International Journal of Evaluation and Research in Education (IJERE)
Vol. 13, No. 6, December 2024, pp. 3705~3716
ISSN: 2252-8822, DOI: 10.11591/ijere.v13i6.29009

Information overload, anxiety, stress, and depression of online distance learners

Mohamad Noorman Masrek, Mohammad Fazli Baharuddin, Abdurrahman Jalil, Fadhilah Aman
School of Information Science, College of Computing, Informatics and Mathematics, Universiti Teknologi MARA, Selangor, Malaysia

Article Info

Article history:

Received Oct 25, 2023
Revised Apr 29, 2024
Accepted May 7, 2024

Keywords:

Anxiety
Distant learners
Information overload
Mental well-being
Online education

ABSTRACT

In the ever-expanding landscape of online education, the mental well-being of online distant learners has emerged as a critical concern. This study delves into the complex interplay between information overload, stress, anxiety, and depression among online distant learners in Malaysian universities. Using a survey research method and utilizing perceptual measures, we explored the psychological states of online distant learners in Malaysia. Based on the analysis of 384 responses, the results showed that online distant learners did not report experiencing information overload, stress, anxiety, or depression. Despite this absence, the study identified significant positive associations between information overload and stress, information overload and anxiety, as well as between stress and anxiety, and anxiety and depression. The implications of this study resonate profoundly in the realm of online education policy-making and implementation.

Corresponding Author:

Mohamad Noorman Masrek
School of Information Science, College of Computing, Informatics and Mathematics,
Universiti Teknologi MARA
Shah Alam, Selangor, Malaysia
Email: mnoorman@uitm.edu.my

1. INTRODUCTION

The information revolution has fundamentally transformed the way societies access, share, and process information [1]. With the proliferation of digital technologies, the world has become interconnected, providing unprecedented access to vast amounts of information. However, this accessibility has given rise to a phenomenon known as information overload [2]. In the digital age, individuals are bombarded with an overwhelming volume of data from various sources, leading to challenges in managing this influx. This information overload has significant implications, especially in the realm of education [3]. As traditional classrooms give way to virtual spaces, students and educators alike are navigating an information-rich environment. For learners, sifting through this deluge of data can be daunting, impacting their ability to focus, comprehend, and retain information. The digital era's blessings of abundant knowledge come hand-in-hand with the curse of information overload, necessitating a nuanced understanding of its effects, particularly in the educational landscape [4].

In response to the information revolution, the education landscape has undergone a radical transformation. Educational institutions worldwide are embracing technology, migrating to online platforms to meet the demands of a digital age [5]. This trend toward online education has seen a remarkable global surge. The convenience and accessibility offered by online learning platforms have opened new avenues for learners, transcending geographical boundaries [6]. However, this transition has also exposed students to the challenges of information overload. As online education becomes mainstream, learners find themselves amidst an overwhelming sea of digital resources, assignments, and communication channels [7]. Navigating

this digital labyrinth demands a delicate balance between harnessing the benefits of the information revolution and mitigating the adverse effects of information overload on students' mental well-being [8].

The close relationship between information overload and mental well-being cannot be overstated [9]. The digital barrage faced by learners can lead to increased stress, anxiety, and even depression [10]. As individuals grapple with the constant influx of information, their mental health becomes vulnerable. Recognizing this intricate connection is paramount in the digital education landscape. Based on the discussion, there are several research questions (RQ) to be addressed by the study: i) Are Malaysian online distance learners suffering from information overload, anxiety, stress, and depression? (RQ1); and ii) What is the relationship between information overload, anxiety, stress, and depression among Malaysian online distance learners? (RQ2).

2. PROBLEM STATEMENT AND RESEARCH GAP

In recent years, the proliferation of online education has revolutionized the way students acquire knowledge, with Malaysia being no exception to this global trend. As a significant portion of education has shifted to online platforms, Malaysian distance learners are confronted with a unique set of challenges. One of the primary concerns is the potential impact of information overload, anxiety, stress, and depression on these students' well-being. The digital age has provided unprecedented access to information, but it has also led to an overwhelming influx of data, creating a situation where learners might struggle to process the vast amount of information available to them [11]. This overload, coupled with the stressors of academic responsibilities, could potentially lead to anxiety and, in severe cases, even depression among online distance learners in Malaysia. Understanding the extent of these challenges and their interrelationships is crucial for educational institutions and policymakers to provide effective support systems.

While there is existing literature on information overload, anxiety, stress, and depression in various contexts, there is a noticeable gap concerning Malaysian online distance learners. The existing theories and studies have primarily focused on traditional classroom settings, and there is a scarcity of research specifically addressing the unique challenges faced by online learners in Malaysia [12]–[14]. Additionally, the intersectionality of information overload, anxiety, stress, and depression within the online learning environment remains underexplored theoretically. This study aims to bridge this theoretical gap by investigating these factors collectively, offering a comprehensive understanding of their relationships and implications on the mental well-being of Malaysian online distance learners.

Empirically, there is a dearth of comprehensive studies that examine the situation of information overload, anxiety, stress, and depression of Malaysian online distance learners. Existing research often focuses on one or two of these factors in isolation, providing fragmented insights [15], [16]. This study will contribute to the empirical gap by conducting a thorough investigation that encompasses all these variables simultaneously. By doing so, the research aims to provide nuanced findings that can guide educational institutions, policymakers, and mental health professionals in tailoring interventions specifically designed to address the unique challenges faced by Malaysian online distance learners. This comprehensive approach is essential for developing effective strategies that can enhance the overall well-being and learning experiences of these students, thus filling the existing empirical gap in the literature.

3. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Figure 1 depicts the theoretical framework of the study, delineating the associations among information overload, stress, anxiety, and depression. This framework derives its foundations from a comprehensive analysis of prior research, detailed extensively in subsequent sections. Within this framework, six hypotheses have been formulated, each designed to explore the interrelations between these variables. It is crucial to emphasize that our study adopts a perspective focused on correlation rather than causation.

3.1. Information overload

The prevalence of information overload has sparked divergent perspectives within scholarly discourse. While some regard it as a pressing contemporary challenge, others dismiss its significance, despite its recognition as a pivotal factor in numerous domains such as science, medicine, education, politics, governance, business, marketing, smart city planning, access to news, personal data tracking, home life, social media usage, and online shopping [17]. Information overload represents a detrimental psychological state wherein individuals perceive themselves inundated with excessive information, hindering their task performance [18]. This phenomenon presents emotional and cognitive challenges, often arising from intrinsic and extrinsic information attributes, ill-defined information needs, environmental factors, cognitive capacities, and task complexity [18].

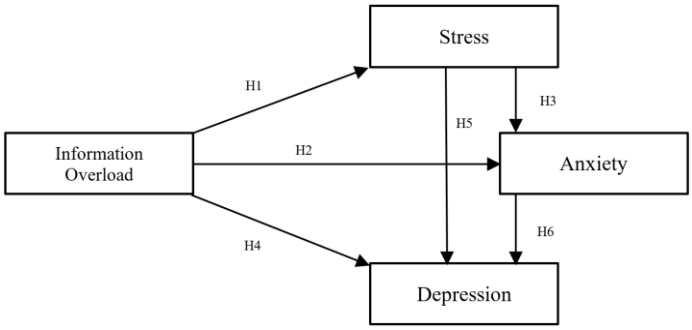

Figure 1. Theoretical framework

Crucially, information overload transcends mere information abundance or technological capacity [19]. Human factors significantly influence the situation, encompassing individuals' propensity to seek and share information through technology [19]. In the realm of education, scholars have underscored the challenge of information overload, particularly in the context of educational technology [20]. This issue profoundly impacts knowledge construction and student learning in online environments. Moreover, research has consistently linked information overload to stress, anxiety, and distress, affecting both students and working professionals alike [21]–[23].

3.2. Stress

Stress, a multifaceted concept, varies widely among individuals based on distinct circumstances. One of the most foundational definitions of stress, proposed by Hans Selye, conceptualizes it as the non-specific response of the body to any demand. In the realm of behavioral sciences, stress is perceived as the "perception of threat, leading to anxiety, discomfort, emotional tension, and challenges in adjustment." Among the myriad factors contributing to stress, information overload stands out prominently. Study by Gardani *et al.* [24] delved into the issue by surveying 10,000 undergraduate students at a major public university in the United States (US). Their study validated a two-factor model of perceived information overload, encompassing cyber-based and place-based sources of stimulation. Notably, higher levels of perceived cyber-based overload were significantly linked to elevated stress levels, poorer health, and reduced time spent on contemplative activities.

Similar patterns emerged in a study conducted by Ndumu [25], who explored the information behavior of Black immigrants in the United States. Participants described feeling overwhelmed due to the vast, dispersed nature of information, particularly within the intricate US information landscape. Research by Misra *et al.* [26] extended this exploration to emergency managers, finding a direct correlation between perceived information overload from digital sources and heightened stress levels. Furthermore, Wang *et al.* undertook a study involving Chinese adults [27], specifically focusing on COVID-19 information overload and its association with anxiety, depression, and posttraumatic stress disorder. Their findings provided compelling evidence: information overload significantly correlated with heightened anxiety, depression, and posttraumatic stress disorder among individuals. Building upon these studies, the present research hypothesizes: There is an association between information overload and stress (H1).

3.3. Anxiety

Anxiety, a complex emotional state interlinked with fear, manifests as a forward-looking mood characterized by intricate cognitive, affective, physiological, and behavioral responses. It stems from the anticipation of threatening events or circumstances [28]. Research by Xi [29] defined anxiety as a disconcerting personal sensation, emerging from non-adaptive physical and mental reactions triggered by intrusive thoughts about an uncertain future. Previous research has established a connection between anxiety and information overload. Matthes *et al.* [21] probed mobile information overload, employing qualitative interviews and contextual inquiry with nine smartphone users. Their findings revealed that five participants experienced varying levels of anxiety due to information overload. This anxiety was twofold: one facet arose from the awareness of an overwhelming volume of information, while the other involved anxious waiting for specific expected information.

In their study, Xu and Yan [23] explored the relationship between information overload and individual state anxiety in the context of routine epidemic prevention and management. The findings of their research, which involved 847 Chinese participants, demonstrated a substantial relationship between information overload and individual state anxiety levels. This relationship was found to be influenced by risk

perception and positive coping techniques. Huang *et al.* [30] conducted an investigation to explore the correlation between individuals' perception of information overload, their levels of anxiety, and their tendency to share unverified information on the social media platform WeChat. The findings of their online survey conducted in China, which had a sample size of 525 participants, indicated a positive correlation between perceived information overload and the tendency to share unverified information. Furthermore, the results suggested that anxiety had a partly mediation role in this relationship. The study by Wang *et al.* [31] examined the relationship between information overload and workplace anxiety in the context of enterprise social media (ESM). The findings of their study indicated that the presence of excessive information on electronic security management (ESM) platforms had a significant impact on increasing employees' levels of anxiety in the workplace. The presence of supervisor-subordinate instrumental links on ESM was found to diminish the strength of this relationship, whereas expressive ties were found to enhance the positive correlation between information overload and workplace anxiety. Drawing from these insights, the study posits the hypothesis: There is an association between information overload and anxiety (H2).

According to Manzar *et al.* [32], high levels of perceived stress and anxiety disorders often coexist, with stress frequently preceding the development of anxiety. Li and Hasson [33] conducted a study involving 71 professionalizing nursing students to investigate social-demographic data and establish correlations between stress and anxiety levels. The results revealed that students exhibited elevated levels of both stress and anxiety, with positive correlations between these two variables. In a similar vein, Ahmad *et al.* [34] surveyed 90 college students across arts, science, and commerce streams to explore the relationship between examination stress and anxiety. Their findings indicated a significant association between the two, emphasizing the impact of exam-related stress on the experience of anxiety.

Xi [29] delved into the self-perceived stress levels of health professions students at the Faculty of Medicine, examining its links to anxiety, depression, and health-related quality of life (QoL) among a sample of 451 students from various medical fields. Their study concluded that heightened perceived stress levels predispose health professions students to anxiety and lower overall QoL. Onieva-Zafra *et al.* [35] investigated the relationship between anxiety, perceived stress, and coping strategies employed by nursing students during clinical training. Their study involved 190 nursing students from Ciudad Real University in Spain, revealing a moderate level of stress among nursing students and a significant correlation with anxiety.

Manzar *et al.* [32] conducted a cross-sectional study spanning three months, involving 475 university students. Their research found that students with higher perceived stress levels, along with comorbid insomnia, were more likely to experience elevated anxiety levels. Interestingly, insomnia appeared to mediate the relationship between stress and anxiety in this cross-sectional study. Drawing from the collective findings, the following hypothesis is proposed: There is an association between stress and anxiety (H3).

3.4. Depression

The term “depression” finds its origins in the Latin word “*depression*”, meaning sinking [36]. This concept encompasses a spectrum, ranging from transient low moods in everyday life to a clinical syndrome marked by severe and enduring symptoms, distinct from normal emotional states [36]. Emerging research indicates a compelling link between information overload and the experience of depression. In a comprehensive study, Matthes *et al.* [21] explored the dynamic interplay between mobile social networking site (SNS) use, information overload, depressive symptoms, and overall well-being. Their findings, based on a diverse sample of 461 adults, revealed that YouTube use universally heightened perceived information overload. Interestingly, WhatsApp and Snapchat use led to information overload specifically among older adults, while Facebook and Instagram usage showed no such impact. Notably, perceptions of information overload significantly predicted depressive symptoms, emphasizing the connection between excessive information consumption and depression.

Fan and Smith [9] delved into the impact of COVID-19-related information overload on well-being in China. Surveying 1,349 participants, it underscored that perceptions of COVID-19 information overload and consequent panic were associated with negative well-being indicators, including stress, negative affect, anxiety, and depression. Furthermore, a research investigated the relationship between information overload and depressive symptoms in active Facebook users aged 18 to 34 in Bangkok [37]. Their study confirmed a significant association between perceived information overload and depressive symptoms, suggesting that heightened perceptions of information inundation correlated with increased depressive tendencies.

Building on social comparison theory and technostress literature, Matthes *et al.* [21] explored the impact of information overload and presented lifestyle in social media on depression. Analyzing 191 responses, the study established a significant relationship between information overload, presented lifestyle, and depression, shedding light on the psychological consequences of excessive online information consumption. Moreover, Wang *et al.* [27] examined the emotional and behavioral outcomes of COVID-19 information overload, focusing on cyber aggression, depression, and anxiety. Their extensive study involving

1,055 participants revealed a positive correlation between COVID-19 information overload and cyber aggression, depression, and anxiety. Importantly, depression and anxiety partially mediated the relationship between information overload and cyber aggression. Considering the wealth of evidence from these studies, it is reasonable to extend this understanding to online distance learners. Therefore, the following hypothesis is put forward: There is an association between information overload and depression (H4).

The intricate relationship between stress and depression is multifaceted and influenced by diverse life events and medical conditions [38]. Notably, stress can stem from a variety of experiences, including both positive events like promotions or marriages, and negative events such as financial difficulties or bereavement, whereas depression is predominantly associated with unwelcome occurrences [38]. Das and Sahoo's study [38], focusing on 51 postgraduate students, revealed a clear correlation between increasing stress levels and escalating depression among both male and female students. Further illuminating this connection, other study [39] explored the link between academic stress and depression in adolescents. Their study involving 1,120 high school students in Tamil Nadu, India, demonstrated that adolescents facing academic stress were at a significantly higher risk of experiencing depression, highlighting the critical impact of stress on mental health, especially during formative years.

Extending understanding to higher education, a comprehensive survey involving 1,245 veterinary medical students in North America was conducted [40]. The findings not only confirmed the prevalence of high stress and depression levels among veterinary medical students but also revealed a distinct correlation between stress and depression, with female students experiencing elevated levels of both compared to their male counterparts. This underscores the unique challenges faced by students in demanding academic fields. In the context of the COVID-19 pandemic, Liu *et al.* [41] delved into the association between perceived stress and depression among medical students in China. Their research not only established a significant link between perceived stress and depression but also identified insomnia as a crucial mediating factor in this relationship. These findings emphasize the intricate interplay of stress, insomnia, and depression, especially in the context of unprecedented global events. Based on the comprehensive insights provided by these studies, the following hypothesis is established: There is an association between stress and depression (H5).

In the realm of psychiatric illnesses, anxiety and depressive disorders stand as prevalent and interrelated conditions, often co-occurring and falling within the broader spectrum of internalizing disorders, as asserted by Kalin [42]. This connection between anxiety and depression has been substantiated by past research endeavors. There was a study aimed at elucidating the prevalence and predictors of anxiety and depression among female medical students at King Abdulaziz University in Jeddah, Saudi Arabia [43]. Their findings, derived from a sample of 450 medical students, revealed a positive correlation between depression and anxiety. Notably, depression emerged as a significant predictor of anxiety, and vice versa, underscoring the intricate interplay between these conditions.

In a longitudinal exploration, a study [44] investigated the relationship between preceding anxiety and subsequent depression, employing avoidance as a mediator and trauma as a moderator. Employing sophisticated structural equation models, their research demonstrated that anxiety predicted later depressive symptoms, with avoidance partially mediating this relationship. This study highlighted how anxiety might influence subsequent depression through avoidance behaviors, an association unaffected by the experience of trauma. Examining the impact of the pandemic, Shek *et al.* [45] explored the relationship between anxiety and depression, with a focus on the moderating role of spirituality indexed by life meaning. Their study affirmed that anxiety consistently predicted depression across multiple time points. Moreover, their multiple regression analyses indicated that life meaning served as a moderator, tempering the predictive effect of anxiety on depression. This nuanced exploration underlines the role of spirituality in mitigating the psychological impact of anxiety on depressive symptoms.

Furthermore, Wen *et al*. [46] delved into the mediating roles of sleep quality and QoL in the context of anxiety and depression among Chinese college students. Their extensive study involving 2,757 participants illuminated the complex relationships at play. Anxiety, they found, exerted both direct and indirect effects on depression, with sleep quality and QoL acting as independent mediators and, intriguingly, as chain mediators in the anxiety-depression relationship. Drawing from this rich body of empirical evidence, the present study posits the hypothesis that: There is an association between anxiety and depression (H6).

4. RESEARCH METHOD

4.1. Participants and data collection

The participants of this research encompassed individuals enrolled in online academic programs in Malaysian universities. Due to the absence of an established sampling framework, a purposive sampling technique, a non-probability method, was employed for participant selection, ensuring a representative sample from Malaysia. The selection was based on participants' expertise and willingness to align with the study's objectives, making purposive sampling apt. The survey consisted of two sections: the first collected

demographic data, including gender, age, educational institution, and program level. The second section delved into the constructs—information overload, anxiety, stress, and depression. Online survey questionnaires, distributed through Google Forms via email, facilitated accessible participation. Data collection transpired between October and November 2022. A five-point Likert scale gauged each construct. Analysis involved 384 valid responses, with questionnaires tailored from prior research. The questionnaires were in English, reflecting its widespread use in Malaysian universities. To address potential common method bias, the study employed Harman's single factor test using SPSS version 24.0. The results indicated that when constrained to one factor, all items accounted for only 31.8% of the total variance, falling below the benchmark of 50%. This finding suggests the absence of common method bias in the study's outcomes.

4.2. Measures

Since SmartPLS does not necessitate the assumption of data normality for analysis, the survey data in this study also does not conform to normal distribution techniques. The research employed partial least squares structural equation modeling (PLS-SEM) as the statistical tool to assess both the measurement and structural models. To gauge perceived stress, perceived information overload, anxiety, and depression, eight items were adapted, drawn from prior work by Masrek *et al.* [47]. Prior to implementation, these measures underwent rigorous evaluation. Initially, they were pre-tested by two experienced academicians—a professor and a senior lecturer—to ensure content validity. Following this, a pilot test was conducted with 43 randomly chosen online distance learners to assess reliability. The responses from these students were analyzed using statistical package for social science (SPSS), revealing Cronbach alpha scores well above 0.7 for each construct, indicating the measures' reliability for this study.

4.3. Data analysis

In this study, descriptive analysis for demographic data and the four key constructs was conducted using SPSS version 24.0. Confirmatory and exploratory analysis typically relies on appropriate methods [48]. In this research, SmartPLS 3.2.9 was employed, following the PLS-SEM approach for the measurement model, structural model, and hypothesis testing [49]. The use of PLS-SEM is recommended for common and composite-based populations [50]. To ascertain the necessary sample size, Soper's sample size calculator was utilized [51], indicating a requirement of 288 responses. Consequently, the study's sample size of 384 is deemed sufficient to conduct the essential analyses.

5. RESULTS

5.1. Common method bias

It is common to see Harman's single-factor score being used to test common method bias (CMB). Harman's test of all items (measuring latent variables) is loaded into one common factor. If the total variance for a single factor is less than 50%, it suggests that CMB does not affect the data, hence the results. For this study, all items from all constructs were entered for analysis and constrained to only a single factor. The results showed that the single factor explained only 31.8%, less than the benchmark value of 50% of the total variance, indicating that common method biasness was not a likely contaminant of the research.

5.2. Demographic profiles

Out of 384 respondents, 224 (58.3%) were female, while the remainder were male (160 or 41.7%). The largest age group is 21-25 (37%), followed by 26-30 (23.2%) and 31-35 (18.5%), while 51> is the smallest at 0.5%. Among the respondents, 271 or 70.6% have a bachelor's degree, 79, or 20.6% a diploma, 26 or 6.8% a master's degree, and 8 or 2.1% a doctoral degree. In this study, respondents' family monthly income was also recorded. Finding from figure shows that most of the respondents reported a monthly family income of less than RM5,000.00, comprising 259 respondents (67.4%). Subsequently, 109 participants (28.4%) fell within the income bracket of RM5,001.00 to RM10,000.00. The category with the lowest representation was those reporting a monthly family income exceeding RM10,000.00, accounting for 16 respondents (4.2%). In terms of family size, the predominant group consisted of households with four members, totaling 241 respondents (62.8%). Conversely, households with fewer than four members constituted 143 respondents (37.2%).

5.3. Descriptive analysis

Table 1 shows the mean and standard deviations for each variable in the present study. Respondents were asked to indicate their opinions on information overload, stress, anxiety, and depression. Information overload recorded the highest mean score of 2.86 out of 5.0 points with a standard deviation of 1.118, indicating that the respondents overwhelmingly concurred with the notion that an excessive volume of information related to COVID-19 exists, making it challenging for them to discern what constitutes accurate

and dependable information. Meanwhile, anxiety and depression recorded mean scores of 2.75 and 2.74 out of 5.0 points with standard deviations of 1.108 and 1.307, respectively, showing that some individuals experienced higher anxiety and depression levels while others reported lower levels. As far as stress is concerned, the recorded means are 2.58. Responses varied among participants, as indicated by a standard deviation of 1.101, showing that some individuals experienced higher stress levels while others reported lower levels.

Table 1. Descriptive analysis of construct

	Mean	Standard deviation
Information overload	2.86	1.118
Stress	2.58	1.101
Anxiety	2.75	1.108
Depression	2.74	1.307

5.4. Measurement model assessment

The assessment of the measurement model findings is presented in Table 2. The criteria employed to evaluate the measurement model included factor loading, composite reliability (CR), and average variance extracted (AVE). Sarstedt *et al.* [52] proposed a suggested threshold of 0.708 or greater for the loading of indicators in order to assess indicator reliability. According to previous research [53]–[55], loading values more than 0.7, 0.6, 0.5, and 0.4 respectively are considered sufficient. However, it is important to note that these loading values should be supplemented by other items that exhibit high loading scores, in order to ensure the accuracy and reliability of the AVE and CR measures. The CR and AVE benchmarks are 0.7 and 0.5, correspondingly. The findings shown in Table 2 indicate that all of the aforementioned criteria have been satisfied, hence implying that the measurement model has convergent validity. The measurement model assessment is depicted in Figure 2, which displays the SmartPLS result.

Following that, the model's discriminant validity was evaluated using the Heterotrait-Monotrait ratio of correlations (HTMT), as recommended by Sarstedt *et al.* [52]. In the present study, it was observed that all the HTMT values for each construct fell within the specified threshold values of 0.90 [56] and 0.85 [57]. Therefore, this suggests that the discriminant validity has been established. The fulfillment of each criterion, as indicated in Table 3, substantiates the assertion of discriminating validity for the measurement model.

Table 2. Factor loading, composite reliability, and average variance extracted

Item	Items code	Factor loading	CR	AVE
Anxiety	A1	0.777	0.910	0.629
	A2	0.763		
	A3	0.810		
	A4	0.748		
	A5	0.837		
	A6	0.817		
Depression	D2	0.707	0.907	0.622
	D3	0.680		
	D4	0.821		
	D5	0.866		
	D6	0.827		
	D7	0.814		
Information overload	IO1	0.723	0.900	0.531
	IO2	0.753		
	IO3	0.770		
	IO4	0.768		
	IO5	0.673		
	IO6	0.738		
	IO7	0.678		
	IO8	0.720		
Stress	S3	0.879	0.899	0.749
	S4	0.855		
	S5	0.861		

Table 3. HTMT assessment of discriminant validity

	Anxiety	Depression	Information overload	Stress
Anxiety				
Depression	0.855			
Information overload	0.560	0.486		
Stress	0.883	0.831	0.594	

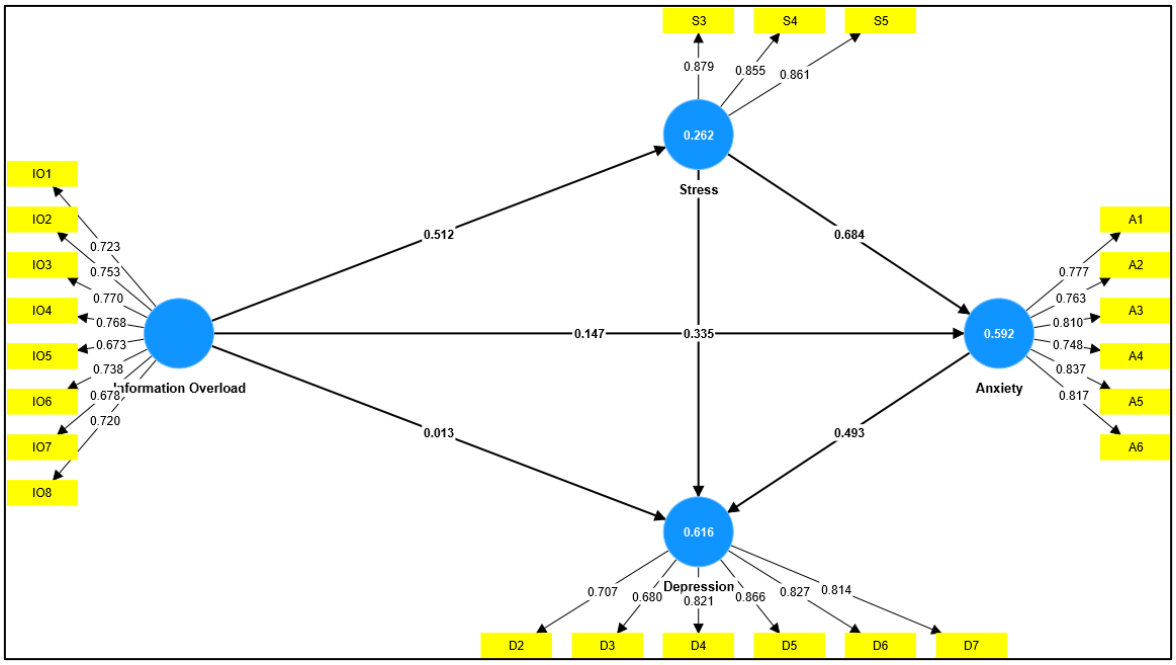

Figure 2. SmartPLS output of the measurement model

5.5. Structural model assessment

Table 4 exhibited the results of path analysis, VIF, f2, R2, and Q2 for information overload, stress, anxiety, and depression. The variance inflation factor (VIF) was evaluated to determine if there is a multicollinearity issue in the model and must be at a suggested value of VIF <5.0 [13] or VIF <3.3 [47]. The result of this procedure showed that the model is not having the problem of multicollinearity as all VIF values are well below 3.3. The rule used to interpret the results is: support the hypothesis when $p<0.001$ ($t>1.645$) or $p<0.05$ ($t>1.96$) or $p<0.001$ ($t>2.58$). The results have clearly demonstrated that all hypotheses are supported. The next step in assessing the significance and relevance of the structural model relationship is to assess the level of R2. Previous research [58] also recommends a different value of R2, where 0.26, 0.13, 0.02 respectively are described as substantial, moderate, and weak. The value of R2 in this study are 0.592 (substantial), 0.616 (substantial), and 0.262 (moderate).

The blindfolding procedure was also carried out using the D=7 distance omission by analyzing the predictive relevance. The predictive relevance Q^2 for stress, anxiety, and depression are 0.238, 0.176 and 0.254 respective. The result of the Q^2 value is considered above zero and can be concluded that the model has predictive relevance based on stress, anxiety, and depression (endogenous construct). Meanwhile, it is recommended by Sarstedt *et al.* [52] to assess the level of effect size (f2) using effect size proposed by Cohen [58]. The objective of the f2 assessment is to identify the level of the effect size of predator constructs on an endogenous construct [52], [58]. As recommended by Cohen [58], the recommended (f2) values, 0.35, 0.15, and 0.02 are interpreted as large, medium, and small with regard to the level of effect size. Table 4, the results showed that the effect is either small, medium, or large for all relationships except the relationship between information overload and depression which has no effect.

Table 4. Results of path analysis, VIF, f^2, R^2, and Q^2

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T values	P values	VIF	f^2	R^2	Q^2
Anxiety -> Depression	0.493	0.495	0.052	9.488	0.000	2.453	0.258	0.592	0.238
Information overload -> Anxiety	0.147	0.149	0.046	3.188	0.001	1.355	0.039	0.616	0.176
Information overload -> Depression	0.013	0.013	0.042	0.304	0.761	1.408	0.000	0.262	0.254
Information overload -> Stress	0.512	0.516	0.041	12.381	0.000	1.000	0.355		
Stress -> Anxiety	0.684	0.682	0.038	18.013	0.000	1.355	0.846		
Stress -> Depression	0.335	0.334	0.051	6.571	0.000	2.501	0.117		

6. DISCUSSION

6.1. Discussion related to RQ1

The descriptive analysis results present a striking departure from the prevailing trend observed in similar studies. Contrary to the findings of numerous past research endeavors [25], [31], [44]–[46], the respondents in this study, comprising online distance learners, did not exhibit signs of information overload, stress, anxiety, or depression. This deviation raises intriguing questions, prompting a deeper exploration into the underlying factors at play. One potential explanation for this deviation could be attributed to the distinctive nature of the academic programs pursued by the respondents. Unlike many previous studies, where participants were predominantly students enrolled in medical or health-related programs, our study focused on individuals pursuing non-medical programs. It is essential to recognize the inherent challenges associated with medical programs, which are widely acknowledged for their rigorous demands and intense curriculum. Consequently, it is understandable that students in such programs often grapple with varying degrees of information overload, stress, anxiety, or depression due to the complexity of their coursework and the high stakes involved in their studies.

Another compelling factor to consider is the timing of data collection in the cited studies. Many of these studies gathered data during the height of the COVID-19 pandemic when students were significantly constrained in their movement and mobility [23], [30], [34], [37], [41]. Under such circumstances, constant inundation with COVID-19 information likely contributed to information overload, leading to elevated levels of stress, anxiety, and depression among the students. In contrast, our study collected data when these restrictions had eased, allowing students more freedom in their movement and activities. This shift in circumstances might explain why our participants did not exhibit signs of information overload, stress, anxiety, and depression. The difference in the data collection periods highlights the impact of external factors, such as pandemic-related restrictions, on students' mental well-being, emphasizing the importance of contextual factors in understanding the psychological experiences of students.

6.2. Discussion related to RQ2

Intriguingly, despite indicating the absence of information overload, stress, anxiety, and depression among online distant learners, unveiled intriguing associations within these psychological domains. We observed a positive and significant relationship between information overload and stress, between information overload and anxiety, as well as between stress and anxiety and between anxiety and depression. Remarkably, these findings echo the patterns identified in prior studies referenced earlier [22], [23], [34], [37], [41], underscoring the consistency of these interconnections across diverse academic contexts.

However, deviating from our expectations, the study did not establish a significant association between information overload and depression among online distant learners. One plausible explanation for this unexpected outcome could lie in the proactive coping mechanisms developed by learners. It appears that online distant learners have adeptly devised coping strategies to navigate the realm of information overload. These strategies, which may encompass selective information processing, refined time management, or the efficient utilization of digital tools, seem to have effectively neutralized the detrimental impact of information overload on their mental well-being. Consequently, this resilience has led to the absence of a discernible link between information overload and depression, highlighting the adaptability and resourcefulness of these learners in managing the challenges of the digital information landscape. Further exploration into these coping strategies and their effectiveness could provide valuable insights into the nuanced dynamics of information processing and its influence on mental health among online distant learners.

7. CONCLUSION

This study's findings hold significant implications for both academic understanding and practical implementation in the realm of online education. By uncovering the complex interplay between information overload, stress, anxiety, and depression among online distant learners, this research enriches the existing knowledge base in educational psychology. The positive correlations identified between information overload and stress, as well as between information overload and anxiety, offer valuable insights for educators and institutions to develop targeted interventions and support systems. Understanding the pivotal role of stress and anxiety allows for the adoption of pedagogical approaches that foster a more conducive learning environment. Additionally, recognizing learners' adept coping mechanisms underscores the resilience of online distant learners and suggests avenues for enhancing adaptive skills within educational settings. Moreover, the implications extend to the policy-making and implementation of online education. As digital learning platforms continue to expand globally, prioritizing the mental health and well-being of online distant learners becomes essential. The insights emphasize the need for holistic student support services, including mental health resources and inclusive learning environments. By acknowledging potential stressors

and anxiety triggers related to information overload, institutions can design online curricula that promote balanced information dissemination and reduce overwhelming experiences for students.

Despite its contributions, the study acknowledges limitations in its methodological approach, particularly relying on perceptual measures for assessment. Future research endeavors should consider integrating diverse methods, including objective assessments and longitudinal studies, to provide a more comprehensive understanding of students' mental health dynamics in the digital learning landscape. By embracing methodological advancements, such as experimental designs and randomized controlled trials, researchers can further elucidate causal relationships and develop tailored interventions to mitigate the negative effects of information overload on students' psychological well-being. Overall, this study underscores the importance of a comprehensive approach to online education that prioritizes both academic growth and psychological resilience for a truly enriching learning experience.

ACKNOWLEDGEMENTS

This research was funded by Universiti Teknologi MARA under the DUCS scheme [File number:600-UiTMSEL (PI.5/4) (009/2022)].

REFERENCES

[1] O. Sarnavska, T. Yakovyshyna, O. Kachmar, M. Sherman, T. Shadiuk, and T. Koberska, "The influence of the culture of the third information revolution on the formation of personality in the M. Serres philosophical discourse," *Postmodern Openings*, vol. 12, no. 1, pp. 241–253, Mar. 2021, doi: 10.18662/po/12.1/257.

[2] A. Lehman and S. J. Miller, "A theoretical conversation about responses to information overload," *Information*, vol. 11, no. 8, p. 379, Jul. 2020, doi: 10.3390/info11080379.

[3] L. Lauri, S. Virkus, and M. Heidmets, "Information cultures and strategies for coping with information overload: case of Estonian higher education institutions," *Journal of Documentation*, vol. 77, no. 2, pp. 518–541, Nov. 2020, doi: 10.1108/JD-08-2020-0143.

[4] S. Fu, H. Li, Y. Liu, H. Pirkkalainen, and M. Salo, "Social media overload, exhaustion, and use discontinuance: Examining the effects of information overload, system feature overload, and social overload," *Information Processing & Management*, vol. 57, no. 6, p. 102307, Nov. 2020, doi: 10.1016/j.ipm.2020.102307.

[5] B. Yusuf, L. M. Walters, and S. N. Sailin, "Restructuring educational institutions for growth in the fourth industrial revolution (4IR): A systematic review," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 15, no. 03, p. 93, Feb. 2020, doi: 10.3991/ijet.v15i03.11849.

[6] S. Thakur, F. Mayabadi, F. Sabrina, and S. Sohail, "Online education: Challenges, tools, and emerging trends," in *Teaching and Learning in the Digital Era*, World Scientific, 2024, pp. 121–136. doi: 10.1142/9789811285622_0004.

[7] H. Alheneidi, M. Alterkait, and A. Smith, "Exploring the influence of e-learning systems on information overload and social media addiction during the Covid-19 pandemic," *Sumerianz Journal of Social Science*, no. 42, pp. 59–64, Apr. 2021, doi: 10.47752/sjss.42.59.64.

[8] W. Li and A. N. Khan, "Investigating the impacts of information overload on psychological well-being of healthcare professionals: Role of COVID-19 stressor," *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, vol. 59, p. 004695802211096, Jan. 2022, doi: 10.1177/00469580221109677.

[9] J. Fan and A. P. Smith, "Information overload, well-being, and COVID-19: a survey in China," *Behavioral Sciences*, vol. 11, no. 5, p. 62, Apr. 2021, doi: 10.3390/bs11050062.

[10] R. G. Steele, J. A. Hall, and J. L. Christofferson, "Conceptualizing digital stress in adolescents and young adults: Toward the development of an empirically based model," *Clinical Child and Family Psychology Review*, vol. 23, no. 1, pp. 15–26, Mar. 2020, doi: 10.1007/s10567-019-00300-5.

[11] M. A. Siason, "Data, communication, and human cognition: Challenges and best practices," *SSRN Electronic Journal*, 2020, doi: 10.2139/ssrn.3665779.

[12] A. S. Radeef and G. G. Faisal, "Depression, anxiety and stress among pharmacy students in Malaysia," *Journal of International Dental and Medical Research*, vol. 13, no. 2, pp. 628–632, 2020.

[13] W. S. Wan Ismail *et al.*, "The relations of internet and smartphone addictions to depression, anxiety, stress, and suicidality among public university students in Klang Valley, Malaysia," *Perspectives in Psychiatric Care*, vol. 56, no. 4, pp. 949–955, Oct. 2020, doi: 10.1111/ppc.12517.

[14] M. H. L. Lee, M. Kaur, V. Shaker, A. Yee, R. Sham, and C. S. Siau, "Cyberbullying, social media addiction and associations with depression, anxiety, and stress among medical students in Malaysia," *International Journal of Environmental Research and Public Health*, vol. 20, no. 4, p. 3136, Feb. 2023, doi: 10.3390/ijerph20043136.

[15] N. E. Mohamad, S. M. Sidik, M. Akhtari-Zavare, and N. A. Gani, "The prevalence risk of anxiety and its associated factors among university students in Malaysia: a national cross-sectional study," *BMC Public Health*, vol. 21, no. 1, p. 438, Mar. 2021, doi: 10.1186/s12889-021-10440-5.

[16] S. S. Wong, C. C. Wong, K. W. Ng, M. F. Bostanudin, and S. F. Tan, "Depression, anxiety, and stress among university students in Selangor, Malaysia during COVID-19 pandemics and their associated factors," *PLOS ONE*, vol. 18, no. 1, p. e0280680, Jan. 2023, doi: 10.1371/journal.pone.0280680.

[17] D. Bawden and L. Robinson, "Information overload: an overview," in *Oxford Research Encyclopedia of Politics*, Oxford: Oxford University Press, 2020. doi: 10.1093/acrefore/9780190228637.013.1360.

[18] M. A. Belabbes, I. Ruthven, Y. Moshfeghi, and D. R. Pennington, "Information overload: a concept analysis," *Journal of Documentation*, vol. 79, no. 1, pp. 144–159, Jan. 2023, doi: 10.1108/JD-06-2021-0118.

[19] O. D. Apuke, B. Omar, E. A. Tunca, and C. V. Gever, "Information overload and misinformation sharing behaviour of social media users: Testing the moderating role of cognitive ability," *Journal of Information Science*, p. 016555152211219, Sep. 2022, doi: 10.1177/01655515221121942.

[20] N. H. Al-Kumaim, S. H. Hassan, M. S. Shabbir, A. A. Almazroi, and H. M. A. Al-Rejal, "Exploring the inescapable suffering among postgraduate researchers: information overload perceptions and implications for future research," *International Journal of Information and Communication Technology Education*, vol. 17, no. 1, pp. 19–41, Jan. 2021, doi: 10.4018/IJICTE.2021010102.
[21] J. Matthes, K. Karsay, D. Schmuck, and A. Stevic, "'Too much to handle': Impact of mobile social networking sites on information overload, depressive symptoms, and well-being," *Computers in Human Behavior*, vol. 105, p. 106217, Apr. 2020, doi: 10.1016/j.chb.2019.106217.
[22] J. Wang, X. Huang, Y. Wang, M. Wang, J. Xu, and X. Li, "COVID-19 information overload, negative emotions and posttraumatic stress disorder: a cross-sectional study," *Frontiers in Psychiatry*, vol. 13, May 2022, doi: 10.3389/fpsyt.2022.894174.
[23] C. Xu and W. Yan, "The relationship between information overload and state of anxiety in the period of regular epidemic prevention and control in China: a moderated multiple mediation model," *Current Psychology*, vol. 42, no. 25, pp. 21842–21859, Sep. 2023, doi: 10.1007/s12144-022-03289-3.
[24] M. Gardani *et al.*, "A systematic review and meta-analysis of poor sleep, insomnia symptoms and stress in undergraduate students," *Sleep Medicine Reviews*, vol. 61, p. 101565, Feb. 2022, doi: 10.1016/j.smrv.2021.101565.
[25] A. Ndumu, "Linkages between information overload and acculturative stress: The case of Black diasporic immigrants in the US," *Journal of Librarianship and Information Science*, p. 096100061985711, Jul. 2019, doi: 10.1177/0961000619857115.
[26] S. Misra, P. Roberts, and M. Rhodes, "Information overload, stress, and emergency managerial thinking," *International Journal of Disaster Risk Reduction*, vol. 51, p. 101762, Dec. 2020, doi: 10.1016/j.ijdrr.2020.101762.
[27] Q. Wang, X. Luo, R. Tu, T. Xiao, and W. Hu, "COVID-19 information overload and cyber aggression during the pandemic lockdown: the mediating role of depression/anxiety and the moderating role of Confucian responsibility thinking," *International Journal of Environmental Research and Public Health*, vol. 19, no. 3, p. 1540, Jan. 2022, doi: 10.3390/ijerph19031540.
[28] S. P. Chand and R. Marwaha, "Anxiety," in *StatPearls*, StatPearls Publishing, 2023.
[29] Y. Xi, "Anxiety: a concept analysis," *Frontiers of Nursing*, vol. 7, no. 1, pp. 9–12, Mar. 2020, doi: 10.2478/fon-2020-0008.
[30] Q. Huang, S. Lei, and B. Ni, "Perceived information overload and unverified information sharing on WeChat amid the COVID-19 pandemic: A moderated mediation model of anxiety and perceived herd," *Frontiers in Psychology*, vol. 13, Feb. 2022, doi: 10.3389/fpsyg.2022.837820.
[31] C. Wang, T. Yuan, J. Feng, and X. Peng, "How can leaders alleviate employees' workplace anxiety caused by information overload on enterprise social media? Evidence from Chinese employees," *Information Technology & People*, vol. 36, no. 1, pp. 224–244, Jan. 2023, doi: 10.1108/ITP-01-2021-0097.
[32] M. D. Manzar, M. Salahuddin, S. R. Pandi-Perumal, and A. S. Bahammam, "Insomnia may mediate the relationship between stress and anxiety: a cross-sectional study in university students," *Nature and Science of Sleep*, vol. 13, pp. 31–38, Jan. 2021, doi: 10.2147/NSS.S278988.
[33] Z.-S. Li and F. Hasson, "Resilience, stress, and psychological well-being in nursing students: A systematic review," *Nurse Education Today*, vol. 90, p. 104440, Jul. 2020, doi: 10.1016/j.nedt.2020.104440.
[34] I. Ahmad, R. Gul, and M. Zeb, "A qualitative inquiry of university student's experiences of exam stress and its effect on their academic performance," *Human Arenas*, Apr. 2022, doi: 10.1007/s42087-022-00285-8.
[35] M. D. Onieva-Zafra, J. J. Fernández-Muñoz, E. Fernández-Martínez, F. J. García-Sánchez, A. Abreu-Sánchez, and M. L. Parra-Fernández, "Anxiety, perceived stress and coping strategies in nursing students: a cross-sectional, correlational, descriptive study," *BMC Medical Education*, vol. 20, no. 1, p. 370, Dec. 2020, doi: 10.1186/s12909-020-02294-z.
[36] A. Thapar, O. Eyre, V. Patel, and D. Brent, "Depression in young people," *The Lancet*, vol. 400, no. 10352, pp. 617–631, Aug. 2022, doi: 10.1016/S0140-6736(22)01012-1.
[37] V. Taechajinda, "Facebook and depression in COVID-19 pandemic: the role of time spent on information overload and depressive symptoms with trait rumination as a moderator," Chulalongkorn University, Bangkok, Thailand, 2021. doi: 10.58837/CHULA.THE.2021.338.
[38] P. P. P. Das and R. Sahoo, "Stress and depression among post-graduate students," *International Journal of Scientific and Research Publications*, vol. 2, no. 7, pp. 1–5, 2012.
[39] C. Zhang *et al.*, "Associations between academic stress and depressive symptoms mediated by anxiety symptoms and hopelessness among Chinese college students," *Psychology Research and Behavior Management*, vol. 15, pp. 547–556, Mar. 2022, doi: 10.2147/PRBM.S353778.
[40] H. W. Q. Chan and C. F. R. Sun, "Irrational beliefs, depression, anxiety, and stress among university students in Hong Kong," *Journal of American College Health*, vol. 69, no. 8, pp. 827–841, Nov. 2021, doi: 10.1080/07448481.2019.1710516.
[41] Z. Liu *et al.*, "Association between perceived stress and depression among medical students during the outbreak of COVID-19: The mediating role of insomnia," *Journal of Affective Disorders*, vol. 292, pp. 89–94, Sep. 2021, doi: 10.1016/j.jad.2021.05.028.
[42] N. H. Kalin, "The critical relationship between anxiety and depression," *American Journal of Psychiatry*, vol. 177, no. 5, pp. 365–367, May 2020, doi: 10.1176/appi.ajp.2020.20030305.
[43] C. C. G. da Silva, C. V. Bolognani, F. F. Amorim, and A. M. Imoto, "Effectiveness of training programs based on mindfulness in reducing psychological distress and promoting well-being in medical students: a systematic review and meta-analysis," *Systematic Reviews*, vol. 12, no. 1, p. 79, May 2023, doi: 10.1186/s13643-023-02244-y.
[44] N. H. Zainal and M. G. Newman, "Increased inflammation predicts nine-year change in major depressive disorder diagnostic status," *Journal of Abnormal Psychology*, vol. 130, no. 8, pp. 829–840, Nov. 2021, doi: 10.1037/abn0000716.
[45] D. T. L. Shek, W. Chai, and L. Tan, "The relationship between anxiety and depression under the pandemic: The role of life meaning," *Frontiers in Psychology*, vol. 13, Nov. 2022, doi: 10.3389/fpsyg.2022.1059330.
[46] L. Wen *et al.*, "Associations between Chinese college students' anxiety and depression: A chain mediation analysis," *PLOS ONE*, vol. 17, no. 6, p. e0268773, Jun. 2022, doi: 10.1371/journal.pone.0268773.
[47] M. N. Masrek, W. Ahmed, A. Jalil, and M. F. Baharuddin, "Mobile game addiction and social interaction anxiety of Malaysian youth," *Environment-Behaviour Proceedings Journal*, vol. 7, no. SI10, pp. 3–8, Nov. 2022, doi: 10.21834/ebpj.v7iSI10.4094.
[48] J. Benitez, J. Henseler, A. Castillo, and F. Schuberth, "How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research," *Information & Management*, vol. 57, no. 2, p. 103168, Mar. 2020, doi: 10.1016/j.im.2019.05.003.
[49] C. M. Ringle, S. Wende, and J.-M. Becker, "SmartPLS3 (version 3.2.9)." SmartPLS, Bönningstedt, 2020. [Online]. Available: www.smartpls.com
[50] C. M. Ringle, M. Sarstedt, R. Mitchell, and S. P. Gudergan, "Partial least squares structural equation modeling in HRM research," *The International Journal of Human Resource Management*, vol. 31, no. 12, pp. 1617–1643, Jul. 2020, doi: 10.1080/09585192.2017.1416655.
[51] D. S. Soper, "A-priori Sample Size Calculator for Structural Equation Models." 2023. [Online]. Available: https://www.danielsoper.com/statcalc

[52] M. Sarstedt, J. F. Hair, M. Pick, B. D. Liengaard, L. Radomir, and C. M. Ringle, "Progress in partial least squares structural equation modeling use in marketing research in the last decade," *Psychology & Marketing*, vol. 39, no. 5, pp. 1035–1064, May 2022, doi: 10.1002/mar.21640.
[53] A. Almarzouqi, A. Aburayya, and S. A. Salloum, "Prediction of user's intention to use metaverse system in medical education: A hybrid SEM-ML learning approach," *IEEE Access*, vol. 10, pp. 43421–43434, 2022, doi: 10.1109/ACCESS.2022.3169285.
[54] G. Dash and J. Paul, "CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting," *Technological Forecasting and Social Change*, vol. 173, p. 121092, Dec. 2021, doi: 10.1016/j.techfore.2021.121092.
[55] W. Wan and L. Liu, "Intrapreneurship in the digital era: driven by big data and human resource management?" *Chinese Management Studies*, vol. 15, no. 4, pp. 843–875, Sep. 2021, doi: 10.1108/CMS-07-2020-0282.
[56] J. Konopik, C. Jahn, T. Schuster, N. Hoßbach, and A. Pflaum, "Mastering the digital transformation through organizational capabilities: A conceptual framework," *Digital Business*, vol. 2, no. 2, p. 100019, 2022, doi: 10.1016/j.digbus.2021.100019.
[57] R. B. Kline, *Principles and practice of structural equation modeling*. New York: Guilford Publications, 2023.
[58] D. Lakens, "Sample size justification," *Collabra: Psychology*, vol. 8, no. 1, Mar. 2022, doi: 10.1525/collabra.33267.

BIOGRAPHIES OF AUTHORS

Mohamad Noorman Masrek is a professor of Information Systems Management at the Faculty of Information Management, Universiti Teknologi MARA (UiTM). He holds his MSc from UiTM and PhD in Information Technology from Islamic International University Malaysia (IIUM). His research interests are in the area of assessment of technology effectiveness; diffusion and infusion of technologies; systems design, development and implementation; strategic information systems planning; knowledge management and organizational behavior; data mining and knowledge discovery. He can be contacted at email: mnoorman@uitm.edu.my.

Mohammad Fazli Baharuddin holds a Doctor of Philosophy (PhD) degree in Information Management and currently serves as a Senior Lecturer at the School of Information Science, College of Computing, Informatics, and Mathematics at Universiti Teknologi MARA in Malaysia. His research interests encompass information literacy, digital literacy, data science, innovative work behavior and digital citizenship. In the academic context, his contributions involve conducting research, disseminating knowledge, and likely instructing students, with a focus on information management and related subjects. He can be contacted at email: fazli811@uitm.edu.my.

Abdurrahman Jalil holds a Doctor of Philosophy (PhD) degree in Information Systems and currently serves as a Senior Lecturer at the School of Information Science, College of Computing, Informatics, and Mathematics at Universiti Teknologi MARA in Malaysia. His research interests encompass mobile application, digital social innovation, internet of things, cloud computing and artificial intelligence. He can be contacted at email: abdurrahman.jalil@uitm.edu.my.

Fadhilah Aman holds a Doctor of Philosophy (PhD) degree in Information Systems and currently serves as a Senior Lecturer at the School of Information Science, College of Computing, Informatics, and Mathematics at Universiti Teknologi MARA in Malaysia. Her research interest's information system, knowledge management system and information system adoption. She can be contacted at email: fadhilahaman@uitm.edu.my.