



Research article

Exploring the factors that influence academic performance in Jordanian higher education institutions

Manaf Al-Okaily^{a,*}, Sima Magatef^b, Aws Al-Okaily^a, Fadi Shehab Shiyab^c^a School of Business, Jadara University, Irbid, Jordan^b Faculty of Administrative and Financial Sciences, University of Petra, Amman, Jordan^c Accounting Department, School of Business, The Hashemite University, Zarqa, Jordan

ARTICLE INFO

Keywords:

Digital learning
 Distance learning
 e-learning
 COVID-19
 Higher education institutions
 A mixed methods approach

ABSTRACT

Since the coronavirus 2019 (COVID-19) pandemic hit the world, many universities have used digital asynchronous learning tools such as Digital Learning Management Systems (DLMS) to continue the educational process. Despite its global usage, only a few studies have investigated its quality in the Jordanian context during the COVID-19 period from a quantitative and qualitative approach perspective. Thus, the current study aims to explore the factors that influence academic performance in Jordanian higher education institutions during the COVID-19 pandemic. A mixed methods research approach was employed to evaluate the quality of the teaching-learning process for Jordanian students in higher education institutions. The triangulated data focused on three core pillars namely if students saw a difference in their grades prior to, during, and after the pandemic, the challenges faced and improvement suggestions. Accordingly, the quantitative approach with an online questionnaire and the qualitative approach with structured interviews were applied to collect the required data from Jordanian students in higher education institutions. The results of the current study revealed that the evaluation of the teaching-learning process quality during the pandemic period affected students' academic performance in different proportions based on their specialization area. In addition, the study results also identified the most important challenges that faced the students during this period and suggested procedures to overcome them and improve the distance learning process. The current study offers empirical evidence on critical success factors underlying digital learning management systems in the COVID-19 era, which can help policymakers in Jordanian universities and the ministry of higher education and scientific research to improve the quality of the teaching-learning process in the Jordanian context.

1. Introduction

The recent COVID-19 outbreak has had a significant influence on various areas, such as the economy, society, and health [1]. As a result, travel prohibitions and limitations were enforced, along with mandatory social separation measures [2]. In addition, the education system suffered a major crisis, potentially the most perilous in our modern era, as numerous students worldwide abandoned traditional schools and universities in favor of online learning through the Internet. This shift may have had adverse consequences on their academic performance, their ability to comprehend and retain information, and their capacity to generate knowledge [3]. This

* Corresponding author.

E-mail address: manaf.alokaily@gmail.com (M. Al-Okaily).

crisis has also caused many students to drop out of school. Inequality was noticed in the educational systems, especially in poor countries or families that lack modern and electronic educational means [4]. This pandemic also caused the postponement or cancellation of all educational activities in universities. In all cases, there was no choice but to resort to e-learning through electronic educational platforms in order to reduce contact between students and between students and faculty members. Many students suffered due to online education as they lacked educational means and tools, due to the economic and digital gap [5–7].

The COVID-19 pandemic has had a significant impact on traditional in-person schooling, leading governments to enforce different virus-control measures, such as prohibiting big meetings and implementing strict physical social distancing. As a result, policymakers quickly transferred education from conventional face-to-face instruction to remote learning using different distance learning platforms [8,9]. Despite the rapid transition, several public institutions, especially in developing nations such as Jordan, lack formal knowledge and use of digital learning management systems (DLMS) that are essential for sustaining e-learning [10]. Higher education authorities and public higher education leaders had to promptly develop options for the traditional classroom-based learning model. Several research have investigated the effects of COVID-19 on the higher education sector in different Western and Arab nations [9].

There are many studies conducted in the same context during the Corona period in universities around the world, including Jordan's public and private universities, each of which dealt with the issue of e-learning from different angles and its impact on students' performance and grades, the technologies that were used through online education, and the satisfaction of users who are affected by the quality of information and services. Alkhwalidi et al. [11] discussed the use of metaverse technology to promote interactive learning in education. However, there is limited understanding of how higher education institutions, particularly in developing countries like Jordan, utilize this technology. They aimed to identify the factors that influence users' intention to use metaverse technology for educational purposes in Jordanian higher education institutions. The analysis of the model revealed that the behavioral intentions towards the use of this technology were significantly affected by user satisfaction, performance expectation, and facilitation of conditions, and the study also showed that the quality of information and the quality of services have a significant impact on user satisfaction. The study by AL-Nuaimi et al. [12] talked about the massive increase in investments in e-learning systems across higher education institutions to revolutionize educational practices, which led to the dispensation of Education Management Systems (LMS) in higher education, especially during the period of the Corona pandemic and the closures that occurred during it, forcing higher education institutions around the world to deal with online education, and this study pelletized, integrated and verified a theoretical model integrated through three theories. The results revealed that quality factors significantly and clearly affected the ease of use, while the quality of the technical system showed its great importance on the tangible benefit.

Furthermore, Alkhawaja et al. [13] conducted a study that examined the relationship between technology usage and self-efficacy in Jordanian public universities during the Corona period. The findings revealed an important beneficial effect of self-efficacy on the actual utilization of e-learning systems. Additionally, the study found that teachers expressed greater concern regarding the use of technology compared to those who had less concern. The study conducted by Abdullah et al. [14] examined the effects of the coronavirus pandemic on education at the Jordan University of Science and Technology. The findings revealed that the rate of success of students during the pandemic was significantly higher compared to the pre-pandemic period. This outcome was anticipated due to the implementation of online exams. However, the proportion of students achieving excellent grades remained consistent with the percentage observed in courses before the pandemic.

This study stands out from others by examining the subject from a unique perspective compared to previous research on education in Jordanian universities. The coronavirus pandemic impacted all levels of the educational system, leading to the complete or partial closure of educational institutions worldwide to curb the spread of the virus. Consequently, there was a shift from face-to-face education to e-learning, with a significant emphasis on self-learning to minimize direct contact among students and teachers. Among the countries that have implemented this to ensure the health of students in Jordan, whether it is in schools or even universities at their different levels. Was e-learning effective in Jordanian universities? Was e-learning available to all students? Were the internet packages available to Jordanian students sufficient to follow their lessons and lectures online, and were their speeds appropriate for that? Did Jordanian students have sufficient experience and knowledge to deal with programs dedicated to e-learning? Was e-learning suitable for all disciplines, whether humanitarian or scientific? What was the impact of e-learning on students' performance? The primary objective of the current research is to examine the association between demographic factors and students' academic performance in Jordanian universities. Based on this main objective, the following sub-objectives are formulated: (1) To examine the relationship between demographic factors and Jordanian university students' evaluation of e-learning. (2) To investigate the relationship between demographic factors and Jordanian university students' evaluation of practical lessons.

2. Literature review

Technological and internet advancements have globally contributed to improving the quality of learning [15]. With the rapid technological developments worldwide, distance learning systems have emerged and evolved to facilitate the educational process, particularly for individuals facing barriers to enrolling in foreign universities. Recently, due to the COVID-19 crisis, distance learning has become an urgent necessity and an essential component of education in most countries around the world [16–18]. Its importance is evident in addressing the challenges faced by quarantined students, mitigating the impacts of the coronavirus epidemic, and supporting societies in their efforts to combat the COVID-19 pandemic [9]. Therefore, evaluating the adoption of distance learning systems during the COVID-19 pandemic is crucial to ensure their effective use by instructors and their positive impact on students.

Prior research has mostly examined the contentment of students in scientific fields with e-learning, emphasizing the difficulties they encountered as a result of the termination of scientific instruction and practical experiences [19–21]. Our study examines the effects of COVID-19 on university students in Jordan from different academic fields. We specifically focus on identifying the main

instructional instruments and methodologies employed in online education. Furthermore, it tackles the primary obstacles that students face during their online learning journey. The study done by Keshavarzi et al. [22] investigated the influence of COVID-19 on the psychological well-being of university students in Malaysia. The results indicated that 40 % of the participants reported experiencing significant levels of loneliness and social exclusion, with a subset expressing occasional suicidal ideation. The results indicated that loneliness and social isolation were widespread concerns among Malaysian students, exerting a significant influence on the occurrence of suicidal thoughts. Mental health specialists are aggressively searching for appropriate answers and techniques to combat the worsening of severe sadness and anxiety among students, which the COVID-19 pandemic has intensified.

The study conducted by Blankenberger and Williams [23] provides insights into the influence of COVID-19 on higher education, highlighting its pivotal role in advancing social equity, especially during this epidemic and the ensuing efforts to recover. Higher education institutions successfully implemented robust mechanisms to address the problems and limitations posed during this period. These systems effectively ensured that students obtain high-quality education, regardless of the manner of delivery. The objective of this technique is to motivate students to enroll without any concerns about switching to electronic means, which might potentially lower expenses and support the values of social justice. Kerzić et al. [24] investigated the extensive implementation of e-learning as a reaction to COVID-19. Their study specifically analyzed the elements that influenced students' perceptions of their academic performance during the sudden shift from in-person education to e-learning. This study included a heterogeneous cohort of students from multiple nations spanning various continents. During the first wave of the pandemic, it became clear that the effectiveness of e-learning depends on the engaged involvement of professors, the electronic interactions of students, and the sufficiency of information technology infrastructure. Nevertheless, throughout the pandemic, pupils' academic achievement decreased because of the implementation of e-learning. The efficacy of e-learning was contingent upon the happiness of students with the strategy. In summary, this study emphasizes the importance of developing a clear plan for teaching, research, and investment in improving digital skills for both students and academics. Furthermore, it highlights the need to encourage and nurture studies and innovative cooperation across all fields in the domain of distance learning.

This was further corroborated by research undertaken by Hickey et al. [25] which highlighted how many universities reacted to COVID-19 by cancelling numerous campus activities and transitioning all education to an online format. This significant development led to several changes for students, impacting their academic performance and professional goals. The majority of pupils have expressed the substantial impact of the coronavirus on their academic achievements and prospective professional paths. Moreover, this experiment revealed a significant correlation between concern about the illness and adherence to preventive measures. Moreover, it emphasized a correlation between barriers to achieving academic excellence and fluctuations in academic performance. Spitzer and Musslick [26] conducted a study that examined the expanding disparity in education, namely among youngsters, due to the swift transmission of COVID-19 and the shutdown of schools. In contrast to previous studies suggesting adverse effects, this research uncovered a beneficial impact on the educational process, namely in the domains of science and sports, as they shifted to online platforms. Notably, the study, which also included university students, established that their performance enhanced during the pandemic period compared to the prior two years. The enhancement was ascribed to the augmented duration allocated for studying.

The study conducted by Bilal et al. [27] investigated the repercussions of COVID-19 on all facets of life, with a specific focus on the transition from in-person education to online learning. This research specifically focused on graduate students from several universities in Karachi, Pakistan. The majority of these students agreed to participate in reinforcement lessons to better navigate electronic educational programs via the Internet. After the onset of the COVID-19 pandemic, the amount of time students spent on the Internet during face-to-face education, which typically did not exceed 3 h, significantly increased. This rise in online activity impacted their sleep, leading to fatigue, exhaustion, and distraction. E-learning also resulted in prolonged isolation and staying indoors, which contributed to feelings of laziness and depression, subsequently diminishing their educational performance compared to face-to-face education. Many students expressed dissatisfaction with e-learning, preferring traditional classroom settings. Consequently, educational institutions needed to implement measures to enhance e-learning and support students in improving their performance during the pandemic. Satar et al. [28] approached the topic from a different perspective, focusing on the mediating roles of students' educational effort and their willingness to learn. The study, conducted on university students in Malaysia, revealed that students' educational effort fully mediated the relationship between the changing pace of information technology and e-learning. Similarly, the students' readiness for learning fully mediated the relationship between the presentation of information technology and the changes in its pace.

The study by Dragomir and Munteanu [29] explored the impact of online education on students' professional training, social relations, and the interaction between students and professors during the COVID-19 period. Focusing on graduate students in the management of European organizations, the study considered the effects of the pandemic on vocational training and student-teacher relationships. The findings highlighted the necessity for universities to reassess and enhance their online educational programs, aligning them with the actual needs of students. The study emphasized that e-learning should not replace traditional teaching methods but should complement them by adding value. Additionally, it underscored the importance of maintaining direct communication between professors and students. The study by Allah et al. [30] focused on the impact of COVID-19 on mental health, psychological well-being, and social conditions worldwide, similar to other studies in this area. Specifically, it highlighted the pandemic's effects on the mental health and educational performance of medical students, noting varying levels of anxiety and fear. The study emphasized the need for psychological support and protection for students, alongside the provision of high-quality distance education. The study by Mahdy [31] examined the impact of the COVID-19 pandemic on academics and researchers in biomedicine, paralleling other studies that focused on students, their performance, and mental health. The results indicated a significant impact of the pandemic on these professionals, with varying degrees among respondents.

Although online education facilitated self-learning, veterinary students faced significant challenges in receiving practical lessons.

This hindered the efficient delivery of information. However, the study demonstrated that these difficulties could be addressed effectively by presenting real-world cases, providing concise information, and utilizing three-dimensional virtual tools to simulate practical experiences. Many past studies have used various theories to understand the influence of COVID-19 on student academic performance. Nevertheless, the ongoing discussion regarding the influence of online instruction and learning on students' academic achievement following the pandemic has not been settled. Several studies have demonstrated that online instruction and learning have a positive impact on students' academic performance [19]. While others have found it to have a detrimental impact [32]. Despite the critical role of social networking sites in higher education as a rapid response mechanism, particularly during the COVID-19 pandemic, students continue to face numerous challenges. The current study investigates the impact of COVID-19 on the academic performance of Jordanian university students. This study aims to fill a vacuum in knowledge by investigating the impact of distance learning systems on students' academic performance. The results could have substantial ramifications for the future of online education in higher learning institutions, specifically in developing nations' public and private colleges, with a specific focus on Jordan. In this light, we proposed the following hypotheses:

Ho1. There is no evidence of a significant association between demographic factors and the students' academic performance in Jordanian universities.

Ho2. There is no evidence of a significant association between demographic factors and the students' evaluation in Jordanian universities.

Ho3. There is no evidence of a significant association between demographic factors and the evaluation of Jordanian university students of practical lessons.

3. Research methodology

A mixed methods research approach was employed to evaluate the quality of the teaching-learning process for Jordanian students in higher education institutions. The triangulated data focused on three core pillars namely if students saw a difference in their grades prior, during, and after the pandemic, the challenges faced, and improvement suggestions Accordingly, to describe the required data and answer the questions posed in the study above, the idea behind this type of research is to study frequencies, averages and other statistical calculations, and accordingly, the quantitative approach was applied through the use of two tools to collect the required data, the first of which was the questionnaire by distributing 636 questionnaires online to Jordanian students in higher education institutions. To support the data collected and ensure data triangulation, the second tool, student interviews, was used, through the qualitative research approach of this study using 85 structured interviews that emphasized on skills, experiences, limitations, and recommendations to improve e-learning systems.

The questionnaires were distributed to Jordanian university students through the Internet, where the link to the questionnaire was sent to many Jordanian universities and using personal relationships in order to distribute it to students from different disciplines and

Table 1
Sample profile.

Characterization		Frequency
Gender	Male	286
	Female	350
	Total	636
University Type	Public	244
	Private	392
	Total	636
Degree Level	Postgraduate	89
	Undergraduate	547
	Total	636
Academic Year	First	159
	Second	176
	Third	138
	Fourth	118
	Fifth	29
	Sixth	16
	Total	636
School	School of Engineering	17
	School of IT	28
	School of Medicine	13
	School of Pharmacy	11
	School of Business	359
	Others	208
Total	636	
DLM Platform	Microsoft Teams	389
	Zoom	230
	Google meet	17
	Total	636

levels of study and in different regions, with a focus on the Amman region because it contains the largest number of universities and from various disciplines, and these methods were chosen to collect the required data in order to reach the largest possible number of students and shorten time, effort and cost, and it was The number of questionnaires filled out by students is comparable to the number of questionnaires in similar studies, which makes the sample subject to analysis and generalization in the results.

The online questionnaire distribution application aims to gather data from students in public and private universities in Jordan. Its purpose is to assess the impact of the COVID-19 pandemic on the quality of digital learning management systems in higher education institutions. The study will include students from different scientific and humanities fields and academic levels and will be conducted during the COVID-19 lockdown. Obtaining a representative sample has been challenging due to the impact of the COVID-19 outbreak and the lockdown measures implemented by the Jordanian government. This study used non-probability sampling with the purposive sampling technique to target the specific age class of participants (e.g., Jordanian universities students). Thus, the purposive sampling technique allowed the selection of a large-size sample of participants in the specific age class targeted in this study namely universities students in Jordanian [33–36]. Table 1 provides the demographic characteristics of the respondents.

4. Data analysis and results

4.1. Quantitative approach results

The finding for the first hypothesis was (*Calculated $\chi^2 = 3.439$; $p = 0.491$; $p > 0.05$, see Table 2*). The Chi-square statistic outcomes revealed a lack of significant correlation between the kind of university and the level of academic achievement among Jordanian university students. Similarly, there was not a statistically significant association observed between educational level and academic achievement within the pandemic. Furthermore, there was no noteworthy correlation between the academic year and academic performance. Nevertheless, a statistically significant correlation was detected between faculty and academic achievement among Jordanian university students throughout the COVID-19 pandemic.

For the second hypothesis, (*Tabulated $\chi^2 = 9.44$ df = 4; $\alpha = 0.05$; Calculated $\chi^2 = 0.643$; $p = 0.958$; $p > 0.05$ see Table 3*). The findings revealed a lack of significant association between the educational level of Jordanian university students and their assessment of e-learning amidst the COVID-19 pandemic (*Tabulated $\chi^2 = 9.44$ df = 4; $\alpha = 0.05$; Calculated $\chi^2 = 3.652$; $p = .455$; $p > 0.05$*). Furthermore, no statistically significant correlation was seen between the academic year and the appraisal of e-learning by Jordanian university students (*Tabulated $\chi^2 = 31.410$ df = 20; $\alpha = 0.05$; Calculated $\chi^2 = 21.226$; $p = .384$; $p > 0.05$*). The findings shown a significant association between faculty and Jordanian university students' evaluation of e-learning systems (*Tabulated $\chi^2 = 31.410$ df = 20; $\alpha = 0.05$; Calculated $\chi^2 = 35.105$; $p = 0.020$; $p < 0.05$*).

The results of the third hypothesis indicated that there was not a statistically significant connection between the type of university and the appraisal of practical lessons by Jordanian university students during the COVID-19 pandemic (*Tabulated $\chi^2 = 9.44$ df = 4; $\alpha = 0.05$; Calculated $\chi^2 = 2.844$; $p = 0.584$; $p > 0.05$ see Table 4*). Additionally, the results indicated that there was no significant association between educational level and the evaluation of Jordanian university students of practical lessons (*Tabulated $\chi^2 = 9.44$ df = 4; $\alpha = 0.05$; Calculated $\chi^2 = 1.751$; $p = 0.781$; $p > 0.05$*). Similarly, there was no significant association found between the academic year and the evaluation of practical lessons (*Tabulated $\chi^2 = 31.410$ df = 20; $\alpha = 0.05$; Calculated $\chi^2 = 30.839$; $p = .057$; $p > 0.05$*). However, there was a significant association observed between faculty and the evaluation of practical lessons among students (*Tabulated $\chi^2 = 31.410$ df = 20; $\alpha = 0.05$; Calculated $\chi^2 = 52.590$; $p = 0.000$; $p < 0.05$*).

4.2. Qualitative approach results

Based on the results revealed from the quantitative analysis, instructed interviews were held with undergraduate students from various faculties who didn't participate earlier in filling the questionnaire, aiming to deepen the understanding of the results attained by the quantitative approach.

Table 2
Tests for first hypothesis.

Factors	Chi- Square Tests		
		Value	Asymp. Sig. (2-sided)
University type	Pearson Chi-Square	3.439a	0.491
	Likelihood Ratio	3.461	0.489
	Cases	636	
Degree Level	Pearson Chi-Square	2.383a	0.671
	Likelihood Ratio	2.362	0.673
	Cases	636	
Academic year	Pearson Chi-Square	27.781a	0.119
	Likelihood Ratio	31.461	0.051
	Cases	636	
Faculty	Pearson Chi-Square	32.832a	0.037
	Likelihood Ratio	36.002	0.018
	Cases	636	

Table 3
Tests for second hypothesis.

Factors	Chi- Square Tests		
		Value	Asymp. Sig. (2-sided)
University type	Pearson Chi-Square	0.643a	0.958
	Likelihood Ratio	0.644	0.958
	Cases	636	
Degree Level	Pearson Chi-Square	3.652a	0.455
	Likelihood Ratio	3.766	0.439
	Cases	636	
Academic year	Pearson Chi-Square	21.226a	0.384
	Likelihood Ratio	21.893	0.346
	Cases	636	
Faculty	Pearson Chi-Square	35.105a	0.020
	Likelihood Ratio	38.408	0.008
	Cases	636	

Table 4
Tests for third hypothesis.

Factors	Chi- Square Tests		
		Value	Asymp. Sig. (2-sided)
University Type	Pearson Chi-Square	2.844 ^a	0.584
	Likelihood Ratio	2.799	0.592
	Cases	636	
Degree Level	Pearson Chi-Square	1.751 ^a	0.781
	Likelihood Ratio	1.717	0.788
	Cases	636	
Academic Year	Pearson Chi-Square	30.839 ^a	0.057
	Likelihood Ratio	32.623	0.037
	Cases	636	
Faculty	Pearson Chi-Square	52.590 ^a	0.000
	Likelihood Ratio	49.895	0.000
	Cases	636	

Assessment of Online Learning Systems in Lockdown Period: The term ‘new normal’ has gained significant popularity since the onset of the COVID-19 pandemic. Online learning resources have become the norm in education. The worldwide pandemic has spurred inventive methods of instruction, as educational institutions globally have resorted to internet platforms to sustain student education. There has been a shift in the educational model, with online learning being the basis for this transformation. The use of technology has become indispensable for students and educational institutions worldwide. This signifies a novel methodology in teaching that numerous universities have been pushed to embrace.

“I believe the only two advantages of online teaching and learning are the flexibility and convenience. You can choose when to attend and decide what to study based on your own schedule and preferences” (MS 14)

The Impact of COVID-19 Lockdown on Academic Performance: Most undergraduate students indicated that, even though they were forced to stay at home with their families they could easily be distracted by noise, requests, and needs causing many students to be unable to focus on their studies, as one student said:

“During the pandemic my father brought my grandparents to stay with us and we literary had the house, I sometimes locked myself on the staircase or sat on the toilet floor to have a minute for myself and listen to a lecture without being constantly distracted by everything and anyone”. (MS25)

During the outbreak of the pandemic, many of the students shared how difficult it was to access online platform due to overload on the system. They stated that having to rely on home network meant that the whole family used the same Wi-Fi connection, therefore, causing many issues. For instance, as one of the student’s states:

“Imagine we are 8 at home, all of us having to attend lecture, work online, sort issues and manage everything on the same server, it was honestly a nightmare” (FS12)

Report that the environment for learning was not there in their households. One of the students who was interviewed claimed that the COVID-19 made homes noisier because children were also there. A female student who was questioned said she had to take care of the requirements of the kids at home, particularly those relating to the activities of the distant schools, in addition to cooking and cleaning the house. The pupils claim that it is difficult for them to focus on their own academic work. The pupils claim that their area’s Internet access was erratic and occasionally non-existent. Majority of the pupils lamented on how pricey and out of their price range

computers were. According to several teachers we spoke with, students in higher education during COVID-19 had significant academic obstacles due to a shortage of e-learning resources. Since this kind of education is computer-based, the availability of e-learning resources like computers, Internet connectivity, and a steady power supply is crucial for its efficient use.

The vast majority of participants mentioned financial constraints as another significant challenge during the time of lockdown, stating that they were unable to purchase data due to affordability issues. Twenty-four students explicitly mentioned their inability to purchase data. One student noted that the lockdown exacerbated the issue of acquiring data. Another student pointed out that with all businesses closed and no sources of income, obtaining data became a significant concern. These financial constraints prevented many students from engaging in learning during the lockdown. An instructor, who primarily taught postgraduate students, confirmed that his students were experiencing these difficulties.

“The pandemic devastated my family business, making it impossible for me to ask my father for money to buy a laptop or top up my phone data. Constantly worried about this, I eventually sought help from our neighbor. Thankfully, his Wi-Fi occasionally reached my house, allowing me to access my lectures on time. However, when the signal didn’t reach or I didn’t have enough data, there was nothing I could do” (FS71)

The fourth most significant academic hurdle students faced during the COVID-19 epidemic was the issue with teachers’ attitudes. A total of 35 students identified the pandemic academic challenges as being caused by the teachers’ attitude. According to one of the students who was spoken to, the overwhelming number of assignments provided by professors was what made them difficult. He claimed that lessons held in a classroom are still preferable compared to home arrangements when responsibilities and assignments are piling up at the same time. Some professors lack genuine awareness of the variations among students and are not driven to provide each student with a meaningful educational experience. Students have recognized fear, anxiety, and sadness as significant obstacles that have contributed to their subpar academic performance during the global epidemic. The topics of social retreat, fear of the unknown, and fears about the pandemic’s future effects were frequently addressed.

“Before the pandemic, my grades were consistently high, and I ranked in the top ten in my major. However, after the pandemic hit, I felt like I lost control of my life. Everything around me seemed to be falling apart, and I became extremely stressed and overwhelmed. There were so many assignments and tasks, and professors began introducing new assignments, videos, and classes. I felt completely confused, and as a result, my grades started to drop, which only deepened my depression” (FS 17)

One student puts it in simple terms as he says

“During the pandemic, I faced so many issues, I think I speak for at least all students in the Fintech major as we had this Facebook group to touch base with each other and honestly, not being able to reach out to professors when needed, the mental stress, feeling unsafe, not having that spirit of competing with other students and the rapid change in technology made it so difficult to understand what truly is, valuable knowledge and what’s not!” (MS53)

5. Discussions

The research findings suggested that the COVID-19 epidemic had an impact on pupils’ academic performance to different extents. This variation is attributed to the differences between students’ specializations and their respective faculties. Scientific disciplines, such as medicine, pharmacy, and engineering, experienced a substantial impact as a result of the obstacles posed by remote lectures and the complexities of practical implementation. In contrast, students in social and human sciences encountered much fewer difficulties in adapting to remote learning. Despite these issues, the satisfaction of students with the electronic educational process and practical sessions varied. On average, students demonstrated the highest level of satisfaction with the electronic educational process, followed by a moderate level of satisfaction, and then complete satisfaction. The completely dissatisfied learners had the lowest level of satisfaction. This feat can be attributed to the extensive resources and variety of virtual learning tools offered by both public and private universities, with Microsoft Teams being the most widespread platform. Students frequently utilized tools such as Google Meet, Zoom, and other online video platforms. Akour et al. [37] have confirmed the effectiveness of these technologies in the digital process of learning through their research. Furthermore, schools have proactively organized training sessions for faculty members to enhance their proficiency in employing these kinds of technologies.

Another crucial factor that adds to this satisfaction is the government-mandated processes and conventions, as well as the policies established by educational institutions. Each school has incorporated these strategic objectives and customized these laws to establish differentiation, thus improving the efficiency and efficacy of e-learning. Dahoud’s [38] analysis revealed several essential factors for the efficacy of remote education. The key factors encompass government regulations, institutional officials, teachers’ commitment, students’ drive, and the assistance offered by their family members. The research confirmed the efficacy of remote e-learning in higher education institutions, facilitated by the platforms provided to students and the guidelines set forth by the Ministry of Higher Education and the Accreditation Commission [MHEAC]. However, despite its positive qualities, online e-learning was found to be poorer than traditional in-person education.

Regarding the first hypothesis, the data results showed that there is no significant relationship between demographic data and students’ academic performance. Hence, as evident in the qualitative data, the students who faced the highest difficulty in teaching and learning virtually were those from scientific stream. They explained that, linking theory and practice was not only difficult but also related to the complexity of their modules and the modules requirements. A recent study by Dahoud [38] concluded that several variables have an impact on remote learning. The COVID-19 had some positive effects on Jordan’s educational system. Teachers and

the ministry of Education (MOE) may use it in the future after switching back to a face-to-face educational system. With society's acceptance, they may convert some conventional tools into online applications. The outcomes were also impacted by the students' gender, whereby female students entered the MOE and Noor space platforms more clearly than male students. About 80 % of the total number of students shared and utilized distance learning [39]. The remaining students either did not have an online connection, were unable to move between internet locations in their cities or villages, did not have the option to share their internet access with family or friends, or were unconcerned about distance learning. For some of them, the MOE in Jordan moved to provide each household with a tablet with internet access. Unlike the current study, gender did not have an impact on students' blended learning, nor effected their performance. However, this research findings goes in line with the current study as most students voiced the same complaints and highlighted similar challenges.

The second hypothesis indicated that there is also no significant relationship between demographical factors and student's evaluation of e-learning during the pandemic. This statement contradicts the data reported in the study conducted by Mahdy [31]. He revealed that the lockdown imposed due to the COVID-19 pandemic hurt the academic performance of the majority of participants (96.7 %) to different extents. The average assessment score for online education overall was 5.1 ± 2.4 , but the score for practical components was 3.6 ± 2.6 . Hickey et al. [25] found that more than 7 % of the students reported a significant decrease in their Spring 2020 grades compared to previous semesters. He also noticed a correlation between the perceived importance of obstacles and the Spring 2020 GPA. Students facing substantial obstacles such as stress, absence of enthusiasm, technological challenges, financial constraints, poor time management, distracting home environments, and limited time owing to caregiving responsibilities were significantly more prone to reporting worse grades than usual for the spring 2020 semester. This does not contradict the study by Abdullah et al. [14] which confirmed the high success rates among students during the Corona period due to conducting exams electronically, but the percentage of those with higher degrees during this period was not affected compared to previous sessions, which indicates that many students benefited during the pandemic period, while others were affected and others were affected by their rates as they are.

However, in the cause of the Jordanian higher education sector, the data show that the students have increased rather than decreased. This was justifiable by higher flexibility, access to virtual cites and publications and most importantly, the freedom that came with being able to stay at home and priorities. The third hypothesis showed that the only demographical factor that had an impact on student's evaluation of the Jordanian university of practical lessons during COVID-19 were linked with the faculty students were studying in. In fact, the results showed that students who study medicine, pharmaceutical, engineering, and other scientific grounded undergraduate and postgraduates, faced difficulty in using blended learning to learn practical lessons. Blankenberger and Williams [23] highlighted disparities in outcomes among different groups of students. Large-scale studies focusing on community college students revealed poorer outcomes in full online courses, with particularly steep declines observed among students with lower GPAs, males, and African-American students. While demographic factors such as age and gender were not significantly correlated with low course completion rates, student-specific factors including academic background, abilities, and prior online experience were found to be linked to successful completion of online courses. Their research findings concur with our research as the results show clear evidence that factors such as university type, gender, level of study, and academic year does not impact student's performance.

According to Alsoud and Harasis [19] online teaching may lead to decreased satisfaction among students, consequently impacting their learning. Additionally, students with low confidence in using internet sources and technological platforms may exhibit lower engagement in online learning strategies and have limited opportunities for interaction with teachers. This lack of interaction can lead to dissatisfaction and ultimately decreased learning and disengagement during online classes. Their study revealed that 49 % of undergraduate students expressed dissatisfaction with online classes, mainly due to technical issues experienced during the sessions. In their study, Keržič et al. [24] found that the quality of e-learning within the initial stage of the COVID-19 epidemic was mostly influenced by service quality. This includes factors like as administrative support, technical assistance, and the availability of learning resources given by tutors and the library. Moreover, the proactive participation of educators in distance education, particularly their promptness and prompt provision of feedback, has a substantial impact on the quality of e-learning. The system's quality, which encompasses both the distribution method and the technical infrastructure, also had a vital impact. Although students' digital skills and online contacts with peers and teachers had a significantly lesser impact, they nevertheless had a significant statistical effect. Moreover, it was emphasized that the level of student satisfaction with e-learning had a significant role in mediating the influence of e-learning quality on student performance. Satar et al. [28] discovered that the impact of changes in the pace of information technology on students' happiness with e-learning is completely mediated by their learning stress. Moreover, the extent to which students are motivated to study completely influences the connections between IT presenteeism and IT tempo change in students' pleasure with e-learning. Sundarasan et al. [40] indicated that the use of digital technology and artificial intelligence solutions to manage stress levels of students should be intensified. According to this study, female students portray a high level of anxiety in comparison to males. It concurs with this research finding which shows that students have flagged the issue of stress and instability linked with COVID-19, which has negatively affected their performance. However, according to this study, gender does not have an impact on academic performance during COVID-19.

Simok et al. [41] addressed the challenges of online learning, stating that appropriate preparation, training, and preventive measures, were among them. They suggested that future research on e-mentoring platforms or modules to optimize their efficiency. The primary stressors that students face are primarily financial limits, remote online learning, and uncertainty regarding their academic achievement and future employment possibilities. Chinna et al. [42] and Sobaih et al. [9] have shown that the inclusion of students and faculty members facilitates the utilization of social media for official academic functions. Students perceived social media as a more efficacious means of communication compared to other cost-free online communication platforms such as Google Classroom and Zoom, owing to its ease of use, usefulness, and engagement [43]. Consequently, they leveraged social media to facilitate the

process of learning. A study undertaken by Akour et al. [37] questioned Jordanian university instructors to assess their psychological well-being, the problems of distance learning systems, strategies for coping, and issues related to the pandemic. The data gathered encompassed sociodemographic information, stress management strategies, motivations for participating in distance education, challenges faced with remote learning, and the foremost concerns in the epidemic. The findings indicated that 0.314 of participants encountered severe distress, whilst 0.382 reported experiencing mild to moderate distress. Surprisingly, there was no evidence of a negative link between age and distress severity. However, there was a weak negative relationship. Furthermore, most teachers showed a significant level of enthusiasm and drive when it came to educating in an online setting. The most frequently mentioned self-coping strategy was interaction with relatives. These findings underscore the varying levels of psychological distress and challenges faced by university professors, aligning with the research findings on the difficulties encountered by students during the pandemic.

The key issue in online education is how to deliver practical lessons. Since most subjects are practical in the scientific faculties, learning them online is challenging. In fact, the data showed that some of the major challenges students faced during the pandemic were closely linked to the internet connectivity, appropriate space for studying, personal devices to attend online classes and availability of devices. One of the highest challenges faced by students was closely intertwined with stress and anxiety caused by the high uncertainty of the pandemic and how it affected students' future goal attainments. This aligns with the research conducted by Alsoud and Harasis [19] which aimed to comprehend the influence of COVID-19 on the educational experience of students in Jordan. The students provided ideas to enhance education and online education, which included making the teaching and learning websites more engaging, showcasing practical procedures in real-life scenarios, offering straightforward data, and incorporating 3D virtual instruments to simulate real situations. Online education can be improved and enhance student's IT adaptation [44].

6. Theoretical and practical implications

The results of this empirical investigation suggest that online learning is both beneficial and feasible. Although the COVID-19 pandemic presents difficulties and technological obstacles that can have a detrimental effect on online learning, student participation continues to be advantageous. Nevertheless, because of the existing constraints in infrastructure, tactics for engagement, semantic web methodologies, and knowledge management, the majority of participants maintain the viewpoint that online learning is incapable of completely substituting traditional education. To successfully navigate the period following the COVID-19 pandemic, stakeholders in the education system must establish strong and effective processes. The study also discovered a notable association between academic attainment and the utilization of online learning instruction during the period of pandemic. This period has heralded the commencement of a novel epoch in online schooling, bolstering users' assurance in the platform. One of the main factors contributing to this satisfaction is the implementation of government regulations and higher education policy. Universities modify their strategic orientations and tailor rules to achieve distinction and improve the effectiveness and efficiency of online learning systems.

In a study conducted by Dahoud [38] it was determined that the effectiveness of distance education is influenced by various aspects. These elements include the involvement of government, authorities, and professors, as well as the incentives for students to seek education and information, whether it be in colleges or institutions. The study validated the efficacy of online learning systems in educational institutions, as it established communication networks for students and implemented standards from the MHEAC. Nevertheless, technology is not seen as superior to in-person schooling. The results of this experimental investigation demonstrate that distance learning is effective and useful and that student involvement is advantageous, regardless of any challenges that may disrupt and hurt our digital educational experience during the current COVID-19 pandemic. Nevertheless, because of the existing constraints in infrastructure, semantic web methods, and the necessity for improved information systems, the general of those surveyed believed that it could not fully substitute the traditional method of learning. To navigate the period following the COVID-19 pandemic, stakeholders in the education system must establish robust processes. Moreover, in the period of the COVID-19 pandemic, there was a notable association between academic performance and the utilization of digital tools for remote teaching. The outbreak also introduced an entirely novel form of online schooling. This outbreak will also initiate a new age for distance learning and enhance users' confidence in the platform.

7. Limitations and future work

It is important to acknowledge that this research has certain limitations. One significant constraint is the size of the sample, which could impact the capacity to apply the findings to a larger population. In future studies, researchers may utilize quantitative methodologies to investigate the influence of the dimensions revealed in the current study, as well as demographic factors such as age, gender, and qualification, on academic achievement. Moreover, doing a comparison of outcomes before and after the pandemic could yield valuable observations. The research results indicate that students' disciplines and majors have a substantial effect on their performance within the context of the pandemic. This may stimulate subsequent researchers to examine the fundamental causes of this variance and customize instructional and learning approaches accordingly, as well as suggest strategies for future integration. Consequently, incorporating students from small towns and rural regions in future studies might augment the applicability of the results, given that our sample predominantly comprised students from urban settings. Students residing in rural or suburban areas may face restricted availability of online resources or educational tools, thereby affecting their academic performance.

Future research might concentrate on adapting the suggested approach to other nations to assess online learning for university students in relation to the COVID-19 pandemic. Additionally, it is important to do research on the efficiency of online learning as well as students' anxieties and tensions in the face of such pandemics. Researchers may also look at more thorough deep-learning models, which are based on extracting features attained by sophisticated optimization techniques. Researchers can also use the proposed

approach to address additional challenging optimization issues. Our finding suggest that Jordanian universities should invest in facilities and ICT infrastructure that can support e-learning. Therefore, authorities should develop a customized strategy to establish a suitable online atmosphere. It is essential to establish policies and standard operating procedures to provide pupils with simplified and clear education about the origins and implications of the epidemic, while also offering support during times of stress. Using novel strategies to maintain social cohesion among students while adhering to regulations from the government.

Finally, students proposed several solutions to enhance the online learning systems, even beyond the COVID-19 pandemic, particularly for subjects that continue to be taught online: 1) conduct exams in person, even for subjects taught online, to ensure fairness among students, 2) improve internet connectivity, 3) provide students with computers, with the option of paying in installments, 4) offer free internet packages to students, 5) offer free courses for students and faculty members on e-learning mechanisms and how to effectively utilize e-learning systems, 6) enhance the infrastructure of educational institutions, 7) adjust the educational process to prioritize actual attendance and address absences more effectively, 8) reduce the number of students in online class sections to facilitate adequate discussion between students and faculty members, and 9) require students and faculty members to turn on their cameras during online sessions to increase interaction and engagement.

Ethical statements

All subjects gave their informed consent for inclusion before they participated in the study.

Funding

This research received no external funding.

CRediT authorship contribution statement

Manaf Al-Okaily: Methodology, Formal analysis, Conceptualization. **Sima Magatef:** Software, Resources. **Aws Al-Okaily:** Writing – original draft, Visualization, Supervision. **Fadi Shehab Shiyyab:** Writing – review & editing, Resources, Project administration.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Manaf Al-Okaily reports a relationship with Heliyon that includes: board membership. Corresponding Author “Manaf Al-Okaily” is Associate Editor in Heliyon Journal. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Not Applicable.

References

- [1] M. Al-Okaily, So what about the post-COVID-19 era?: do users still adopt FinTech products? *Int. J. Hum. Comput. Interact.* (2024).
- [2] D. Al-Fraihat, M.M. Al-Debei, A. Al-Okaily, Factors influencing the decision to utilize eTax systems during the COVID-19 pandemic: the moderating role of anxiety of COVID-19 infection, *Int. J. Electron. Govern. Res.* 18 (1) (2022) 1–24.
- [3] A. Alkhalifah, U.A. Bakar, Examining the prediction of COVID-19 contact-tracing app adoption using an integrated model and hybrid approach analysis, *Front. Public Health* 10 (2022) 847184.
- [4] A. Alsaad, M. Al-Okaily, Acceptance of protection technology in a time of fear: the case of Covid-19 exposure detection apps, *Inf. Technol. People* 35 (3) (2022) 1116–1135.
- [5] A. Bany Mohammad, M. Al-Okaily, D. Qasim, M.K. Al-Majali, Towards an understanding of business intelligence and analytics usage: evidence from the banking industry, *International Journal of Information Management Data Insights* 4 (1) (2024) 100215, <https://doi.org/10.1016/j.ijime.2024.100215>.
- [6] M. Al Amin, M. Razib Alam, M.Z. Alam, Antecedents of students' e-learning continuance intention during COVID-19: an empirical study, *E-Learn.* 20 (3) (2023) 224–254.
- [7] M. Roman, A.P. Ploeanu, The effectiveness of the emergency eLearning during COVID-19 pandemic, in: *The Case of Higher Education in Economics in Romania. International Review of Economics Education* 37, 2021 100218. Hsieh, M.Y., 2020. The most sustainable niche principles of social media education in a higher education contracting era. *Sustainability*, 12(1), p.399.
- [8] F. Hasan, M. Al-Okaily, T. Choudhury, U. Kayani, A comparative analysis between FinTech and traditional stock markets: using Russia and Ukraine war data, *Electron. Commer. Res.* (2023) 1–26, <https://doi.org/10.1007/s10660-023-09734-0>.
- [9] A.E.E. Sobaih, A.M. Hasanein, A.E. Abu Elnasr, Responses to COVID-19 in higher education: social media usage for sustaining formal academic communication in developing countries, *Sustainability* 12 (16) (2020) 6520.
- [10] A.P. Teoh, M. Al-Okaily, Evaluation of data analytics-oriented business intelligence technology effectiveness: an enterprise-level analysis, *Bus. Process Manag. J.* 29 (3) (2023) 777–800.
- [11] A.F. Alkhwaldi, Understanding learners' intention toward Metaverse in higher education institutions from a developing country perspective: UTAUT and ISS integrated model, *Kybernetes* (2023).
- [12] M.N. Al-Nuaimi, O.S. Al Sawafi, S.I. Malik, M. Al-Emran, Y.F. Selim, Evaluating the actual use of learning management systems during the covid-19 pandemic: an integrated theoretical model, *Interact. Learn. Environ.* 31 (10) (2023) 6905–6930.
- [13] M.I. Alkhawaja, M.S.A. Halim, A. Afthanorhan, Technology anxiety and its impact on E-learning system actual use in Jordan public universities during the coronavirus disease pandemic, *Eur. J. Educ. Res.* 10 (4) (2021) 1639–1647.

- [14] M. Abdullah, M. Al-Ayyoub, S. AlRawashdeh, F. Shatnawi, E-learningDJUST: E-learning dataset from Jordan university of science and technology toward investigating the impact of COVID-19 pandemic on education, *Neural Comput. Appl.* (2023) 1–15.
- [15] D. Al-Fraihat, M. Joy, J. Sinclair, Evaluating E-learning systems success: an empirical study, *Comput. Hum. Behav.* 102 (2020) 67–86.
- [16] M. Al-Okaily, Advancements and forecasts of digital taxation information systems usage and its impact on tax compliance: does trust and awareness make difference? *J. Financ. Report. Account.* (2024) <https://doi.org/10.1108/JFRA-09-2023-0567> and No. ahead-of-print.
- [17] M. Al-Okaily, Implications of the COVID-19 pandemic on continuance usage of electronic tax declaration platforms: extending classical UTAUT model. *Digital Policy, Regulation and Governance* (2024), <https://doi.org/10.1108/DPRG-08-2023-0116> and No. ahead-of-print.
- [18] H. Alkayed, A. Al-Okaily, Does XBRL adoption increase financial information transparency in digital disclosure environment? Insights from emerging markets, *International Journal of Information Management Data Insights* 4 (1) (2024) 100228.
- [19] A.R. Alsoud, A.A. Harasis, The impact of COVID-19 pandemic on student's e-learning experience in Jordan, *Journal of Theoretical and Applied Electronic Commerce Research* 16 (5) (2021) 1404–1414.
- [20] A.L. Aws, T.A. Ping, M. Al-Okaily, Towards business intelligence success measurement in an organization: a conceptual study, *Journal of System and Management Sciences* 11 (2) (2021) 155–170.
- [21] D. Al-Majali, A. Al-Okaily, T. Majali, Blockchain technology and its applications in digital accounting systems: insights from Jordanian context, *J. Financ. Report. Account.* (2023), <https://doi.org/10.1108/JFRA-05-2023-0277> and No. ahead-of-print.
- [22] F. Keshavarzi, C. Megan, C.K. Sin, C.C. Wei, C.C. Ming, C. Wong, Y. Yin, The impact of COVID-19 pandemic on the mental health of college and university students, *ASEAN* 22 (2021) 1–7.
- [23] B. Blankenberger, A.M. Williams, COVID and the impact on higher education: the essential role of integrity and accountability, *Adm. Theor. Prax.* 42 (3) (2020) 404–423.
- [24] D. Keržič, J.K. Alex, R. Pamela Balbontín Alvarado, D.D.S. Bezerra, M. Cheraghi, B. Dobrowolska, A.F. Fagbamigbe, M.E. Faris, T. França, B. González-Fernández, L.M. Gonzalez-Robledo, Academic student satisfaction and perceived performance in the e-learning environment during the COVID-19 pandemic: evidence across ten countries, *PLoS One* 16 (10) (2021) e0258807.
- [25] S.E. Hickey, E.P. Hebert, N. Webb, College student experiences of the COVID-19 pandemic: concerns, preventive behaviors, and impact on academics and career choice, *Am. J. Health Stud.* 36 (2) (2021) 76–87.
- [26] M.W.H. Spitzer, S. Musslick, Academic performance of K-12 students in an online-learning environment for mathematics increased during the shutdown of schools in wake of the COVID-19 pandemic, *PLoS One* 16 (8) (2021) e0255629.
- [27] A. Bilal, S. Ehsan, M.M. Tahir, Z. Ahmad, Online teaching during covid-19 pandemic challenges and the solutions, *Annals of Punjab Medical College* 15 (4) (2021) 245–249.
- [28] M. Satar, N. Safie, O. Dastane, A.H. Morshidi, E-Learning Satisfaction during COVID-19 Pandemic Lockdown: Analyzing Key Mediators (Preprint), 2021.
- [29] C.C. Dragomir, A. Munteanu, Impact of online education on economic students' professional training in the context of the covid-19 pandemic, *Review of General Management* 31 (1) (2020) 41–55.
- [30] Allah, A.A., N.E. Algethami, R.A. Algethami, R.H. Alayyubi, W.A. Altalhi, A.A.A. Atalla, Impact of COVID-19 on psychological and academic performance of medical students in Saudi Arabia, *J. Fam. Med. Prim. Care* 10 (10) (2021) 3857.
- [31] M.A. Mahdy, The impact of COVID-19 pandemic on the academic performance of veterinary medical students, *Front. Vet. Sci.* 7 (2020) 732.
- [32] R. Shishakly, A. Sabah, Challenges of online learning systems during COVID-19 in the UAE universities and its effect on business students' academic performance, *American Journal of Online and Distance Learning* 3 (1) (2021) 1–24, <https://doi.org/10.47672/ajodl.757>.
- [33] M. Al-Kofahi, F.S. Shiyab, A. Al-Okaily, Determinants of user satisfaction with financial information systems in the digital transformation era: insights from emerging markets, *Global Knowledge, Memory and Communication* (2023), <https://doi.org/10.1108/GKMC-12-2022-0285> and No. ahead-of-print.
- [34] A.A. Alsmadi, N. Alrawashdeh, A. Al-Okaily, Y. Oroud, A.S. Al-Gasaymeh, The role of digital accounting transformation in the banking industry sector: an integrated model, *J. Financ. Report. Account.* 22 (2) (2024) 308–326.
- [35] A.P. Teoh, M. Al-Okaily, M. Iranmanesh, M.A. Al-Betar, The efficiency measurement of business intelligence systems in the big data-driven economy: a multidimensional model, *Information Discovery and Delivery* 51 (4) (2023) 404–416, <https://doi.org/10.1108/IDD-01-2022-0008>.
- [36] M.S. Abd Rahman, A. Ali, E. Abu-Shanab, R. Masa' deh, An empirical investigation on acceptance of mobile payment system services in Jordan: extending UTAUT2 model with security and privacy, *Int. J. Bus. Inf. Syst.* 42 (1) (2023) 123–152.
- [37] A. Fakour, B. Ala'a, M. Barakat, R. Kanj, H.N. Fakhouri, A. Malkawi, G. Musleh, The impact of the COVID-19 pandemic and emergency distance teaching on the psychological status of university teachers: a cross-sectional study in Jordan, *Am. J. Trop. Med. Hyg.* 103 (6) (2020) 2391.
- [38] M.S. Dahoud, The Effect of Covid-19 Pandemic on Distance Learning in Jordan (Al Westeyah District Schools), 2020.
- [39] MOE, Ministry of education, Retrieved October, 19, 2022, from, <http://www.moe.gov.edu.jo>, 2020, May 20.
- [40] S. Sundarasan, K. Chinna, K. Kamaludin, M. Nurunnabi, G.M. Baloch, H.B. Khoshaim, S.F.A. Hossain, A. Sukayt, Psychological impact of COVID-19 and lockdown among university students in Malaysia: implications and policy recommendations, *Int. J. Environ. Res. Publ. Health* 17 (17) (2020) 6206.
- [41] A.A. Simok, M.N. Mat Pa, A.F. Abdul Rahim, Challenges of e-mentoring medical students during the COVID-19 pandemic, *Education in Medicine Journal* 13 (4) (2021) 107–111.
- [42] K. Chinna, S. Sundarasan, H.B. Khoshaim, K. Kamaludin, M. Nurunnabi, G.M. Baloch, S.F.A. Hossain, A. Sukayt, N. Dalina, U. Rajagopalan, R. Kumar, Psychological impact of COVID-19 and lockdown measures: an online cross-sectional multicounty study on Asian university students, *PLoS One* 16 (8) (2021) e0253059.
- [43] A.A. Alsmadi, A. Shuhaiber, M. Al-Okaily, A. Al-Gasaymeh, N. Alrawashdeh, Big data analytics and innovation in e-commerce: current insights and future directions, *J. Financ. Serv. Market.* (2023) 1–18, <https://doi.org/10.1057/s41264-023-00235-7>.
- [44] S. Magatef, T. Abuhusseini, L. Ashour, S.U. Rehman, A comparative analysis of COVID-19 pandemic effects on students' academic performance in higher education sector, *Global Knowledge, Memory and Communication* (2024), <https://doi.org/10.1108/GKMC-07-2023-0260> and No. ahead-of-print.