approval from the Institutional Review Board (IRB) of ANNU.

Results

A thousand and hundred and sixteen participants were included in the analysis, of which 103 were staff and 1013 were students. The mean age of students and staff was 20.10 ± 2.96 and 42.71 ± 11.11, respectively. 70% of students were females, compared to 33% of staff. More than 95% of all participants live in cities or villages, and only 2.6% of them live in refugee camps.

Table 2 demonstrates the distribution of participants in both categories (staff and students) according to their weight category. 18.5% of staff were with obesity compared to 9.4% of students, and more than half of the sample had normal weight. Approximately, half of the sample of both staff and students had gained weight during the period of e-learning during the COVID-19 pandemic. Additionally, participants were asked to indicate the type of technology used during e-learning. The majority of staff (compared to 59.3% of students) used laptops, while 38% of students used mobile phones instead.

Insomnia and anxiety

As discussed in the methodology section, participants' questionnaire scores were categorized into four as shown in Table 3. Accordingly, 45.7% of the total sample were suffering from moderately severe

insomnia after one year of e-learning during Covid-19 pandemic, in comparison to 28.2% of subthreshold insomnia. 17.9% of the sample females were grouped as having severe insomnia, in contrast to 12.3% among males.

Similarly, regarding anxiety levels, 40.6% of the 1116 participants were considered to have severe anxiety over the period of e-learning (Table 3). The results indicated that there were major differences in relation to anxiety levels between staff and students, where 71.8% of students' scores indicated moderate and severe anxiety compared to only 36.9% among staff participants.

Physical pain and social impact

The average mean of the six paragraphs of the physical pain assessment indicated that the effect of e-learning on both staff and students seems to be high (2.49 ± 0.56). The highest mean was for the paragraph of 'feeling lazy and not wanting to move' (2.62 ± 0.74), where the lowest mean and the 'No change' effect was for the paragraph of 'headache feeling' (2.28 ± 0.91) (Table 4).

Regarding the effect of e-learning on social impact of staff and students, the average mean of the 5 paragraphs showed a 'No change' effect (2.11 ± 0.46). The paragraph of 'Desire for loneliness and solitude' had the highest mean compared to the lowest mean for the paragraph of 'Desire to communicate with colleagues' (2.31 ± 0.84) and (1.98 ± 0.75), respectively.

Table 5 depicts the impact of gender on the magnitude of the effects of a year of remote learning on the physical pain of students and staff. Females were shown to be much more affected by the physical pain of e-learning than males (p-value $= 0.001$). A similar effect was shown between students and staff, as the effect was higher on students (p-value $= 0.001$). However, occupation and gender did not have any effect on the social impact on participants.

Table 3. Anxiety rates by gender and staff and students.

	Categories		%*N*
Anxiety ($N = 1116$)	Minimal	Female	7.6 (57)
		Male	17.2 (63)
		Student	9.2 (93)
		Staff	26.2 (27)
	Mild	Female	18.2 (136)
		Male	25.6 (94)
		Student	19 (192)
		Staff	36.9 (38)
	Moderate	Female	28.2 (211)
		Male	27.8 (102)
		Student	29.1 (295)
		Staff	17.5 (18)
	Severe	Female	46.1 (345)
		Male	32.6 (108)
		Student	42.7 (433)
		Staff	19.4 (20)

Table 4. Perceived effect of e-learning on physical pain and its social impact.

	Component	Mean (*SD*)	Level
Physical pain	Headache feeling	2.28 (0.91)	No change
	Neck and shoulders pain	2.48 (0.83)	High
	Lower back pain	2.38 (0.84)	High
	Tired eyes	2.60 (0.76)	High
	Feeling lazy and not wanting to move	2.62 (0.74)	High
	Feeling of physical exhaustion	2.56 (0.77)	High
Social impact	Desire for loneliness and solitude	2.31 (0.84)	No change
	Desire to communicate with family	1.96 (0.87)	No change
	Desire to communicate with friends	2.14 (0.88)	No change
	Desire to communicate with colleagues	1.98 (0.85)	No change
	Don't have time for any type of communication	2.18 (0.80)	No change

Table 5. Physical pain, social impact, anxiety, and insomnia by gender and staff and students.

		Mean (*SD*)	Effect level	*p*-Value
Physical pain	Female	2.50 (0.45)	High	0.001
	Male	2.27 (0.56)	No Change	
	Student	2.46 (0.48)	High	0.001
	Staff	2.15 (0.60)	No change	
Social impact	Female	2.12 (0.44)	No change	0.672
	Male	2.11 (0.48)	No change	
	Student	2.12 (0.45)	No change	0.177
	Staff	2.06 (0.48)	No change	
Anxiety	Female	13.26 (5.47)	High	0.001
	Male	10.80 (6.04)	No change	
	Student	12.85 (5.62)	High	0.001
	Staff	8.55 (5.84)	No change	
Insomnia	Female	15.95 (5.89)	High	0.001
	Male	14.72 (6.26)	No change	
	Student	15.76 (5.91)	High	0.001
	Staff	13.48 (6.85)	No change	

Discussion

This study reported the impact of COVID-19-related e-learning experience on university staff and students' social life, physical pain, anxiety rates, and insomnia, using a cross-sectional survey at the largest Palestinian university based in Nablus. The study's findings in each of these domains are summarised and discussed sequentially, putting them in the context of the broader literature and drawing implications for policy and practice.

Insomnia

In the present study, 45.7% of the sample reported symptoms consistent with moderately severe insomnia after 1 year, with 12.4% reporting severe insomnia. This finding was not surprising as insomnia has been reported as one of the most common neuro-psychological consequences from COVID-19, as found by a study published by Lancet Psychiatry (Taquet et al., 2021). The prevalence found in our study is similar to a study conducted in neighboring Jordan, which also found the majority of the sample reporting sleep problems (60%) and half reporting short sleep duration (Al-Ajlouni et al., 2020).

Symptoms consistent with severe insomnia in this study were higher among females and students compared to males and staff. These findings are consistent with a study in Italy which found that increases in bedtime hour, sleep latency, and wake-up time, as well as worsening quality of sleep and insomnia symptoms, were more common in students and in females (Marelli et al., 2021).

These findings are important and have links to other health issues. Insomnia and changes in sleep-wake cycle are driven by anxiety and depressive symptoms, the prevalence of which also increased during the pandemic (Saad et al., 2021). The specific issues facing students include significant changes in lifestyle and daily activities, such as class schedule, physical activity, and social contact. There has also been a significant, near-universal shift to the use of electronic equipment, which can also accentuate sleep problems, and consequently affect academic performance and learning (Cao et al., 2020; Saad et al., 2021).

Anxiety

This study found a high prevalence of anxiety among the sample, with 40.6% reporting severe anxiety, compared to 10.8% with minimal anxiety. These results could be attributed to several factors including the lack of in-person socializing in e-learning , leading to exacerbated feelings of loneliness, a catalyst for anxiety (Liu & Lin, 2024). Moreover, spending several hours in front of a screen could lead to digital fatigue (Devi & Singh, 2023). The constant exposure to screens may cause stress, eye strain, and other physical pain, contributing to a high level of anxiety. The obtained results are in line with the global literature published. A detailed study from France found that confinement to residences in particular was detrimental to students' health during the pandemic (Husky et al., 2020). Similar findings were published in studies from China, the Philippines, Indonesia, and Iran, where all reported significant increases in the

prevalence of anxiety among students during the pandemic. This included students from different disciplines and cultural backgrounds (Ardan et al., 2020; Baloran, 2020; Cao et al., 2020; Nakhostin-Ansari et al., 2020).

Rates of anxiety were higher among students (71.8%) compared to staff (36.9%). This may be explained by the fact that students before the pandemic already had high rates of anxiety (Chau et al., 2019; Mao et al., 2019). On top of the pre-existing rates of anxiety, the pandemic may have placed a disproportionate level of psychological distress compared to staff (Maia & Dias, 2020). Staff felt more stressed and anxious in the COVID-19 era due to an increase in workload, making their role more ambiguous, and altering their work style because of the need for updated knowledge and skills to meet the new educational demands (Zheng et al., 2022). Moreover, anxiety among students is resulted by insufficient sleep (Yasmin et al., 2020).

The significant rates of anxiety may not be surprising considering the mechanism and known risk factors for anxiety since the COVID-19 pandemic presents an obvious challenge to health and wellbeing, and the mitigations taken against it lead to social isolation. Therefore, although measures to reduce viral transmission are important for the health of the population, any negative consequences for groups or individuals should also be considered in planning and implementing policies.

Physical pain

In this study, a majority of participants reported physical pain in each of the pain symptoms investigated (headache, neck pain, lower back pain, tired eyes, physical exhaustion), which was significantly associated with increased BMI. This could be because online learning usually involves long hours of sitting in front of a screen, which could lead to physical inactivity (Poon & Tang, 2024) and irregular eating patterns (Pung et al., 2021), causing physical pain. The rates of reported pain are comparable to the findings of other studies. In a study conducted in India, 54% of participants reported eye strain, and around 40% reported neck pain, back pain, and headache (Singh et al., 2021). A study in Saudi Arabia found that 45.2% of the participants faced physical or emotional disturbances during the e-learning process, including eye strain, back pain, and headache (Gajendran, 2020). A Palestinian study conducted among the same population as this study reported that 43.1% of participants had pain in the neck, back, or shoulder that was not present before the commencement of e-learning (Yaseen & Salah, 2021). It is important to underline that lower back pain is considered to be the most reported musculoskeletal pain among different populations and age groups during the COVID-19 quarantine period (Christofaro et al., 2022; Šagát et al., 2020). It is noteworthy to mentionthat there are different methodologies used across different studies. For example, while our study offered a 3-point scale (no pain, little pain, much pain), many other studies used a binary option (yes, no).

Among our study participants, students (2.46) reported a higher level of pain compared to staff (mean 2.15) while a study in Nepal found that more staff (59.6%) reported pain than students (50.5%) (Subedi et al., 2020). While there are methodological differences, this may still be an important finding as using evidence from other studies on smartphone use may explain the differences in our sample. 38% of the students in our sample used smartphones which have been associated with additional stress and pain in the hands, neck, and shoulders (Sharan et al., 2014). 75% of a sample of students in Saudi Arabia agreed that smartphone use for distance learning caused body fatigue (Mustafa, 2020). Therefore, it is plausible that the additional use of smartphones for e-learning among our student sample may have put them at increased risk of pain. These effects of pain may be modified by some factors. There is an association between the duration of computer usage for e-learning and pain duration (Yaseen & Salah, 2021). The user's posture and weight of devices also affect the potential for pain (Birimoglu & Begen, 2022).

Social impact

During the COVID-19 pandemic, many students globally experienced social isolation and a general loss of motivation (Rahm et al., 2021). This was contrary to the finding of our study, which did not find significant negative social effects on students or staff. This may be explained by strong familial ties,

especially in a cultural context where multi-generational households are common, which may reduce social isolation. A similar finding was made in Saudi Arabia, which shares some cultural similarities with the context we studied, where students reported enjoying spending time with their families and that their family relationships were strong throughout the COVID-19 pandemic (Alghamdi, 2021).

Conclusions, implications, and limitations

The findings of this study highlight the critical psychological and physical health impacts of the COVID-19 pandemic on students and staff. Insomnia and anxiety were prevalent, with higher rates observed among students, especially in females, which aligns with global trends during the pandemic. The transition to online learning contributed to these issues, exacerbating stress, sleep disturbances, and physical pain, particularly due to long screen time and sedentary behavior. Despite the challenges, the study also found that cultural factors may have mitigated multiple negative social impacts of the pandemic, as students and staff reported social isolation and loneliness. These findings underscore the need for well-designed interventions to address mental health and physical well-being in educational settings, especially as e-learning continues to be a part of academic life post COVID-19.

Implications

This research is important as e-learning has become a fixed feature of academic life and learning. Although the rapid transition was forced by the COVID-19 pandemic, there are many useful aspects to learn from and apply in general. In addition, the widespread changes are likely to have direct and indirect social, physical, and mental health effects, which makes it important to appreciate the potential negative consequences of these effects. Although these potential effects were highlighted by Radu et al. (2020), there are still vital policy steps to be considered to support the organization of mitigation measures. These can include ensuring that students have easy and consistent access to appropriate devices and facilities to support their learning, as well as the necessary social support and physical and mental health services to address any problems that may arise. Mental and physical health are two important components that researchers should put more focus on to enhance the adoption of e-learning beyond the pedagogical component. Therefore, more school/university regulations and policies should be established in this regard. For instance, specifythe maximum number of consecutive hours that an online course session should be scheduled for ; outline the needed approaches to make e-learning more humanized and increase social presence; implement precautions that should be taken in e-learning to protect students' mental health and reduce anxiety.

Strengths and limitations

Our study was unique in its scope. First, it is a very large scale study, which took a holistic analysis of many factors, including mental health, sleep, gender effect, and the type of technology used all in light of e-learning process which are sometimes neglected in other literature. In addition, the present study covered staff as participants in addition to students, a group which is often neglected in such studies. Second, it offers an important contribution due to the research . While many other countries, have long used e-learning, this was a completely novel experience in the Palestinian context. Therefore, the scale at which it had to be implemented, with no prior experience, presents potentially significant consequences for students and staff. Although the student sample was predominantly female (70.6%), this is consistent with the make-up of the student body at the university, of which 65% are female (ANNU, 2022).

A key limitation of this study is the cross-sectional design. This potentially introduces recall bias which could have been mitigated by a longitudinal design with an initial survey taken at the start of the pandemic. The data on physical pain and social factors were based on self-reporting only, not using validated or objective measures. Although there is value in self-reporting, it limits our ability to quantify these effects or to compare them precisely with findings from other studies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

References

Abiddine, F. Z. E., Aljaberi, M. A., Gadelrab, H. F., Lin, C.-Y., & Muhammed, A. (2022). Mediated effects of insomnia in the association between problematic social media use and subjective well-being among university students during COVID-19 pandemic. *Sleep Epidemiology*, *2*, 100030. https://doi.org/10.1016/j.sleepe.2022.100030

Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, *26*(2), 1665–1685. https://doi.org/10.1007/s10639-020-10331-z

Al-Ajlouni, Y. A., Park, S. H., Alawa, J., Shamaileh, G., Bawab, A., El-Sadr, W. M., & Duncan, D. T. (2020). Anxiety and depressive symptoms are associated with poor sleep health during a period of COVID-19-induced nationwide lockdown: A cross-sectional analysis of adults in Jordan. *BMJ Open*, *10*(12), e041995. https://doi.org/10.1136/bmjopen-2020-041995

Alam, M. (2022). Mental health impact of online learning: A look into university students in Brunei Darussalam. *Asian Journal of Psychiatry*, *67*, 102933. https://doi.org/10.1016/j.ajp.2021.102933

Alghamdi, A. A. (2021). Impact of the COVID-19 pandemic on the social and educational aspects of Saudi university students' lives. *PLOS One*, *16*(4), e0250026. https://doi.org/10.1371/journal.pone.0250026

Ali, S., Diab, S., & Elmahallawy, E. (2021). Exploring the psychological stress, anxiety factors, and coping mechanisms of critical care unit nurses during the COVID-19 outbreak in Saudi Arabia. *Frontiers in Public Health*, *9*, 767517. https://doi.org/10.3389/fpubh.2021.767517

Alqabbani, S., Almuwais, A., Benajiba, N., & Almoayad, F. (2021). Readiness towards emergency shifting to remote learning during COVID-19 pandemic among university instructors. *E-Learning and Digital Media*, *18*(5), 460–479. https://doi.org/10.1177/20427530209816 51

Alsoud, A., & Harasis, A. (2021). The impact of COVID-19 pandemic on student's e-learning experience in Jordan. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(5), 1404–1414. https://doi.org/10.3390/jtaer16050079

Alterri, D., Hindi, M., AlMarar, R., & Shubair, R. (2020). Transition to distance learning during the COVID-19 pandemic: Efforts within the Higher Education sector in the United Arab Emirates. *Journal of Applied Learning and Teaching*, *3*(2), 31–39. https://doi.org/10.37074/jalt.2020.3.2.17

Alyahya, M. A., Elshaer, I. A., Abunasser, F., Hassan, O. H. M., & Sobaih, A. E. E. (2022). E-learning experience in higher education amid COVID-19: Does gender really matter in a gender-segregated culture? *Sustainability*, *14*(6), 3298. https://doi.org/10.3390/su14063298

Alyoubi, A., Halstead, E. J., Zambelli, Z., & Dimitriou, D. (2021). The impact of the COVID-19 pandemic on students' mental health and sleep in Saudi Arabia. *International Journal of Environmental Research and Public Health*, *18*(17), 9344. https://doi.org/10.3390/ijerph18179344

An Najah National University (2022). Facts and figures. https://www-cdn.najah.edu/media/filer_public/cc/93/cc93f24b-2b15-4186-905c-b6e4adfb30e0/fact_2019_2020_en.pdf

Ardan, M., Rahman, F., & Geroda, G. (2020). The influence of physical distance to student anxiety on COVID-19, Indonesia. *Journal of Critical Reviews*, *7*(17), 1126–1132.

Baber, H. (2022). Social interaction and effectiveness of the online learning—A moderating role of maintaining social distance during the pandemic COVID-19. *Asian Education and Development Studies*, *11*(1), 159–171. https://doi.org/10.1108/AEDS-09-2020-0209

Bakry, H., Alrasheed, N. A., Alqahtani, S. M., Alshahri, R. M., Alburaidi, G. S., & Almoayad, F. (2022). Ergonomic Perceptions and Practices among Students in E-learning during COVID-19. International Journal of Learning, Teaching and Educational Research, 21(9), 348-369. https://doi.org/10.26803/ijlter.21.9.20

Baloran, E. (2020). Knowledge, attitudes, anxiety, and coping strategies of students during COVID-19 pandemic. *Journal of Loss and Trauma*, *25*(8), 635–642. https://doi.org/10.1080/15325024.2020.1769300

Banerjee, D., & Rai, M. (2020). *Social isolation in Covid-19: The impact of loneliness*. SAGE Publications Sage UK.

Barkley, J. E., Lepp, A., Glickman, E., Farnell, G., Beiting, J., Wiet, R., & Dowdell, B. (2020). The acute effects of the COVID-19 pandemic on physical activity and sedentary behavior in university students and employees. *International Journal of Exercise Science*, *13*(5), 1326–1339. https://doi.org/10.70252/QCVG2516

Birimoglu, O. C., & Begen, M. A. (2022). Working from home during the COVID-19 pandemic, its effects on health, and recommendations: The pandemic and beyond. *Perspectives in Psychiatric Care*, *58*(1), 173–179. https://doi.org/10.1111/ppc.12847

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Research*, *287*, 112934. https://doi.org/10.1016/j.psychres.2020.112934

Chau, S. W. H., Lewis, T., Ng, R., Chen, J. Y., Farrell, S. M., Molodynski, A., & Bhugra, D. (2019). Wellbeing and mental health amongst medical students from Hong Kong. *International Review of Psychiatry*, *31*(7–8), 626–629. https://doi.org/10.1080/09540261.2019.1679976

Christofaro, D. G. D., Tebar, W. R., da Silva, G. C. R., Oliveira, M. D., Cucato, G. G., Botero, J. P., Correia, M. A., Ritti-Dias, R. M., Lofrano-Prado, M. C., & Prado, W. L. (2022). Depressive symptoms associated with musculoskeletal pain in inactive adults during COVID-19 quarantine. *Pain Management Nursing*, *23*(1), 38–42. https://doi.org/10.1016/j.pmn.2021.07.004

De Michele, R. (2020). Benefits, drawbacks and psychological impact of online lectures during quarantine due to Covid-19 pandemic. In *Proceedings of the 6th EAI International Conference on Smart Objects and Technologies for Social Good* (pp. 257–260). https://doi.org/10.1145/3411170.3411265

Devi, K. A., & Singh, S. K. (2023). The hazards of excessive screen time: Impacts on physical health, mental health, and overall well-being. *Journal of Education and Health Promotion*, *12*(1), 413. https://doi.org/10.4103/jehp.jehp_447_23

Ebner, M., Schön, S., Braun, C., Ebner, M., Grigoriadis, Y., Haas, M., Leitner, P., & Taraghi, B. (2020). COVID-19 epidemic as e-learning boost? Chronological development and effects at an Austrian University against the background of the concept of "e-learning readiness". *Future Internet*, *12*(6), 94. https://doi.org/10.3390/fi12060094

Enyama, D., Balti, E. V., Simeni Njonnou, S. R., Ngongang Ouankou, C., Kemta Lekpa, F., Noukeu Njinkui, D., Fouogue, J. T., Mayouego Kouam, J., Njateng, G. S. S., Kenfack, B., Watcho, P., & Choukem, S. P. (2021). Use of WhatsApp®, for distance teaching during COVID-19 pandemic: Experience and perception from a sub-Saharan African setting. *BMC Medical Education*, *21*(1), 517. https://doi.org/10.1186/s12909-021-02953-9

Fatima, T., Li, B., Malik, S. A., & Zhang, D. (2023). Mapping the relationship between virtual supervision, online program quality, and international student satisfaction in COVID-19 pandemic world: Does e-learning quality mediates the relationship. *Interactive Learning Environments, 32*, 1–17. https://doi.org/10.1080/10494820.2023.2177677

Fawaz, M., & Samaha, A. (2021). E-learning: Depression, anxiety, and stress symptomatology among Lebanese university students during COVID-19 quarantine. *Nursing Forum*, *56*(1), 52–57. https://doi.org/10.1111/nuf.12521

Gajendran, N. (2020). A study on faculty perspective towards alternative teaching practices (e-learning—blackboard) during COVID 19. *Indian Journal of Science and Technology*, *13*(34), 3538–3548.

García-González, J., Ruqiong, W., Alarcon-Rodriguez, R., Requena-Mullor, M., Ding, C., & Ventura-Miranda, M. I. (2021). Analysis of anxiety levels of nursing students because of e-learning during the COVID-19 pandemic. *Healthcare*, *9*(3), 252. https://doi.org/10.3390/healthcare9030252

Govender, R., & Mpungose, C. (2022). Lecturers' technostress at a South African university in the context of coronavirus (COVID-19). *Cogent Education*, *9*(1), 2125205. https://doi.org/10.1080/2331186X.2022.2125205

Gumasing, M. J. J., & Castro, F. M. F. (2023). Determining ergonomic appraisal factors affecting the learning motivation and academic performance of students during online classes. *Sustainability*, *15*(3), 1970. https://doi.org/10.3390/su15031970

Haider, A. S., & Al-Salman, S. (2020). Dataset of Jordanian university students' psychological health impacted by using e-learning tools during COVID-19. *Data in Brief*, *32*, 106104. https://doi.org/10.1016/j.dib.2020.106104

Hammoudi, S. F., Mreydem, H. W., Ali, B. T. A., Saleh, N. O., Chung, S., Hallit, S., & Salameh, P. (2021). Smartphone screen time among university students in lebanon and its association with insomnia, bedtime procrastination, and body mass index during the COVID-19 pandemic: A cross-sectional study. *Psychiatry Investigation*, *18*(9), 871–878. https://doi.org/10.30773/pi.2021.0120

Hasan, N., & Bao, Y. (2020). Impact of "e-Learning crack-up" perception on psychological distress among college students during COVID-19 pandemic: A mediating role of "fear of academic year loss. *Children and Youth Services Review*, *118*, 105355. https://doi.org/10.1016/j.childyouth.2020.105355

Hassan, S.-N., Algahtani, F. D., Atteya, M. R., Almishaal, A. A., Ahmed, A. A., Obeidat, S. T., Kamel, R. M., & Mohamed, R. F. (2021). The impact of extended e-learning on emotional well-being of students during the COVID-19 pandemic in Saudi Arabia. *Children*, *9*(1), 1. https://doi.org/10.3390/children9010013

Hawley, S., Thrivikraman, J., Noveck, N., Romain, T., Ludy, M., Barnhart, L., Chee, W., Cho, M., Chong, M., Du, C., Fenton, J., Hsiao, P., Hsiao, R., Keaver, L., Lee, H., Shen, W., Lai, C., Tseng, K., Tseng, W., & Tucker, R. (2021). Concerns of college students during the COVID-19 pandemic: Thematic perspectives from the United States, Asia, and Europe. *Journal of Applied Learning and Teaching*, *4*(1), 11–20. https://doi.org/10.37074/jalt.2021.4.1.10

Hoque, M. N., Hannan, A., Imran, S., Alam, M. A., Matubber, B., & Saha, S. M. (2021). Anxiety and its determinants among undergraduate students during e-learning in Bangladesh amid Covid-19. *Journal of Affective Disorders Reports*, *6*, 100241. https://doi.org/10.1016/j.jadr.2021.100241

Hossain, M. J., Ahmmed, F., Rahman, S. M. A., Sanam, S., Emran, T. B., & Mitra, S. (2021). Impact of online education on fear of academic delay and psychological distress among university students following one year of COVID-19 outbreak in Bangladesh. *Heliyon*, *7*(6), e07388. https://doi.org/10.1016/j.heliyon.2021.e07388

Husky, M. M., Kovess-Masfety, V., & Swendsen, J. D. (2020). Stress and anxiety among university students in France during Covid-19 mandatory confinement. *Comprehensive Psychiatry*, *102*, 152191. https://doi.org/10.1016/j.comppsych.2020.152191

Ionescu, C. A., Paschia, L., Gudanescu Nicolau, N. L., Stanescu, S. G., Neacsu Stancescu, V. M., Coman, M. D., & Uzlau, M. C. (2020). Sustainability analysis of the e-learning education system during pandemic period—COVID-19 in Romania. *Sustainability*, *12*(21), 9030. https://doi.org/10.3390/su12219030

Irie, M. A. C., Abergas, J. R. G., Cruz, J. T. P., de Ramos, B. R., & San Jose, J. M. (2021). E-learning as a key player of Philippine education in light of the COVID-19: An analysis of the e-learning effectiveness, modality and impact using a multi-perspective approach towards the students of De La Salle University Manila. 2021 12th International Conference on E-Education, E-Business, E-Management, and E-Learning (pp. 80–88). https://doi.org/10.1145/3450148.3450149

Jafar, A., Dollah, R., Mittal, P., Idris, A., Kim, J. E., Abdullah, M. S., Joko, E. P., Tejuddin, D. N. A., Sakke, N., Zakaria, N. S., Mapa, M. T., & Vun Hung, C. (2023). Readiness and challenges of e-learning during the COVID-19 pandemic era: A space analysis in Peninsular Malaysia. *International Journal of Environmental Research and Public Health*, *20*(2), 905. https://doi.org/10.3390/ijerph20020905

Kabir, H., Hasan, M. K., & Mitra, D. K. (2021). E-learning readiness and perceived stress among the university students of Bangladesh during COVID-19: A countrywide cross-sectional study. *Annals of Medicine*, *53*(1), 2305–2314. https://doi.org/10.1080/07853890.2021.2009908

Kamysbayeva, A., Koryakov, A., Garnova, N., Glushkov, S., & Klimenkova, S. (2021). E-learning challenge studying the COVID-19 pandemic. *International Journal of Educational Management*, *35*(7), 1492–1503. https://doi.org/10.1108/IJEM-06-2021-0257

Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., Barman, B., Das, P., & Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Children and Youth Services Review*, *116*, 105194. https://doi.org/10.1016/j.childyouth.2020.105194

Karos, K., Williams, A. C. C., Meulders, A., & Vlaeyen, J. W. S. (2018). Pain as a threat to the social self: A motivational account. *Pain*, *159*(9), 1690–1695. https://doi.org/10.1097/j.pain.0000000000001257

Koo, M., & Yang, S.-W. (2025). Likert-type scale. *Encyclopedia*, *5*(1), 18. https://doi.org/10.3390/encyclopedia5010018

Kulikowski, K., Przytuła, S., & Sułkowski, Ł. (2022). E-learning? Never again! On the unintended consequences of COVID-19 forced e-learning on academic teacher motivational job characteristics. *Higher Education Quarterly*, *76*(1), 174–189. https://doi.org/10.1111/hequ.12314

Kwan, J. (2022). Academic burnout, resilience level, and campus connectedness among undergraduate students during the Covid-19 pandemic: Evidence from Singapore. *Journal of Applied Learning and Teaching*, *5*(1), 11–20. https://doi.org/10.37074/jalt.2022.5.s1.7

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.

Lee, J. (2020). Mental health effects of school closures during COVID-19. *The Lancet. Child & Adolescent Health*, *4*(6), 421. https://doi.org/10.1016/S2352-4642(20)30109-7

Lim, M. (2020). Educating despite the Covid-19 outbreak: Lessons from Singapore. *Times Higher Education*, *20*. https://www.timeshighereducation.com/blog/educating-despite-covid-19-outbreak-lessons-singapore

Liu, Q., & Lin, D. (2024). The impact of distance education on the socialization of college students in the Covid-19 era: Problems in communication and impact on mental health. *BMC Medical Education*, *24*(1), 575. https://doi.org/10.1186/s12909-024-05551-7

Maia, B., & Dias, P. (2020). Anxiety, depression and stress in university students: The impact of COVID-19. *Estudos de Psicologia*, *37*, 1–8.

Mao, Y., Zhang, N., Liu, J., Zhu, B., He, R., & Wang, X. (2019). A systematic review of depression and anxiety in medical students in China. *BMC Medical Education*, *19*(1), 327. https://doi.org/10.1186/s12909-019-1744-2

Marelli, S., Castelnuovo, A., Somma, A., Castronovo, V., Mombelli, S., Bottoni, D., Leitner, C., Fossati, A., & Ferini-Strambi, L. (2021). Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *Journal of Neurology*, *268*(1), 8–15. https://doi.org/10.1007/s00415-020-10056-6

Milas, G., Martinović Klarić, I., Malnar, A., Saftić, V., Šupe-Domić, D., & Slavich, G. M. (2021). The impact of stress and coping strategies on life satisfaction in a national sample of adolescents: A structural equation modelling approach. *Stress and Health*, *37*(5), 1026–1034. https://doi.org/10.1002/smi.3050

Mosleh, S. M., Shudifat, R. M., Dalky, H. F., Almalik, M. M., & Alnajar, M. K. (2022). Mental health, learning behaviour and perceived fatigue among university students during the COVID-19 outbreak: A cross-sectional multicentric study in the UAE. *BMC Psychology*, *10*(1), 47. https://doi.org/10.1186/s40359-022-00758-z

Moy, F. M., & Ng, Y. H. (2021). Perception towards E-learning and COVID-19 on the mental health status of university students in Malaysia. *Science Progress*, *104*(3), 368504211029812. 00368504211029812. https://doi.org/10.1177/00368504211029812

Mulrooney, H., & Kelly, A. (2020). Covid 19 and the move to online teaching: Impact on perceptions of belonging in staff and students in a UK widening participation university. *Journal of Applied Learning and Teaching*, *3*(2), 17–30. https://doi.org/10.37074/jalt.2020.3.2.15

Mustafa, G. (2020). The use of smartphones in distance learning/e-learning/online classes and its impact to neck pain in the light of the Covid-19 pandemic. *Psychology and Education Journal*, *57*(9), 1988–1999.

Nakhostin-Ansari, A., Sherafati, A., Aghajani, F., Khonji, M. S., Aghajani, R., & Shahmansouri, N. (2020). Depression and anxiety among Iranian medical students during COVID-19 pandemic. *Iranian Journal of Psychiatry*, *15*(3), 228–235. https://doi.org/10.18502/ijps.v15i3.3815

Oncology Nursing Society (2022). Insomnia severity index. https://www.ons.org/sites/default/files/InsomniaSeverityIndex_ISI.pdf

Othman, A., & Mahmood, R. (2021). Evaluation of e-learning in higher education during COVID-19 pandemic: A case study in University of Sulaimani. 2021 12th International Conference on E-Education, E-Business, E-Management, and E-Learning (pp. 68–74). https://doi.org/10.1145/3450148.3450176

Paradina, R. M., & Prasetyo, Y. T. (2023). A physical ergonomics study on adaptation and discomfort of student's e-learning in the Philippines during the COVID-19 pandemic. In *Lecture notes on data engineering and communications technologies* (pp. 192–200). Springer.

Poon, P. L., & Tang, S. F. (2024). An effective teaching pedagogy involving an online learning platform under a multi-campus teaching model. *Technology, Knowledge and Learning*, 1–16. https://doi.org/10.1007/s10758-024-09761-2

Pung, C. Y. Y., Tan, S. T., Tan, S. S., & Tan, C. X. (2021). Eating behaviors among online learning undergraduates during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *18*(23), 12820. https://doi.org/10.3390/ijerph182312820

Raccanello, D., Balbontín-Alvarado, R., Bezerra, D. d S., Burro, R., Cheraghi, M., Dobrowolska, B., Fagbamigbe, A. F., Faris, M. E., França, T., González-Fernández, B., Hall, R., Inasius, F., Kar, S. K., Keržič, D., Lazányi, K., Lazăr, F., Machin-Mastromatteo, J. D., Marôco, J., Marques, B. P., … Aristovnik, A. (2022). Higher education students' achievement emotions and their antecedents in e-learning amid COVID-19 pandemic: A multi-country survey. *Learning and Instruction*, *80*, 101629. https://doi.org/10.1016/j.learninstruc.2022.101629

Radu, M. C., Schnakovszky, C., Herghelegiu, E., Ciubotariu, V. A., & Cristea, I. (2020). The impact of the COVID-19 pandemic on the quality of educational process: A student survey. *International Journal of Environmental Research and Public Health*, *17*(21), 7770. https://doi.org/10.3390/ijerph17217770

Rahm, A. K., Töllner, M., Hubert, M. O., Klein, K., Wehling, C., Sauer, T., Hennemann, H. M., Hein, S., Kender, Z., Günther, J., Wagenlechner, P., Bugaj, T. J., Boldt, S., Nikendei, C., & Schultz, J. H. (2021). Effects of realistic e-learning cases on students' learning motivation during COVID-19. *PLOS One*, *16*(4), e0249425. https://doi.org/10.1371/journal.pone.0249425

Ramane, D. V., Devare, U. A., & Kapatkar, M. V. (2021). The impact of online learning on learners' education and health. *The Online Journal of Distance Education and E-Learning*, *9*(2), 303–309.

Saad, G., de Souza, V., de Menezes Neto, J., de Sousa Martins e Silva, E., & de Souza, J. (2021). Sleep disorders in students during the COVID-19 pandemic. *Creative Education*, *12*(02), 378–390. https://doi.org/10.4236/ce.2021.122027

Šagát, P., Bartík, P., Prieto González, P., Tohănean, D. I., & Knjaz, D. (2020). Impact of COVID-19 quarantine on low back pain intensity, prevalence, and associated risk factors among adult citizens residing in Riyadh (Saudi Arabia): A cross-sectional study. *International Journal of Environmental Research and Public Health*, *17*(19), 7302. https://doi.org/10.3390/ijerph17197302

Sawaya, H., Atoui, M., Hamadeh, A., Zeinoun, P., & Nahas, Z. (2016). Adaptation and initial validation of the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder-7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample. *Psychiatry Research*, *239*, 245–252. https://doi.org/10.1016/j.psychres.2016.03.030

Sharan, D., Mohandoss, M., Ranganathan, R., & Jose, J. (2014). Musculoskeletal disorders of the upper extremities due to extensive usage of hand held devices. *Annals of Occupational and Environmental Medicine*, *26*(1), 22. https://doi.org/10.1186/s40557-014-0022-3

Singh, H. K., Joshi, A., Malepati, R. N., Najeeb, S., Balakrishna, P., Pannerselvam, N. K., Singh, Y. K., & Ganne, P. (2021). A survey of E-learning methods in nursing and medical education during COVID-19 pandemic in India. *Nurse Education Today*, *99*, 104796. https://doi.org/10.1016/j.nedt.2021.104796

Son, C., Hegde, S., Smith, A., Wang, X., & Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *Journal of Medical Internet Research*, *22*(9), e21279. https://doi.org/10.2196/21279

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

Subedi, S., Nayaju, S., Subedi, S., Shah, S., & Shah, J. (2020). Impact of E-learning during COVID-19 pandemic among nursing students and teachers of Nepal. *International Journal of Science and Healthcare Research*, *5*(3), 68–76.

Suleiman, K. H., & Yates, B. C. (2011). Translating the insomnia severity index into Arabic. *Journal of Nursing Scholarship*, *43*(1), 49–53. https://doi.org/10.1111/j.1547-5069.2010.01374.x

Taquet, M., Geddes, J. R., Husain, M., Luciano, S., & Harrison, P. J. (2021). 6-Month neurological and psychiatric outcomes in 236 379 survivors of COVID-19: A retrospective cohort study using electronic health records. *The Lancet. Psychiatry*, *8*(5), 416–427. https://doi.org/10.1016/S2215-0366(21)00084-5

Trotter, J., & Qureshi, F. (2023). Student perspectives of hybrid delivery in a transnational education context during Covid-19. *Journal of Applied Learning and Teaching*, *6*(1), 103–111. https://doi.org/10.37074/jalt.2023.6.1.10

UNESCO (2021). COVID-19 education response. Retrieved August, 2021, from https://en.unesco.org/covid19/educationresponse/globalcoalition

Veqar, Z., & Hussain, M. E. (2017). Validity and reliability of insomnia severity index and its correlation with pittsburgh sleep quality index in poor sleepers among Indian university students. *International Journal of Adolescent Medicine and Health*, *32*(1), 1–5. https://doi.org/10.1515/ijamh-2016-0090

Wang, X., Chen, H., Liu, L., Liu, Y., Zhang, N., Sun, Z., Lou, Q., Ge, W., Hu, B., & Li, M. (2020). Anxiety and sleep problems of college students during the outbreak of COVID-19. *Frontiers in Psychiatry*, *11*, 588693. https://doi.org/10.3389/fpsyt.2020.588693

Weerathunga, P. R., Samarathunga, W. H. M. S., Rathnayake, H. N., Agampodi, S. B., Nurunnabi, M., & Madhunimasha, M. M. S. C. (2021). The COVID-19 pandemic and the acceptance of e-learning among university students: The role of precipitating events. *Education Sciences*, *11*(8), 436. https://doi.org/10.3390/educsci11080436

World Health Organisation (2021). WHO Director-General's opening remarks at the media briefing on COVID-19. WHO. Retrieved August, 2021, from https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020

Yaseen, Q., & Salah, H. (2021). The impact of e-learning during COVID-19 pandemic on students' body aches in Palestine. *Scientific Reports*, *11*(1), 22379. https://doi.org/10.1038/s41598-021-01967-z

Yasmin, H., Khalil, S., & Mazhar, R. (2020). COVID 19: Stress management among students and its impact on their effective learning. *International Technology and Education Journal*, *4*(2), 65–74.

Yekefallah, L., Namdar, P., Panahi, R., & Dehghankar, L. (2021). Factors related to students' satisfaction with holding e-learning during the Covid-19 pandemic based on the dimensions of e-learning. *Heliyon*, *7*(7), e07628. https://doi.org/10.1016/j.heliyon.2021.e07628

Youssef, I., & Richer, C. (2022). Distance teaching in media departments in times of the COVID-19 pandemic. Experiences from six Arab countries. *Journal of Applied Learning and Teaching*, *5*(2), 20–30. https://doi.org/10.37074/jalt.2022.5.2.5

Zhai, Y., & Du, X. (2020). Mental health care for international Chinese students affected by the COVID-19 outbreak. *The Lancet. Psychiatry*, *7*(4), e22. https://doi.org/10.1016/S2215-0366(20)30089-4

Zheng, M., Asif, M., Tufail, M., Naseer, S., Khokhar, S., Chen, X., & Naveed, R. (2022). COVID academic pandemic: Techno stress faced by teaching staff for online academic activities. *Frontiers in Psychology*, *13*, 895371. https://doi.org/10.3389/fpsyg.2022.895371

Zheng, Y., Wei, D., Li, J., Zhu, T., & Ning, H. (2016). Internet use and its impact on individual physical health. *IEEE Access*, *4*, 5135–5142. https://doi.org/10.1109/ACCESS.2016.2602301