



Research article

Estimating students' online learning satisfaction during COVID-19: A discriminant analysis

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ABSTRACT

This study aims to examine online learning effects regarding self-efficacy, generalized anxiety, and fear of COVID-19 on three distinct online learning satisfaction levels (low, moderate, and high) among university students. A cross-sectional survey was utilized for data collection between June 2020 and August 2020 to assess students' online self-efficacy, general anxiety, fear of COVID-19, and online learning satisfaction. The descriptive data analysis demonstrated a fundamental understanding of the gathered data results. Meanwhile, discriminant data analysis was employed to explore different online learning satisfaction levels following various study factors. The correlational analysis implied online learning self-efficacy to be significantly and positively associated with online learning satisfaction while general anxiety and fear of COVID-19 were significantly and negatively related to online learning satisfaction. The discriminant analysis revealed the emergence of three online learning satisfaction levels from online self-efficacy, general anxiety, and fear of COVID-19. This study theoretically justified the essentiality of online learning self-efficacy towards online learning satisfaction. High online learning satisfaction levels occurred with high online self-efficacy, moderate general anxiety, and low fear of COVID-19. Two discriminant functions (academic engagement and fear) were subsequently evolved. Academic engagement corresponded to online self-efficacy and general anxiety while fear was associated with COVID-19. In this vein, online learning self-efficacy and moderate general anxiety led to high online learning satisfaction. The fear of COVID-19 also required alleviation towards online learning satisfaction. For example, academicians and policy-makers needed to focus on developing online self-efficacy and reducing the fear of COVID-19 for high online learning satisfaction.

1. Introduction

Globally, the current COVID-19 outbreak and subsequent lethal impacts have caused adverse living conditions, medical emergencies, and deaths following the highly communicable and infectious virus spread. In other words, the health crisis instigated severe economic, social, and political disruptions (Yang et al., 2020a), multiple lifestyle and industrial shifts, excessive natural resource exploitation, and detrimental climate impacts (Zolotov et al., 2020). The unending COVID-19 pandemic also hampers economic, social, and educational activities (Wang et al., 2020) on a global scale. For example, the UNESCO Director-general (Audrey Azoulay) underscored the COVID-19 impact on education by stating that “never before have we witnessed educational disruption on such a large scale” (UNESCO, 2020). As a worldwide health emergency, COVID-19

jeopardizes students' education by disrupting specific learning goals and students' aims in respective study disciplines (Zolotov et al., 2020). Approximately 91% of students worldwide were affected by the temporary closure of educational institutions. Almost 1.6 billion students were out of school by the end of 2020. Work losses and the need to maintain physical distance further deterred the pandemic countermeasures (UNESCO, 2020).

The unprecedented university facilities closure following COVID-19 has affected millions of varsity students worldwide (Li et al., 2020) through abrupt transformations (from physical teaching modes and learning activities to virtual counterparts) to continue academic course delivery and avoid people-gathering and infection spread risks (Cornine, 2020). Educational quality has been compromised given the drastic shift to distance learning (DL) or remote teaching on digital platforms (Hsu

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et al., 2019). Specifically, the sudden change in instructional delivery requires different skills from teaching faculties and students. As online teaching methods require advanced technological utilisation, distant learning inevitably induces multiple educational disruptions among most students.

The DL denotes learning instruction delivery with information and communication technologies (ICT) that retain a distance between students and teachers (Gray and DiLoreto, 2016). Despite the incorporation of technological resources and innovative educational strategies to transform teaching and learning processes (Cobb, 2009), university instructors were given limited online teaching alternatives (live lectures, recorded video lectures, voice-over demonstrations, and live presentations) following the emergence of COVID-19 for instruction delivery (Demuyakor, 2020). Given the recent intensification involving DL and integrative educational technology in the modern world, it was deemed vital to examine the key determiners of students' satisfaction level in DL contexts and offer adequate technical training and instructions (Naji et al., 2020). Student satisfaction and other course-related perspectives are influenced by online teaching strategies towards online course development following COVID-19 (Demuyakor, 2020). In this vein, students' online learning satisfaction proved crucial to harness learning aptitudes for online learning (Yang et al., 2020b). A sound understanding of learning satisfaction from students' viewpoints proved necessary to consider COVID-19-oriented anxiety and fear.

As the psychological aspect of students' responses reduce adverse environmental conditions and optimize students' performance amidst disruptive circumstances (COVID-19), this research aimed to evaluate students' satisfaction levels of DL regarding anxiety and fear. Self-efficacy denoted another factor that significantly influenced DL satisfaction. The current research objectives aim to address the following questions:

1. How do learners perceive DL satisfaction regarding online self-efficacy, general anxiety, and fear of COVID-19?
2. What are the discriminatory indicators of online self-efficacy, general anxiety, and fear of COVID-19 based on the ability to classify students following three DL satisfaction levels: low, medium, and high?

2. Literature review

2.1. Online learning satisfaction

The COVID-19 outbreak has globally altered educational scenarios by converting traditional learning to alternative remote counterparts or DL to deter infectious disease transmission through social interaction (Li et al., 2020; Wang et al., 2020) and adversely impacts students' lives, grades, and learning achievements (Naji et al., 2020). Notwithstanding, ICT-facilitated online learning is not explicitly associated with COVID-19. For example, online learning activities affect learning objectives, course delivery plans, and assessment activities that differ from conventional delivery modes (Cobb, 2009). As online study or DL (not a novel phenomenon) engages students from distinct study fields, the individuals portray diverse opinions on online learning programmes (Zolotov et al., 2020). Although online learning modules offer experiential and constructive learning environments (Alqurashi, 2016), most students perceive online learning to be challenging as first-time online learners during COVID-19 (Demuyakor, 2020).

Online learning encompasses online lecture delivery, audiovisual aids (AVAs), PowerPoint slides, and recorded video lessons (Baber, 2020). Although most students encountered intricacies in online learning delivery, many felt equally comfortable with the novel instruction delivery mode (Zolotov et al., 2020). Students' online learning satisfaction requires advanced teaching pedagogies and technological know-how to garner students' attention and instruction delivery (Baber, 2020; Hsu et al., 2019). For example, one-to-one student-teacher interaction within a DL setting created complexities in higher engagement levels in terms of resource allocation and priorities (Baber, 2020). Students' teaching

method satisfaction positively impacts academic performance (Cobb, 2009). Meanwhile, students' expectations of online learning systems are highly complex given the novelty of the instruction delivery mode (Hsu et al., 2019). As such, fulfilling student expectations and achieving positive online learning system perspectives subsequently induce online learning satisfaction.

The DL poses complexities to teaching communities as many senior faculty members struggled to fulfil the required course redesign level (Baber, 2020). Furthermore, students displayed contradictory opinions on DL satisfaction. For example, some students perceived DL to be a significant learning opportunity while others observed DL as a poor alternative to conventional (physical) teaching methods (Zolotov et al., 2020). Satisfied learners also proactively engaged with online learning activities and felt comfortable with online learning environments (Baber, 2020). In this vein, students' efficacy level and psychological states influenced learning satisfaction. Further investigation on how and why diverse alternatives existed among students proved necessary. Despite several recent studies on how students' efficacy level and openness to technology induced DL satisfaction (Demuyakor, 2020; Naji et al., 2020; Zimmerman and Kulikowich, 2016), research on students' DL satisfaction regarding perceived COVID-19-related anxiety and fear remained scarce (Savitsky et al., 2020).

2.2. Online learning self-efficacy

Self-efficacy denotes the extent to which individuals possess task or stress management abilities (Zimmerman and Kulikowich, 2016), including the overall self-confidence in managing the intricacies of different environmental contexts. The concept is also related to motivation levels, actions, and psychological states (Zimmerman and Kulikowich, 2016) where individual beliefs of capabilities directly influence personal actions and the degree to which precautionary actions are resisted in crucial situations resembling COVID-19 (Hsu et al., 2019).

Self-efficacy also predicts individuals' confidence level in resisting COVID-19. Specifically, online learning self-efficacy involves individuals' self-resilience in learning within a distance-oriented setting (Zimmerman and Kulikowich, 2016). Meanwhile, gender differences significantly involve DL self-efficacy (Li et al., 2020). Regarding developing economy variances, male learners demonstrated higher self-efficacy levels compared to female counterparts as women potentially received fewer opportunities (Savitsky et al., 2020). Internet-savvy students could also optimally engage in DL. Some students demonstrated high self-efficacy in online learning following educational institutions to save time and improve learning achievements with minimal distractions and social interaction.

Students with high online learning self-efficacy reflected positive online learning satisfaction (Alqurashi, 2016). Although perspectives of technological usage and learners' self-efficacy significantly impacted online learning satisfaction (Naji et al., 2020), research on technology-related self-efficacy that induced learning satisfaction remained scarce. Thus, it was deemed crucial to examine the online learning self-efficacy impacts on online learning satisfaction during COVID-19.

2.3. General anxiety

Generalized anxiety denotes a natural human condition that encompasses nervousness, perceived difficulties, and concerns about individual circumstances (Spitzer et al., 2006). The COVID-19 outbreak has induced high anxiety levels among the global population (Yang et al., 2020b). For example, high general anxiety induced more tension, irritability, restlessness, and distress (Spitzer et al., 2006). Given the high levels of individual anxiety following COVID-19, isolation and precautionary measures proved necessary to deter viral infections. Current literature elaborates on social isolation under quarantine that induced different stressors, including fear of infection and boredom (Zolotov et al., 2020).

Inadequate electronic and social media information inevitably generated frustration during quarantine and anxiety among healthy persons during the lockdown (Wang et al., 2020). On another note, university-level students are highly concerned about the loss of educational activities during COVID-19 that subsequently impacted future employment opportunities (Yang et al., 2020a).

Although anxiety levels (Spitzer et al., 2006) positively impacted necessary classroom activity engagement and facilitated higher educational achievement (Naji et al., 2020), the COVID-19 pandemic significantly elevated general anxiety, depression, and distress levels among individuals with mental illnesses (Yang et al., 2020b). Individuals with high anxiety generally failed to focus and perform well in life, thus resulting in high panic levels and distrust within individual surroundings (Zolotov et al., 2020). In this vein, COVID-19 has caused much anxiety due to loss of work, social events, and economic activities (Baber, 2020).

2.4. Fear of COVID-19

Fear denotes an emotional condition that induces panic, social isolation, or loss of life quality that potentially impedes individual performance (Zolotov et al., 2020). As a proactive mechanism, fear would catalyze individuals to engage in avoidance behavior for low and adverse impacts on daily life (Li et al., 2020). In this vein, fear (attitude-wise) potentially disrupts human life by inducing panic, terror, and inefficiency (Zolotov et al., 2020). The advent of COVID-19 reflects a substantial element of fear, such as the fear of getting ill, ceasing of business and normal life, sensational news items, and fake media reports (Wang et al., 2020). Summarily, the world is facing one of the most adverse fear-oriented implications through COVID-19, such as disrupted social and daily life.

The prolonged closure of educational institutions for most students induces the fear of losing educational attainment and valuable learning time (Demuyakor, 2020). As a psychological aspect that negatively impacts online learning activities (Zolotov et al., 2020), fear of COVID-19 also instigates students' general loss of interest in and disengagement from educational activities (Baber, 2020). Inaccurate news on social media regarding COVID-19 effects and treatments (including rejection of vaccination) also induces fear among the general public on a global scale (Demuyakor, 2020; Li et al., 2020). In this vein, students' fear of COVID-19 could lead to indifference and a sense of loss in human life (Baber, 2020) following COVID fatigue. The disruptions instigated by COVID-19 could increase through perpetual COVID-19 discussions and subsequent pandemic effects on mainstream and social media, thus influencing the fear levels of COVID-19. In this regard, elevated concerns and fear negatively impacted students' cognitive, social, and physiological lives (Li et al., 2020).

3. Method

3.1. Study sample and sampling technique

The target population in this explorative study consisted of enrolled Jordanian university students. Stratified random sampling was specifically utilized in 27 public and private Jordanian universities (Hair, Black, Babin & Anderson, 2011). Geographically, six universities from three Jordanian regions (two from Southern Jordanian, two from Middle Jordanian, and two from Northern Jordanian) were randomly selected with online data gathering. This study also utilized a cross-sectional survey design to collect potential respondents' data through surveys at one time with one respondent type (Hair et al., 2014). Study respondents' consent was first obtained pre-survey participation following the Committee on Publication Ethics (COPE) ethical norms. As this study was conducted in educational settings among higher education institutions (universities) with human subjects, a five-member committee from the School of Educational Sciences (Committee of Reviewing Ethics and Protocols of scientific research) approved the research protocol in line

with the recommendations of the University of Jordan Deanship of Academic Research.

3.2. Measurement scales

Students' online learning satisfaction was evaluated with Cobb's (2009) nine-item scale with reported internal reliability of 0.78. A five-point Likert scale was also utilized to gauge study respondents' DL satisfaction. Meanwhile, Zimmerman and Kulikpwich's (2016) 22-item online self-efficacy scale was employed to measure respondents' self-efficacy towards DL with a six-point Likert scale. Distance learners' self-efficacy encompassed the sub-dimensions of technology use, time management, and online learning environment with reported internal reliability of 0.89. On another note, respondents' general anxiety was assessed with Spitzer et al.'s (2006) seven item-generalized Anxiety Disorder Scale using a four-point Likert scale with internal reliability of 0.89. Lastly, the fear of COVID-19 was forecasted with Zolotov et al.'s (2020) seven-item scale on a five-point Likert scale with internal reliability of 0.82.

3.3. Statistical analysis method

This study employed a preliminary analysis of descriptive statistics for all the study variables: online self-efficacy, general anxiety, fear of COVID-19, and online learning satisfaction. The discriminate analysis identified the discriminant function between analytical techniques. The aforementioned analysis isolated the input variables between individual, organizational, and national groups (Hair et al., 2014). As a statistical technique, discriminant analysis appropriately distinguished between groups following the group means (centroid) and forecasted group membership. Notably, discriminant analysis resembled the linear regression counterpart to predict the dependent variables (Hair et al., 2014). Additionally, the multivariate analysis of variance (MANOVA) was utilized to establish the difference between low, moderate, and high-level online learning satisfaction among study respondents (Hair et al., 2014). Online learning satisfaction (low, moderate, and high) denoted the outcome factor while online self-efficacy, general anxiety, and fear of COVID-19 implied independent variables. The univariate analysis of variance (ANOVA) and post-hoc Scheffe test was conducted to examine the variances between online learning satisfaction groups. The discriminant served to determine the variances among the three-level online learning satisfaction groups (Hair et al., 2014). As discriminant analysis can be used to differentiate among groups on the basis of differences in the set of shared variables, so we can define variables which are most important in differentiating among groups based on functions.

4. Results

4.1. Study respondent profile

Based on the respondents' demographic statistics, 53.6% of the individuals were females. Specifically, 53.8% were enrolled in public Jordanian universities while the remaining were enrolled in private counterparts. Most respondents (42.1%) were enrolled in Engineering programmes. Meanwhile, 16.2% were registered in Computer Sciences, 24.2% in Medical Sciences, 1.2% in Law, 2.7% in Education, 4% in Social Sciences, and the remaining in Business programmes. Furthermore, 21% of the students demonstrated an excellent GPA, 31.9% reflected a very good GPA, 35.7% implied a good GPA, and the remaining respondents demonstrated a passing GPA. Most of the respondents (85%) were enrolled in undergraduate programmes. Specifically, 87.8% of the respondents were Jordanian nationals (see Table 1).

Table 2 depicts the descriptive analysis of all study variables. The results are outlined as follows: DL self-efficacy (Mean = 3.175, SD = 1.53); generalized anxiety (Mean = 1.748, SD = 0.74); fear of COVID-19 (Mean = 3.031, SD = 1.01); online learning satisfaction (Mean = 2.873,

Table 1. Respondent profiles.

	N	%		N	%
Gender		Universities			
Male	679	46.4	Public	787	53.8
Female	784	53.6	Private	676	46.2
Total	1463	100.0	Total	1463	100
Students' GPA		Education			
Excellent	308	21.0	Law	17	1.2
Very Good	467	31.9	Engineering	617	42.1
Good	523	35.7	Computer Sciences	237	16.2
Passing	165	11.3	Education	40	2.7
Total	1463	100	Medical Sciences	354	24.2
Nationality		Social Sciences			
Jordanian	1285	87.8	Business	140	9.6
Other	178	12.2	Total	1463	100.0
Total	1463	100.0	Academic Level		
		Undergraduate		1243	85
		Graduate		220	15
		Total		1463	100.0

Table 2. Descriptive statistics of study variables.

S. No.	Constructs	Mean	SD	Minimum	Maximum	No. of items
1.	Online Self-efficacy	3.175	1.53	1	6	22
2.	Generalised Anxiety	1.748	0.74	0	3	7
3.	Fear of COVID-19	3.031	1.01	1	5	7
4.	Online Learning Satisfaction	2.873	1.13	1	5	9

SD = 1.13). The descriptive statistics proved insufficient in highlighting the differences of all three different DL satisfaction levels among the study respondents. As hypothesized, the significant variances between study respondents for DL satisfaction relied on DL self-efficacy, general anxiety, and fear of COVID-19. Table 3 depicts the study construct correlations.

The correlational analysis distinctly outlined the study construct association. Online self-efficacy denoted a significant and negative association with general anxiety ($r = -0.715, p = 0.05$) while online self-efficacy implied a significant and negative association with the fear of COVID-19 ($r = -0.651, p = 0.05$). Meanwhile, online self-efficacy positively correlated to online learning satisfaction ($r = 0.939, p = 0.05$). Moreover, the association between general anxiety and fear of COVID-19 was positive and significant ($r = 0.697, p = 0.05$). General anxiety and online learning satisfaction implied a negative and significant correlation ($r = -0.745, p = 0.05$). Similarly, the final correlation between the fear of COVID-19 and online learning satisfaction was negative and significant ($r = -0.701, p = 0.05$).

Table 3. Construct correlation matrix.

	Online Self-efficacy	General Anxiety	Fear of COVID-19	Online Learning Satisfaction
Online Self-efficacy	1			
General Anxiety	-0.715**	1		
Fear of COVID-19	-0.651**	0.697**	1	
Online Learning Satisfaction	0.939**	-0.745**	-0.701**	1

Note: *significant at $p = 0.10$; ** significant at $p = 0.05$; ***significant at $p = 0.001$.

Based on the MANOVA analysis to address Research Question 1 (see Table 4), a significant difference (three significant satisfaction levels) existed between the three DL satisfaction groups (low, moderate, and high). For example, low online learning satisfaction relied on high fear of COVID-19, low online self-efficacy, and moderate general anxiety. Meanwhile, moderate online learning satisfaction depended on moderate fear of COVID-19, online self-efficacy, and general anxiety. Regardless, high online learning satisfaction originated from high online self-efficacy and low general anxiety and fear of COVID-19.

Regarding Research Question 2, the discriminate analysis led to two divergent functions. The first function accounted for over 98% of the variance [Wilks' Lambda = 0.251, $F(6, 1457) = 483.76, p < 0.000$]. The discriminate analyses of each factor for the three DL satisfaction levels were duly executed. The second function emerged as follows: $[X^2(6) = 2015.49, p < 0.000; X^2(2) = 50.21, p < 0.000]$. The structure matrix implied the first function to be justified by two constructs (online learning self-efficacy and the absence of general anxiety). Notably, the second function substantially relied on the fear of COVID-19. The first function was named "academic engagement" while the second counterpart was termed as "fear" (see Table 5).

The discriminate analysis facilitated respondents' differentiation of three DL satisfaction groups into two segments. The post-hoc Scheffe test with an alpha level set at $p < 0.05$ implied that students with high DL satisfaction demonstrated higher DL self-efficacy than counterparts with lower DL satisfaction. Likewise, students with low anxiety reflected higher DL satisfaction than individuals with lower DL satisfaction. Low fear of COVID-19 was also associated with high DL satisfaction.

The classification results post-discriminant analysis implied students to be accurately classified by 79.0% (see Table 6).

The discriminant function analysis for each group (less level, moderate level, and high level of satisfaction). It shows that results correctly classified in different group's types. Separation is obvious based on the concentrations of participants in each group (see Figure 1).

5. Discussion

This study attempted to estimate Jordanian university students' DL satisfaction regarding online learning self-efficacy, generalized anxiety, and the fear of COVID-19 and how the factors potentially discriminated online learning satisfaction. Resultantly, online learning self-efficacy significantly impacted satisfaction levels where COVID-19 promoted DL self-efficacy and DL satisfaction among students. The study outcomes justified the positive correlation between online learning self-efficacy and online learning satisfaction (Al-Tarawneh et al., 2021) and paralleled the theory of self-efficacy where personal valuation significantly influenced learning satisfaction development among students (Cobb, 2009).

A negative relationship existed between (i) general anxiety and online learning satisfaction and (ii) the fear of COVID-19 and online learning satisfaction. The study findings corresponded to Osmani (2021) where student learning satisfaction improved with the online learning education system among Iranian medical students. As an established phenomenon, online learning offered unique learning platforms that facilitated students towards learning satisfaction from distance or online learning platforms (Cobb, 2009). Specifically, online learning platforms offered pragmatically and productively delivered learning instructions based on students' learning objectives (Alqurashi, 2016). Generalized anxiety and fear of COVID-19 were negatively associated with online learning satisfaction. Additionally, students demonstrated three satisfaction levels (low, moderate, and high) in online learning. For example, students with low satisfaction levels reflected low self-efficacy and high anxiety and fear of COVID-19.

Students with moderate satisfaction levels revealed moderate self-efficacy with low anxiety and fear of COVID-19. Students with high satisfaction levels exhibited high self-efficacy and fear of COVID-19 and low anxiety. Students with high anxiety and fear demonstrated low DL

Table 4. Mean and standard deviation of low, moderate, and high learning satisfaction.

S. No.	Constructs	Satisfaction Low-level	Satisfaction Moderate-level	Satisfaction High-level	F	Sig.
1	Online Self-efficacy	1.239 (0.47)	2.697 (0.87)	4.864 (0.79)	2004.36	0.000
2	General Anxiety	2.544 (0.50)	1.890 (0.60)	1.133 (0.56)	439.69	0.000
3	Fear of COVID-19	4.150 (0.31)	3.115 (0.79)	2.333 (0.92)	597.28	0.000
	Respondent No.	255	714	493		

Table 5. Multiple discriminant function results.

S. No.	Constructs	Functions	
		1	2
1	Online Self-efficacy	0.982*	0.121
2	General Anxiety	-0.535*	0.328
3	Fear of COVID-19	-0.449	0.892*

Note: *Largest absolute correlation between each variable and discriminant functions.

Table 6. Original and classification results.

Case count and Percentage	Sat level	Predicted Group Membership			Total
		Less	Moderate	High	
Cross-validated count	Less	274	7	1	255
	Moderate	153	440	121	714
	High	0	25	468	493
Cross-validated percentage	Less	96.9	2.7	0.4	100
	Moderate	21.4	61.6	16.9	100
	High	0.0	5.1	94.9	100

79.0% of the organization grouped cases are correctly classified.

satisfaction (negatively associated with self-efficacy in Table 5). In this vein, students' online self-efficacy proved necessary for online learning satisfaction. The discriminate analysis outcomes revealed that students

with high DL satisfaction reflected high self-efficacy with moderate generalized anxiety. Fear implied a negative trait that explicitly and considerably affected satisfaction level. Students with high fear of COVID-19 reflected low DL satisfaction due to the absence of external interaction with the world and people (Alqurashi, 2016; Yang et al., 2020b). Regardless, students' perspectives of online learning satisfaction became low with low online learning self-efficacy. As such, moderate anxiety proved obligatory in developing the required DL satisfaction level (Yang et al., 2020a), induce online learning attainment, and promote DL satisfaction following past literature (Cornine, 2020).

Online learning satisfaction relied on students' online self-efficacy with moderate general anxiety and academic engagement following the discrimination analysis. A possible explanation was outlined for both outcomes. Specifically, online self-efficacy reduced general anxiety and the fear of COVID-19 and promoted online learning satisfaction. Students reflected low learning satisfaction with low self-efficacy, moderate anxiety, and high fear of COVID-19. In other words, anxiety and fear of COVID-19 reduced online learning satisfaction. Meanwhile, moderate online learning satisfaction relied on moderate online self-efficacy, general anxiety, and fear of COVID-19. As such, the study outcomes corresponded to Bandura's theoretical stance where self-efficacy could promote learning satisfaction and minimize the adverse impacts of anxiety and fear (Cobb, 2009). Summarily, online learning could be optimized with the right content for high self-efficacy and low (adverse) COVID-19 impacts.

As students who were highly engaged with educators revealed high online learning self-efficacy and low fear of COVID and general anxiety, efforts were required to teach students based on high interaction levels (Al-Tarawneh et al., 2021). Although highly-participative learning

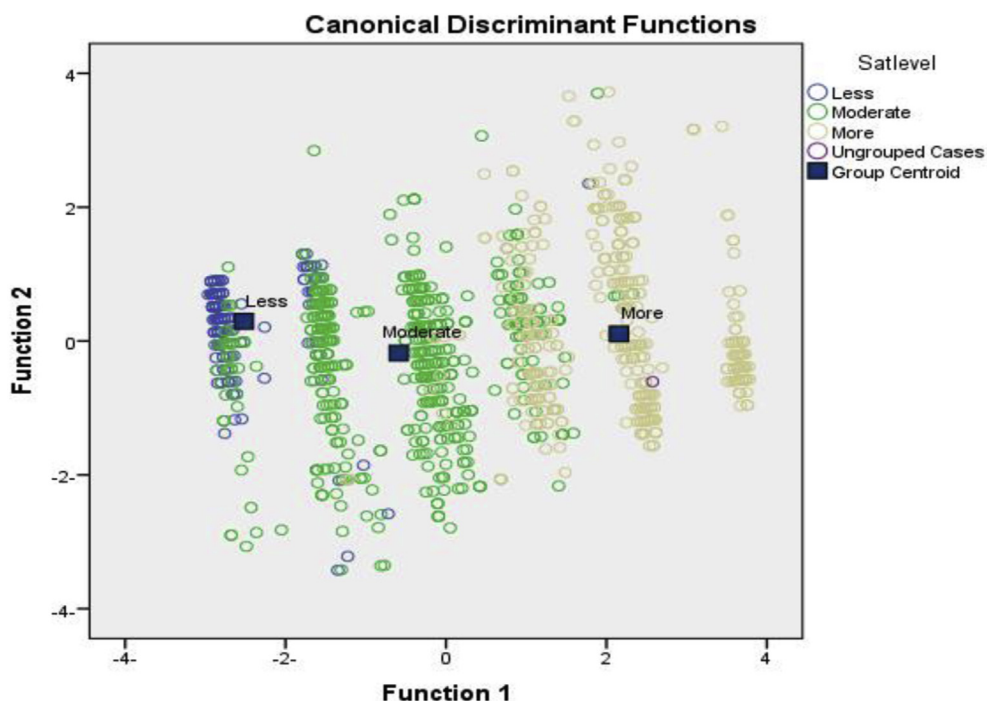


Figure 1. Canonical Discriminant Functions plot.

environments improved learning satisfaction (Hsu et al., 2019), the phenomenon required extensive exploration. For example, online learning satisfaction could be examined in line with other personal factors (personality, interest in education, and past learning achievements).

Governmental and healthcare agencies should also consider developing national guidelines to address psychological distress during and post-COVID-19. Mental health management proved necessary during COVID-19 to protect students' health and promote resilience during difficult times. Meanwhile, academicians needed to imbibe the right strategies in developing specific learning modules and improving students' academic achievements. High engagement levels could induce online self-efficacy that subsequently led to online learning satisfaction (Naji et al., 2020). Furthermore, pedagogical interventional could facilitate educators' remote interaction with students and digitally deliver course content for high online learning satisfaction and low general anxiety and fear of COVID-19.

Research on university students has found that student satisfaction and perception of distance learning during the pandemic can prove to be a predictor of their own self-efficacy. Yet it is not possible to measure their self-efficacy based solely on their ability to mentally prepare for this unique learning experience. This study thus provides a different angle to look at the importance of self-efficacy by investigating university students' perception of the consequences of this transition from in-person to distance learning.

Finally, the COVID-19 pandemic is negatively impacting students' education around the world, with children in emerging and developing economies some of the worst-affected. Based on UNRWA's report in March 2020, the Government of Jordan was amongst the first in the MENA region to enforce a strict lockdown and close all schools and universities, as early as mid-March. The Government of Jordan rapidly responded to these closures in order to minimize learning losses, where e-learning became the norm. Along with struggles related to e-learning, university students have to handle several kinds of environmental and mental challenges due to COVID-19. Furthermore, different educational systems have dealt with varying responses to distance learning. For example, study by Al-Tarawneh et al., 2021 reported a significant gap between public and private university students' distance learning satisfaction, online learning self-efficacy, and anxiety levels, while the students' scores on fear of COVID-19 were insignificant. Students in private universities were also reported to have higher baseline rates for all the constructs involved in this study. In research conducted by Almaiah et al. (2020), respondents identified many critical factors that affect usage of e-learning systems, including self-efficacy and cultural factors. Hence, we examine such factors in the current study to explore Jordan's education system and its management of distance learning.

5.1. Limitation

This study encountered three limitations. As this study is a quantitative approach with cross-sectional data, the limitations involving cross-sectional data collection inevitably restricted study outcome generalizability. Consequently, future studies could gather qualitative data for an extensive examination of online learning satisfaction. Second, this study solely relied on three variables that depicted the online learning phenomenon. As such, future studies should incorporate more personal variables that impacted online learning phenomena (mindfulness, mental resilience, and past educational achievement) that explicitly influenced online learning satisfaction. Lastly, students' attributes (gender, GPA, study course, and family background) potentially influenced online learning satisfaction. Hence, future studies were required to investigate online learning following the respondents' attributes.

6. Conclusion

This study results offered novel insights into empirical efforts to better understand students' online learning satisfaction during COVID-

19. The study findings supported the argument that students' self-efficacy, generalized anxiety, and fear of COVID-19 was significantly related to online learning satisfaction. As such, online learning satisfaction improved online learning self-efficacy while reducing the general anxiety and fear of COVID-19. Students with low online learning self-efficacy needed adequate attention and support from educators to engage in high-interaction online learning for improved self-efficacy. Although moderate anxiety proved beneficial in online learning, high anxiety levels minimized online learning satisfaction. Moreover, reducing and managing the fear of COVID-19 proved necessary to nurture online learning satisfaction. As such, online modules could be prepared to nurture students' online self-efficacy while fear could be reduced with anxiety management during COVID-19.

Declarations

Author contribution statement

Mais A-Nasah: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Luai Al-Tarawneh: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Feryal Abu Awwad: Performed the experiments; Analyzed and interpreted the data.

Ikhlas Ahmad: Contributed reagents, materials, analysis tools or data.

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Data availability statement

The data that has been used is confidential.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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