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Exploration of vulnerability factors of digital hoarding behavior among university students and the moderating role of maladaptive perfectionism

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Abstract

In light of the rapidly evolving digital landscape, there is an increasing need to explore digital hoarding behavior. This need is driven by concerns regarding its intricate psychological foundations and its impact on individuals within our technology-centric society. This research investigates the influence of various factors, including the fear of missing out, emotional attachment, information overload, and decision fatigue, on digital hoarding behaviors among university students in Iran. Additionally, the study examines the moderating role of maladaptive perfectionism in these relationships. The study involved 275 university students (mean age = 21.62 years; standard deviation = 2.28 years; 65.6% female) selected from four universities in Iran. The data were analyzed using partial least squares structural equation modeling (PLS-SEM). The results revealed that the fear of missing out, emotional attachment, information overload, and decision fatigue significantly predict university students' digital hoarding behavior. Moreover, the findings highlighted the moderating effect of maladaptive perfectionism on the association between emotional attachment and digital hoarding behavior. This suggests that individuals with higher levels of maladaptive perfectionism exhibit amplified digital hoarding tendencies when emotionally attached to their digital data. This study provides a deeper understanding of the relationship between psychological factors and digital hoarding tendencies. These findings have practical implications for educational institutions and mental health professionals, as they can help in developing targeted strategies and interventions to manage digital hoarding behavior in university freshmen and promote healthier digital habits.

Keywords

Decision fatigue, digital hoarding behavior, fear of missing out, emotional attachment, maladaptive perfectionism, university students

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Introduction

The way individuals engage with information, communicate, and save personal content has changed dramatically due to the fast growth of digital technology and the widespread usage of digital devices. A distinct phenomenon known as "digital hoarding" has appeared within this contemporary digital landscape, characterized by an excessive accumulation of digital files or data and a refusal to delete them, which results in cluttered and disorganized digital spaces.[1–3] Among the various populations in the digital

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world, university students have emerged as a highly active group, utilizing digital platforms for social networking and academic and personal activities.[4–7] Neiterman and Zaza[8] found that 49% of university students had trouble organizing their digital files and felt overwhelmed by the volume of information available to them online. Consequently, the study of university students' digital hoarding behavior (DHB) has attracted increasing attention in academic spaces.[9]

Multiple variables influence university students' DHB. Understanding these variables is critical to developing successful therapies and techniques to combat digital hoarding. Attachment theory, developed by Bowlby,[10] is a well-established psychological theory that investigates the dynamics of interpersonal connections and their impact on human behavior and development. This theory can provide valuable insight into the underlying factors contributing to university students' propensity to hoard digital content.

According to the attachment theory, early attachment experiences shape an individual's ability to regulate emotions in adulthood. Students experiencing information overload and decision fatigue may have difficulty regulating their emotions, resulting in an increased amount of negative emotions as they struggle to gather relevant information, weigh options, and consider long-term consequences.[11–13] As a result, these students may avoid making decisions completely, preferring, instead, to save all their digital assets. This avoidance results in the accumulation of digital clutter, which can lead to digital hoarding.[3,14–16]

Furthermore, the attachment theory sheds light on how students with insecure attachment styles, especially anxious attachments,[17,18] may be more prone to experiencing the "fear of missing out" (FoMO). "Anxious attachment" refers to a personality trait defined by an excessive need for reassurance and validation from others, generally motivated by a fear of abandonment or rejection.[19] Students with anxious attachment styles may fear being left out or excluded from social situations.[20] This fear arises from their anxieties and concerns about rejection or abandonment. Consequently, to ease their FoMO, these individuals may obsessively update their digital gadgets to ensure they always have the latest information and social connections. These students may engage in digital hoarding tendencies to cope with their anxieties.[21,22]

Students may also form emotional attachments to digital data, viewing them as sources of information, comfort, or security.[23] These attachments help students maintain their connections to past experiences and memories and may even be utilized to shape their identities. Due to the emotional relevance of these digital belongings, students may be hesitant to delete or organize them, thus leading to the accumulation of digital clutter. Luxon et al.[24] studied DHB exhibited by university students. The study discovered that emotional attachment to digital possessions and the fear of losing essential information contributed significantly to DHB. The moderating impact maladaptive perfectionism has on DHB is critical to understanding this phenomenon. Individuals suffering from maladaptive perfectionism frequently engage in self-critical and self-demanding thoughts and behaviors, striving for perfection in all parts of their lives.[25] In this study's context, maladaptive perfectionism can exacerbate the negative repercussions of digital hoarding. The cluttered digital world that arises from hoarding can exacerbate individuals' perfectionistic tendencies, leading to heightened worry and stress levels. The desire for order and perfection may make discarding or managing digital content daunting for these individuals.

Despite the growing recognition of digital hoarding as a concern among university students, there exists a compelling need to deepen our theoretical understanding of this emerging phenomenon and to supplement existing research that primarily focuses on the negative aspects of technology usage. Drawing inspiration from related disciplines such as psychology, notably the attachment theory, the present study seeks to address the existing gap in research pertaining to vulnerability factors associated with DHB in educational settings. To date, there has been no research that posits a hypothesis suggesting that university students who exhibit higher levels of maladaptive perfectionism may develop stronger emotional connections, experience increased FoMO, face more instances of information overload, and be more susceptible to decision fatigue than their peers. Therefore, this study proposes that these factors may increase university students' likelihood of engaging in digital hoarding. Thus, the core objectives of this research are (a) to assess the pathways connecting FoMO, emotional attachment, information overload, and decision fatigue to DHB and (b) to explore how maladaptive perfectionism moderates these relationships among university students in Iran.

Theoretical background and hypothesis development

In this study, John Bowlby's attachment theory, proposed in 1959, was employed to investigate the emotional and psychological factors associated with DHB among Iranian university students. Attachment theory, originally focused on the formation of emotional bonds between infants and caregivers, has been expanded to examine hoarding tendencies in adulthood.[3,26] The theory suggests that attachment styles, including anxious and avoidant attachment styles, can play a crucial role in understanding the relationships between information overload, decision fatigue, emotional attachment, FoMO, and DHB.

According to the theory, university students with an avoidant attachment style, characterized by a desire for independence and self-reliance, may be susceptible to

DHB. Their preference for emotional distance and self-preservation may lead them to accumulate and hoard digital content to control or avoid vulnerability. They may be more prone to experiencing information overload and decision fatigue, which can further reinforce their inclination towards digital hoarding. Students with an anxious attachment style, characterized by a fear of abandonment or rejection, may experience heightened FoMO and form stronger emotional attachments to their digital content. Their emotional reliance on digital possessions may be driven by FoMO or a fear of losing connections and can contribute to increase DHB.

The theory further suggests that an inclination toward perfectionism can moderate the relationship between attachment styles and DHB. By considering the moderating role of perfectionism, specifically maladaptive perfectionism, the theory can highlight the potential influences attachment styles and perfectionism have on digital hoarding tendencies. This understanding can inform interventions and strategies to address DHB in university students while considering attachment-related variables and perfectionistic tendencies. In this study, maladaptive perfectionism was identified as a moderating variable, while FoMO, emotional attachment, information overload, and decision fatigue were identified as direct variables of DHB in university students.

Fear of missing out

FoMO is a psychological phenomenon that occurs when individuals perceive themselves as missing out on experiences that others are enjoying, especially when these experiences are viewed as superior to their own.[27] In the context of DHB, FoMO represents the emotional state that compels individuals to collect and amass digital content due to their fear of missing critical information.[28] A survey among 556 social networking users in China found that FoMO serves as a mediating factor in the relationship between self-comparisons with others on social networking sites and engagement in DHB.[21] The results indicated that comparing oneself with others on social networking sites is positively associated with FoMO, which, in turn, is positively correlated with DHB. Previous research conducted in workplace settings has also demonstrated that FoMO significantly influences the accumulation of digital materials and the challenges associated with their deletion.[29] Qualitative research conducted in the UK, involving 46 participants in workplace settings, revealed that the sentimental value attributed to hoarding physical possessions is linked to the fear of losing important items.[30] However, no studies have investigated the association between FoMO and digital hoarding among university students.

Therefore, the current study posits the following hypothesis:

H1: There is a positive association between FoMO and the DHB of university students.

Emotional attachment

Emotional attachment, encompassing our feelings and beliefs regarding our possessions, plays a significant role in the development and persistence of hoarding behavior.[31] It stands as one of the pivotal elements, alongside factors like information processing methods (such as sorting and decision-making) and our emotional responses to our belongings, which encompass experiencing pleasure, feeling pride, or facing emotions like grief, anxiety, and loss.[32] In a study conducted by Sweeten et al.,[30] which investigated the DHB of 43 individuals, a clear connection between physical and digital hoarding emerged. DHB involves the excessive accumulation of digital items, difficulties in deleting them, and the emotional distress linked to this behavior.

Another study, involving 101 Pinterest users without clinical hoarding issues, discovered that emotional attachment to electronic items played a role in the relationship between the severity of hoarding behavior and the level of distress individuals experienced when asked to part with their digital possessions.[24] These findings substantiate earlier research identifying a connection between digital and physical hoarding. Furthermore, research links increased negative emotions when individuals imagine discarding items to the severity of hoarding problems.[32] In the same study, it was also observed that individuals with emotional attachments to their digital possessions and higher digital hoarding scores were more prevalent among 282 participants in the UK who selected digital images or videos.

This raises the following question: What is the nature and extent of the relationship between emotional attachment and DHB in university students, and how does it contribute to our understanding of hoarding tendencies in this specific demographic? To answer this question, a second hypothesis was formulated for this study:

H2: There is a positive correlation between emotional attachment and DHB in university students.

Information overload

Information overload occurs when individuals are exposed to an overwhelming volume of information that exceeds their capacity for efficient processing and management.[33] This deluge of data often complicates the task of organizing and handling the received information. Consequently, individuals may resort to accumulating digital content, a behavior referred to as DHB. In a study centered on emergency management, conducted by Misra et al.,[34] the findings indicated that individuals who perceived themselves as

inundated with a substantial volume of information from digital sources tended to report elevated levels of stress. Furthermore, an earlier study by Landau et al.[35] suggested that stress might play a pivotal role in hoarding disorder, and the sensation of being overwhelmed by information could potentially contribute to the development of such a disorder.

Perceived information overload, especially in the realm of social media, not only induces negative emotional states but can also precipitate adverse behavioral responses, as noted by Luqman et al.[36] Moreover, empirical investigations have substantiated a correlation between information overload and internet addiction, as evidenced by the research conducted by Alheneidi.[37] In a previous study, Alheneidi et al.[38] ascertained that excessive exposure to information on social media platforms resulted in heightened stress among users and could ultimately lead to exhaustion. Additionally, analysis of data from 405 WeChat users and 442 smartphone app users demonstrated that information overload and communication overload exert a positive influence on users' exhaustion.[39] The results of survey data obtained from 324 lawyers revealed that excessive and uncontrolled usage of social media was a strong predictor for technostress among them.[40] Another study from 618 WeChat users confirmed that information overload and communication overload positively impacted young people's fatigue.[41] However, despite the existing body of research examining the impact of technology-induced stress and information overload on negative behaviors,[42] there remains a dearth of studies explicitly exploring the potential link between information overload and DHB among university students. Thus, a third hypothesis has been formulated for this study:

H3: There exists a positive association between information overload and the DHB exhibited by college students.

Decision fatigue

Decision fatigue is a widely acknowledged idea in the field of health psychology.[43] It emerges from the belief that prolonged activities can lead to stress and exhaustion, a concept commonly discussed in the study of how our brains work.[44] Decision fatigue, as explained by Moscote-Salazar et al.,[44] refers to the decreasing ability to make the best decisions as the day goes on. This concept is closely linked to a theory called ego depletion, which was first developed by Baumeister et al.[45]

Previous research has indicated that individuals experiencing high levels of ego depletion tend to engage in surface-level thinking processes, similar to what is observed in digital hoarders who accumulate numerous digital files without considering their value.[44,46,47] Despite these findings, there has not been a study specifically addressing how this relates to DHB. Hence, we pose the question of whether there is a relationship between decision fatigue and DHB among university students, as stated in its fourth hypothesis:

H4: There is a positive association between decision fatigue and the DHB of university students.

Maladaptive perfectionism as a moderator of digital hoarding behavior

Perfectionism is a personality trait characterized by setting high standards for oneself and often being overly critical.[48] It comes in two forms: one that can be helpful, called perfectionistic strivings, which motivates individuals to do well, feel satisfied, and achieve their goals, leading to positive outcomes.[48,49] However, when perfectionism takes a less helpful form, known as maladaptive perfectionism, individuals may become excessively focused on the gap between their high standards and their actual performance, which can lead to negative consequences.[50] This negative form of perfectionism has been linked to various problems, including obsessive-compulsive behaviors like hoarding.[51,52]

In today's digital age, people with maladaptive perfectionism tendencies are more likely to exhibit hoarding behaviors online. They may attach excessive importance to their digital possessions, making it hard to delete files or let go, resulting in a cluttered digital space. Despite the increasing occurrence of obsessive-compulsive disorder symptoms in individuals with high maladaptive perfectionism in different contexts,[53–55] there have been no studies exploring how maladaptive perfectionism influences digital behavior. While Wei et al.[56] stated that maladaptive perfectionism moderates adult attachment and depression, its role as a moderator in DHB has not been studied. More research is needed to understand how maladaptive perfectionism interacts with DHB and related factors. Therefore, this study introduces its final hypothesis:

H5: Maladaptive perfectionism moderates the relationships between FoMO, emotional attachment, information overload, decision fatigue, and students' DHB.

The current study

Due to filtering practices such as censorship, Iranian students may have difficulties accessing the full range of academic resources and materials available online. This limited access prompts them to retain and store as much digital information as possible, fearing that it may become inaccessible in the future. They may perceive these resources as being valuable and essential to their studies, leading to a tendency to hoard digital content.[57] It is, therefore, crucial to understand the psychological variables affecting Iranian students when examining their DHB and

developing effective strategies to support their information management needs.

It should be noted that digital hoarding is a relatively new field of study that has received less academic attention than other fields, particularly in Iran. Previous research in Iran primarily focused on digital habits, information gathering, technology usage, information management, digital addiction, and psychological elements of digital engagement.[58–62] These studies, however, did not properly reflect the distinct characteristics and dynamics of university students' DHB. The present study aims to fill this research gap by examining whether FoMO, emotional attachment, information overload, and decision fatigue can impact DHB in Iranian university students. Furthermore, it investigates how maladaptive perfectionism moderates the relationships between these factors (Figure 1).

Method

Participants

This study utilized cross-sectional analysis to study 300 university students from four private universities located in Tehran. Tehran, Iran's capital city, was selected because it is the most highly populated and racially diverse state in Iran, thus providing the best opportunity for generalizing the study findings. A random multistage cluster sampling method was used as a probability-based approach, effectively segmenting the sample.[58] To begin, we divided Tehran into four geographic zones: Northern, Central, Southern, and East Zones. From each of these zones, we randomly selected one municipal district to represent the respective geographic region. From each selected municipal district, one university was chosen, and within each university, three classes were selected, with approximately 75 students participating from each university. Students from these classes at each university were chosen using random number generator software. The inclusion criteria for participants were first-year and full-time university students. G*Power Version 3.1 determined that a sample size of 292 was necessary for small effect sizes. Therefore, a total sample of 300 was selected for this study. SEM typically requires a minimum sample size of 200.[63]

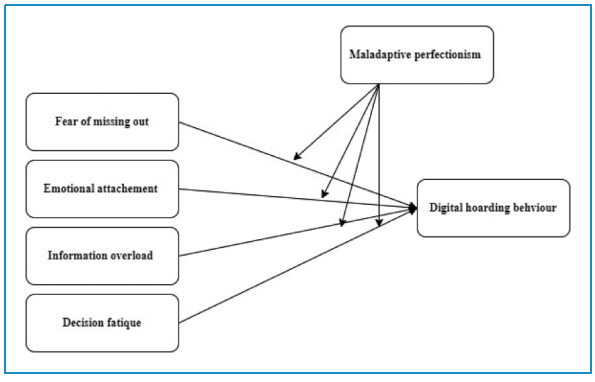

Figure 1. Hypothesized moderation model.

The survey instrument [refer to Appendix 1] initially in English and later translated into Persian, underwent pilot testing with 40 university freshmen, resulting in satisfactory reliability (Cronbach's alpha: 0.72–0.96). Survey questionnaires were distributed by a coauthor, and respondents provided written informed consent before participating. Data collection occurred in April 2023, yielding a 93% response rate after excluding 21 surveys (7%) and 4 surveys (1.33%) with outliers. Respondents' ages ranged from 19 to 24, with a mean of 21.62 and a standard deviation of 2.28. Of the participants, 65.6% identified as female, 97 were from Tehran, and 178 were from various other regions of Iran, with two students not disclosing their home cities.

Instruments

Digital hoarding behavior. Neave et al.[2] developed a scale to evaluate DHB, comprised of 10 items that respondents scored using a five-point Likert scale, ranging from one (1), which represents "Strongly disagree," to five (5), which represents "Strongly agree." An example statement from the scale utilized in this study's survey is "I accumulate files that others may not keep." The total scale's Cronbach's alpha value is 0.84, indicating acceptable internal consistency.

Fear of missing out. Przybylski et al.[64] developed a scale to evaluate participants' levels of FoMO, in which respondents are asked to rate, on a scale of one to five, the degree to which the provided statements accurately describe their personal experiences, with one (1) indicating "Not at all true of me" and five (5) indicating "Extremely true of me." An example of a statement from this study's scale is, "I worry that other people experience more enjoyable things than I do." This scale has been widely employed in studies engaging university students.[65] The Cronbach's alpha coefficient for this scale is 0.92.

Emotional attachment. Steketee et al.[66] developed the 23-item Saving Cognitions Inventory (SCI). In this study, emotional attachment was utilized as a subscale of the SCI. The Savings Cognition Inventory-Emotional Attachment (SCI-EA) consists of nine items, with response options ranging from one (1, "Not at all") to seven (7, "Very much"). An instance of a statement from this study's scale is, "Losing this possession would resemble losing a friend." Participants were asked to rate the items according to the frequency with which they experienced specific thoughts over the week before taking the survey. Higher SCI-EA scores reflect stronger emotional attachment to objects.

The present study's Cronbach's alpha coefficient for this scale is 0.94.

Information overload. Lee et al.[67] developed a four-item scale to measure information overload. An example statement from the scale is, "I find that I am overwhelmed by the amount of information that I process daily." Participants respond to the items via a seven-point Likert scale, in which one (1) represents "Strongly disagree" and seven (7) represents "Strongly agree." The Cronbach's alpha coefficient for this scale is 0.94.

Decision fatigue. Hickman et al.[68] developed a 10-item scale to evaluate decision fatigue, specifically among surrogate decision-makers. An example statement from the scale is, "I am unable to make decisions due to exhaustion and stress." Participants responded through a five-point Likert scale, ranging from one (1, "strongly disagree") to five (5, "strongly agree"). The Cronbach's alpha coefficient for this scale is 0.90.

Maladaptive perfectionism. Slaney et al.[69] developed the Almost Perfect Scale-Revised. The discrepancy subscale from the Almost Perfect Scale-Revised was employed in this study to measure maladaptive perfectionism. An example statement from the scale is, "Doing my utmost to organize digital files never appears to be sufficient." This subscale consists of 12 items, with response options ranging from one (1, "strongly disagree") to seven (7, "strongly agree"). The Cronbach's alpha coefficient for the discrepancy subscale is 0.94.

Data analysis

In this data analysis, we utilized SPSS version 26 for the initial examination of the data, revealing minimal missing data (below 2%). We addressed this using regression imputation. We employed partial least squares structural equation modeling (PLS-SEM) following Kock's guidelines and utilized Smart-PLS 3.3.3 software with bootstrapping (5000 subsamples) for robustness, as suggested by Hair Jr et al.[70] We chose PLS-SEM due to its suitability for interaction moderation models in our exploratory study, aligning with the recommendations of Hair Jr et al..[71] In our study, we investigated the moderating role of maladaptive perfectionism in the relationship between specific factors and DHB, making PLS a robust choice for our relatively small sample size, as advocated by Hair Jr et al.[71] and Carrión et al.[72]

Results

Measurement model

The assessment of the measurement model encompassed an evaluation of its reliability, convergent validity, and discriminant validity.[73] As presented in Table 1, Cronbach's alpha values for all constructs surpassed the threshold of 0.70, indicating a high level of reliability within the measurement. Additionally, the composite reliabilities for all cases exceeded the recommended benchmark of 0.70. Furthermore, all items exhibited factor loadings exceeding the desired level of 0.70, signifying their statistical significance. The average variance extracted (AVE) was found to fall within the range of 0.699–0.783 across constructs, surpassing the recommended threshold of 0.5. Consequently, the measurement model demonstrates both reliability and convergent validity by these findings.

To evaluate discriminant validity, we utilized two criteria: the heterotrait–monotrait (HTMT) criterion and the Fornell–Larcker criterion.[74] As shown in Table 2, none of the intercorrelations among the constructs exceeded the square root of the AVE for their respective constructs. This outcome indicates that the measurement model meets the requirement for discriminant validity.[75] Table 3 demonstrates that the HTMT analysis results were affirming that our study's measurements effectively distinguish between one another. Additionally, the data exhibited a strong model fit, with all standardized root mean square residual (SRMR) values below 0.05 and all normed fit index (NFI) values exceeding 0.88. To assess multicollinearity, we conducted an examination of the variance inflation factor (VIF). As presented in Table 1, all VIF values were below the recommended threshold of 3.33, confirming the absence of multicollinearity in the research model.

Structural model analysis

In this study, the Stone–Geisser (Q^2) and effect size estimate (f^2) values were relied on as indicators of effect sizes alongside the coefficients of the determination R^2 (explained variance).[73] The results showed that FoMO, information overload, decision fatigue, and emotional attachment accounted for 66% of the variance in this study's DHB, with the R^2 for DHB being 0.66. The PLS-SEM results supported all four associations (Table 3). FoMO ($\beta = 0.27$, $t = 3.112$, $p < 0.001$), emotional attachment ($\beta = 0.24$, $t = 3.632$, $p < 0.001$), information overload ($\beta = 0.21$, $t = 6.465$, $p = 0.002$), and decision fatigue ($\beta = 0.39$, $t = 4.244$, $p < 0.001$) positively predict DHB (Figure 2). While the f^2 results for emotional attachment and FoMO were minor, the f^2 scores for decision fatigue and information overload were 0.085 and 0.104, respectively, showing moderate effect sizes. The prediction value of DHB was calculated using Q^2. The analysis

Table 1. The reliability and validity of the measurement.

Constructs	Items	Factor loading	Mean	α	CR	AVE	VIF
DHB	DHB_1	0.804	3.78	0.897	0.924	0.71	1.940
	DHB_4	0.865					2.543
	DHB_5	0.862					2.620
	DHB_7	0.854					2.543
	DHB_{10}	0.825					2.122
IO	IO_1	0.755	3.75	0.917	0.93	0.573	1.958
	IO_2	0.745					1.553
	IO_3	0.781					1.971
	IO_4	0.754		.			1.531
FoMO	$FoMO_1$	0.790	3.81	0.892	0.912	0.597	2.11
	$FoMO_3$	0.839					2.799
	$FoMO_4$	0.822					2.535
	$FoMO_6$	0.811					2.139
	$FoMO_7$	0.784					2.124
	$FoMO_9$	0.853					2.909
	$FoMO_{10}$	0.791					2.150
DF	DF_3	0.701	3.68	0.877	0.908	0.621	2.633
	DF_4	0.71					3.173
	DF_5	0.936					3.289
	DF_7	0.779					2.919
	DF_8	0.753					2.640
	DF_9	0.794					2.564
	DF_9	0.829					2.871
EA	EA_3	0.806	3.87	0.907	0.928	0.684	2.158
	EA_4	0.827					2.457
	EA_5	0.849					2.589
	EA_7	0.832					2.403

(continued)

Table 1. Continued.

Constructs	Items	Factor loading	Mean	α	CR	AVE	VIF
	EA_8	0.817					2.295
	EA_{10}	0.825					2.151
MP	MP_1	0.704	4.06	0.864	0.895	0.52	2.331
	MP_3	0.721					1.897
	MP_5	0.703					2.172
	MP_6	0.702					2.226
	MP_7	0.713					2.011
	MP_9	0.702					2.267
	MP_{10}	0.816					2.376
	MP_{12}	0.728					2.669

DHB: digital hoarding behavior; MP: maladaptive perfectionism; FoMO: fear of missing out; IO: information overload; DF: decision fatigue; EA: emotional attachment.

Table 2. Discriminant validity.

No.	Constructs	1	2	3	4	5	6	7
1	DHB	(0.808)**						
2	MP	0.806	(0.826)**					
3	FoMO	0.741	0.793	(0.826)**				
4	IO	0.714	0.704	0.692	(0.796)**			
5	DF	0.58	0.522	0.603	0.624	(0.855)**		
6	EA	0.512	0.461	0.579	0.506	0.684	(0.894)**	
7	DHB	0.56	0.521	0.63	0.541	0.728	0.843	(0.875)**

DHB: digital hoarding behavior; MP: maladaptive perfectionism; FoMO: fear of missing out; IO: information overload; DF: decision fatigue; EA: emotional attachment. $^{**}p < 0.01$.

revealed that the Q^2 score had a value of 0.446 and that DHB is highly predictive (Table 4).

Test for moderation

The present study also conducted an interaction–moderation analysis, utilizing the Smart-PLS 4.0 software to test the moderating effects of maladaptive perfectionism on the association between selected variables and DHB. The results indicate that maladaptive perfectionism does not significantly moderate the associations between FoMO ($\beta = 0.063$, $t = 1.325$, $p = 0.105$), information overload ($\beta = 0.055$, $t = 1.31$, $p = 0.191$), and decision fatigue ($\beta = 0.065$, $t = 1.444$, $p = 0.149$) and DHB (Table 4). In contrast, maladaptive perfectionism significantly moderates the association between emotional attachment and DHB ($\beta = 0.24$, $t = 3.632$, $p < 0.001$). The change in R^2 from the primary effect model to the interaction effect model was only 0.018, displaying an additional variance of 1.8%.

Table 3. Confidence intervals for the heterotrait–monotrait (HTMT) criterion.

Path	Lower 2.5%	Upper 97.5%	Sig.	HTMT
EA → DHB	0.661	0.785	0.00	0.729
FoMO → DHB	0.632	0.756	0.00	0.699
IO → DHB	0.714	0.812	0.00	0.763
DF → DHB	0.722	0.83	0.00	0.783

$R^2 = 0.66$. DHB: digital hoarding behavior; FoMO: fear of missing out; IO: information overload; DF: decision fatigue; EA: emotional attachment.

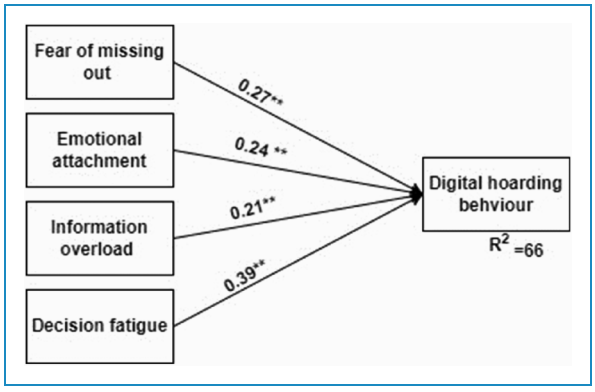

Figure 2. Hypothesis testing.
Path significance: $*p < 0.05$ and $**p < 0.01$.

Emotional attachment's f^2 findings were also of moderate effect size (Table 5).

Discussion

Hoarding behaviors, characterized by the excessive accumulation of physical objects, have gained recognition as a psychiatric disorder.[76] Researchers have made significant progress in understanding the demographics, social, and psychological aspects of individuals with hoarding tendencies.[77] In parallel, the digital age has introduced the concept of "digital hoarding," where people amass digital items such as emails, photos, files, and software. Speculation about its significance has grown on online platforms and in the media. However, academic studies on digital hoarding have been limited, primarily focusing on risk factors influencing DHB.[29] This study pioneers research into digital hoarding, aiming to uncover the underlying risk factors. It draws from attachment theory to explore how risk factors such as the FoMO, emotional attachment, information overload, and decision fatigue influence digital hoarding.

Table 4. Parameter estimates for the path model predicting digital hoarding behavior.

Hypothesis	Path	*t*	*β*	Sig.	f^2	Result
H1	FoMO → DHB	3.112	0.27	0.00	0.03	Supported
H2	EA → DHB	3.632	0.24	0.00	0.032	Supported
H3	IO → DHB	6.465	0.21	0.002	0.104	Supported
H4	DF → DHB	4.244	0.39	0.00	0.085	Supported

DHB: digital hoarding behavior; FoMO: fear of missing out; IO: information overload; DF: decision fatigue; EA: emotional attachment.

Table 5. Maladaptive perfectionism's moderating effect on digital hoarding behavior.

Hypothesis	Path	*β*	*t*	Sig.	R^2	f^2
H5a	EA × MP → DHO	0.240	3.632	0.001	0.678	0.105
H5b	FoMO × MP → DHO	0.063	1.325	0.105		0.007
H5c	IO × MP → DHO	0.055	1.31	0.191		0.004
H5d	DF × MP → DHO	0.065	1.444	0.149		0.005

DHB: digital hoarding behavior; MP: maladaptive perfectionism; FoMO: fear of missing out; IO: information overload; DF: decision fatigue; EA: emotional attachment.

While previous research has predominantly examined digital hoarding in workplace contexts within Western societies,[1,3,21,78] university students, who heavily rely on digital technology, face unique challenges that may contribute to digital hoarding tendencies. Recognizing the necessity for a comprehensive understanding of diverse risk factors in digital hoarding among this demographic, scholars emphasize the importance of considering the experiences of young people in culturally diverse settings. This study addresses this by examining the contributions of these risk factors to digital hoarding and investigating how maladaptive perfectionism moderates the relationship between these factors and digital hoarding in Iranian university students.

The results of this study's analysis suggest that decision fatigue, emotional attachment to digital belongings, information overload, and FoMO on important digital content all significantly contribute to digital content hoarding. Earlier research conducted by Elhai et al.[79] supports the finding that FoMO significantly contributes to DHB in university students. Students with higher levels of FoMO are more likely to excessively accumulate and hoard digital content, driven by the FoMO on valuable information, social contacts, and experiences. Similarly, Yap and Grisham[31] explored the concept of emotional attachment to objects and its link to hoarding. This study's results showed that due to memories or emotional worth attached to digital content, people—including college students—often form nostalgic ties to content. Digital data become difficult to release because of these attachments, which might result in hoarding tendencies.

This study also discovered that information overload impacts students' DHB. These findings align with a prior survey by Sedera et al.,[3] which highlighted how the overwhelming amount of digital resources, online materials, and social media content in the digital era causes information overload that may result in hoarding tendencies. Students may feel obligated to save everything they come across because they believe they will miss out on essential knowledge or possibilities if they do not. Furthermore, this study found that decision fatigue significantly influences university students' DHB. When confronted with several options for saving or removing digital files, students may experience cognitive fatigue. Decision fatigue may cause students to preserve files over making conscious decisions about their relevance or usefulness. This fatigue contributes to the accumulation of digital clutter, resulting in digital hoarding. This study also validates past research findings that used maladaptive perfectionism as a moderating variable.[56,80] The findings of this study suggest that perfectionism in students can lead to emotional attachments being formed with their digital files because of the sentimental value they attribute to them. Due to these emotional ties, students may be reluctant to remove or manage their digital assets, thus engaging in hoarding behavior that can have detrimental effects on their mental health, including decreased productivity and increased anxiety.

In addition, this study carries several theoretical implications based on the attachment theory and psychology research done on DHB in university students. John Bowlby's attachment theory offers a framework for comprehending how university students' attachment styles affect their relationships with digital content, ultimately impacting their DHB. By gaining a thorough understanding of the underlying psychological mechanisms influencing university students' DHB, this study's findings have found and added new theoretical implications to the field's preexisting body of knowledge. By incorporating the attachment theory and focusing on particular psychological variables in their research, future researchers can build on the ideas and models already in existence in the field of digital hoarding.

According to attachment theory, individuals' attachment styles are shaped by their early interactions with their caregivers. Relying on attachment theory, this study suggests that students with different attachment styles may exhibit different levels of DHB. For example, students with anxious attachment styles may be more prone to hoarding digital content due to FoMO and feeling attached to their digital possessions. Contrariwise, university students with avoidant attachment styles could resort to digital hoarding as a coping mechanism for decision fatigue and information overload.

This study has expanded the existing knowledge of the psychological variables underpinning DHB. By emphasizing the significance of these variables, researchers and practitioners may develop targeted interventions to address particular issues related to and reduce the tendency toward digital hoarding. The study, furthermore, emphasizes maladaptive perfectionism's role as a moderator on the impact emotional attachment has on DHB. Emotional attachments have a more significant impact on DHB when maladaptive perfectionism is present. This result highlights the significance of considering individual characteristics and personality variables when researching digital hoarding and developing therapeutic plans to combat DHB.

Finally, understanding the theoretical implications of attachment style, FoMO, emotional attachment, information overload, decision fatigue, and maladaptive perfectionism can direct the creation of strategies to control DHB and encourage healthier digital behavior among university students. With this knowledge, educational institutions, mental health professionals, and students can develop interventions, raise awareness, and practice productive habits that support responsible digital content management and reduce the harmful effects of excessive digital hoarding. This can lead to improved well-being and productivity and a healthier digital environment for university students in academic and personal settings.

Limitations and directions for future research

While this study provides new insights into the factors affecting DHB in university students, several limitations should be noted and future research avenues investigated. Firstly, the cross-sectional design of this study makes it difficult to identify the causes of the variables being investigated. Future research should use longitudinal approaches to examine the temporal associations between the selected behaviors and evolving digital hoarding tendencies. Longitudinal studies can provide a more thorough understanding of university students' evolution and modifications in DHB. Secondly, the results of this study are not very generalizable as they were based on a specific sample of

university students. Future research should include varied samples representing different educational contexts, cultural backgrounds, and age groups to improve the external validity of their results. Thirdly, self-reported measurements, which have their own biases and limitations, were utilized to analyze the variables in this study. Future studies should integrate objective measures, observational data, and qualitative approaches to provide a more thorough and nuanced understanding of these variables and their associations with DHB. Finally, this study emphasizes the significance of developing strategies to control DHB and encourage better digital habits among university students. However, it did not examine specific interventions nor evaluate their effectiveness. Future studies should explore the effectiveness of various intervention techniques, including mindfulness and cognitive–behavioral and digital decluttering techniques, to form evidence-based suggestions that can help students control their DHB.

Conclusion

In conclusion, our exploration of vulnerability factors in DHB among university students, along with the moderating role of maladaptive perfectionism, has shed light on this intriguing and increasingly relevant phenomenon across various cultural contexts, with a specific focus on Iranian students. The study has revealed key risk factors contributing to DHB, including FoMO, emotional attachment to digital content, information overload, and decision fatigue. Importantly, we have uncovered that maladaptive perfectionism can strengthen the negative effects of emotional attachment on DHB. These findings underscore the importance of understanding and addressing vulnerability factors when examining the adverse consequences of modern technology and media consumption. Looking ahead, it is evident that identifying and addressing these vulnerability factors have become paramount, especially in the context of university students in Iran. By doing so, we can better comprehend the root causes of digital hoarding and work toward effective interventions and prevention strategies. This research highlights the urgency of recognizing the implications of digital hoarding and its associated risks and encourages scholars from diverse cultural backgrounds to continue their investigations into strategies that can help university students manage their extensive digital files.

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Appendix 1: The questionnaires used in this study.

Constructs	Items
Digital hoarding behavior	I have a very hard time deleting old or unused files.
	I tend to collect digital files, even if they aren't directly related to my work.
	Deleting certain files feels like saying goodbye to a loved one.
	After I delete certain files, I feel anxious about it.
	I really don't want to delete certain files.
	I strongly believe that some files might be useful in the future.
	I often lose track of how many digital files I have.
	Deleting certain files feels like I'm losing a part of myself.
	Thinking about deleting certain files makes me feel emotionally uncomfortable.
	Sometimes, I struggle to find certain files because I have so many.
Fear of missing out	I have concerns that others may possess more fulfilling digital files than I do.
	I worry that my friends might have access to more satisfying digital files than I do.
	I become anxious when I discover that my friends have digital files for entertainment that don't involve me.
	I experience anxiety when I'm unaware of my friends' current digital file collections.
	It's important to me that I understand the digital content and files my friends share.
	Occasionally, I ponder whether I invest too much time in keeping up with digital file updates and events.
	I am perturbed when I miss an opportunity to exchange or access digital files with friends.
	Sharing the details of enjoyable digital file experiences online, such as updating my status, is significant to me.
	I feel bothered when I can't participate in planned gatherings where digital files might be shared.
	Even when I'm on vacation, I stay connected to my friends' digital file activities.

(continued)

Continued.

Constructs	Items
Emotional attachment	I could not endure parting with this possession.
	Disposing of this possession is akin to discarding a portion of my identity.
	Losing this possession would resemble losing a friend.
	Getting rid of this possession signifies the loss of a significant part of my life.
	I view my digital files as integral to my identity; they are an extension of who I am.
	This possession is imbued with the emotions I associate with it.
	Eliminating these digital files would feel like a part of myself ceasing to exist.
	This possession offers me emotional solace.
	I hold affection for some of my files in a manner similar to my feelings for certain individuals.
Information overload	The sheer volume of digital files and information in my files frequently diverts my attention and becomes a distraction.
	Managing the daily influx of digital files and information can be overwhelming for me.
	I often encounter challenges when trying to synthesize the abundant information available, rather than facing a shortage of information.
	The constant stream of digital data can leave me feeling inundated and struggling to effectively process and organize it.
Decision fatigue	I struggle to manage my digital files when I'm fatigued and stressed, making decisions about them challenging.
	Concentration difficulties impede my ability to make informed decisions regarding my digital file organization.
	Processing information and utilizing it for effective digital file management is a formidable task for me.
	My lack of self-confidence can hinder my capacity to make optimal decisions about my digital files.
	Organizing and deciding how to handle my digital files often feels excessively laborious.
	Sometimes, I contemplate having someone else make decisions about my digital files on my behalf.
	I've occasionally rushed decisions concerning my digital files to expedite the process.
	The choice between different options for managing my digital files can leave me indecisive.
	I've made hasty decisions about my digital files without giving them the careful consideration they deserve.
	My mood fluctuations have at times posed challenges in making decisions related to my digital files.
Maladaptive perfectionism	I often feel frustrated when managing my digital files because I cannot meet my organizational goals.
	My best efforts in digital file management just never seem to meet my own standards.

(continued)

Continued.

Constructs	Items
	Rarely do I succeed in organizing my digital files up to my high standards.
	Doing my utmost to organize digital files never appears to be sufficient.
	I am never satisfied with my accomplishments in the realm of digital file organization.
	Often, I worry about not measuring up to my own expectations for digital file management.
	My performance in organizing digital files rarely aligns with the standards I have set.
	I am not content, even when I know I have done my best in managing my digital files.
	I am seldom able to meet my own high standards for performance in digital file organization.
	I am hardly ever satisfied with my performance when it comes to organizing digital files.
	I hardly ever feel that what I've accomplished with my digital files is good enough.
	Often experiencing disappointment after completing a task because I know I could have done better.