Assessing the relationship between internet usage and technostress: A moderated mediation model

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ABSTRACT

Purpose: Technostress or technology-induced stress is well-known in the literature among working people. Although technology is becoming more prevalent in higher education, there is still a lack of research investigating the predictors of technostress and its impact on university students. The current study explored: (i) the mediating role of problematic internet use (PIU) in the relationship between internet usage and technostress and (ii) the moderation of personality type on the relationship between internet usage and PIU among university students in Pakistan.

Design/Methodology/Approach: For this correlational study, participants (n=165) were bachelor's and master's students from two public universities in Pakistan. A purposive sampling technique was used and SmartPLS was used for analysis.

Findings: Problematic internet usage partially mediated the relationship between internet usage and technostress among university students. Conscientiousness moderated the relationship between internet usage and problematic internet use negatively whereas neuroticism moderated the relationship positively.

Conclusion: The findings are an essential landmark for the consequences of problematic internet usage and the presence of technostress among students. Workshops and specialized programs are necessary to promote awareness among university students and proper counseling services to reduce the adverse effects of internet usage, problematic internet usage and technostress.

Keywords: *Conscientiousness, Internet addiction, Neuroticism, Pakistan, Personality traits, Problematic internet use, Technostress, University students*

1. INTRODUCTION

Technostress is a form of stress experienced by people due to excessive Information and communication technologies (ICTs) usage. Initially, Brod (1984) introduced the "modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy way." Many researchers have explored technostress among ICT users, particularly among employees (Fuglseth & Sørebø, 2014; Salanova, Llorens, & Cifre, 2013; Tarafdar, Tu, & Ragu-Nathan, 2010). However, there is a shortage of empirical studies exploring the incidence, prevalence and antecedents of technostress in the general population, particularly among youngsters. Technostress is a serious concern for students and higher education institutions (Upadhyaya, 2021). Therefore, it is pivotal to examine technostress and its predictors among university students.

Education research merely focused on the teachers', (Joo, Lim, & Kim, 2016) educators' and academicians' (Burke, 2009; Jena, 2015) and ignored the impact of technology on the students' experience of technostress. This insufficiency in the literature about technostress among university students is due to the belief that the present young generation was born during the global technology outburst. Hence, youngsters are typically considered to possess satisfactory technology-related abilities to adjust to changes in innovation (Burke, 2009). Technostress is generally viewed as a response for those with fewer skills in modern technology. According to Qi (2019), technostress may severely arise in students due to the profuse use of ICTs for teaching and learning purposes. Such a situation may be truer in the contemporary context when students use modern technologies

for personal interest and leisure. It would be necessary to empirically test the relevance of technostress in the young generation, especially university students.

Internet usage expanded widely and has become essential to everyone's life (Thorsteinsson, 2014; Wallace, 2014). Considerable global research has focused on the overuse of the internet leading to addictive levels (Kuss, Griffiths, & Binder, 2013). This problem is prevalent among emerging adults as they frequently use the internet for different purposes compared to other age groups (Madden, Cortesi, Gasser, Lenhart, & Duggan, 2012). According to Kuss, Griffiths, Karila, and Billieux (2014), the frequency of problematic internet use among youngsters ranged between 0.8% and 26.7%. Kuss et al. (2014) also reported that PIU is more prevalent among Asian adolescents than in other regions. A study conducted among Pakistani medical students informed them about their excessive internet usage (Waqas et al., 2016). Problematic internet usage elicits social physique anxiety, nomophobia and phubbing behavior among students (Ayar, Gerçeker, Özdemir, & Bektas, 2018; Bajwa, Abdullah, Jaafar, & Samah, 2021b). Researchers have explored that excessive internet use escalates internet addiction and student stress levels (Unsar et al., 2020). Another study showed a positive relationship between internet addiction and perceived stress among students (Feng, Ma, & Zhong, 2019). Another study also reported that excessive internet use causes addiction and technostress (Souza & Cappellozza, 2018).

Few researchers have established a strong association between personality traits and addictive behaviors (Lee & Jung, 2012). Personality differentiates one person from another based on unique characteristics, emotions, behaviors, and patterns of beliefs, organized differently with psychological mechanisms working under those patterns (Funder, 2012). These findings explain that internet usage may be healthy for one person but may lead to addiction for another person. Researchers affirmed that personality traits significantly influence excessive internet use (Rachubińska, Cybulska, Szkup, & Grochans, 2021). Studies have established that PIU is substantially correlated with high neuroticism and low extroversion (Hussain & Pontes, 2019; Saini, Baniya, Verma, Soni, & Kesharwani, 2016). Another study suggested that out of five core personality traits, neuroticism and consciousness are strongly related to the PIU (Montag et al., 2011; Montag & Reuter, 2017).

The current study tested a model of technostress to explore the determinants of technostress among university students. The inter[vening function of PIU in the association between internet usage and technostress was investigated among Pakistani university students. The study also examined how personality characteristics affected the association between PIU and internet usage. The current research model is shown in Figure 1.
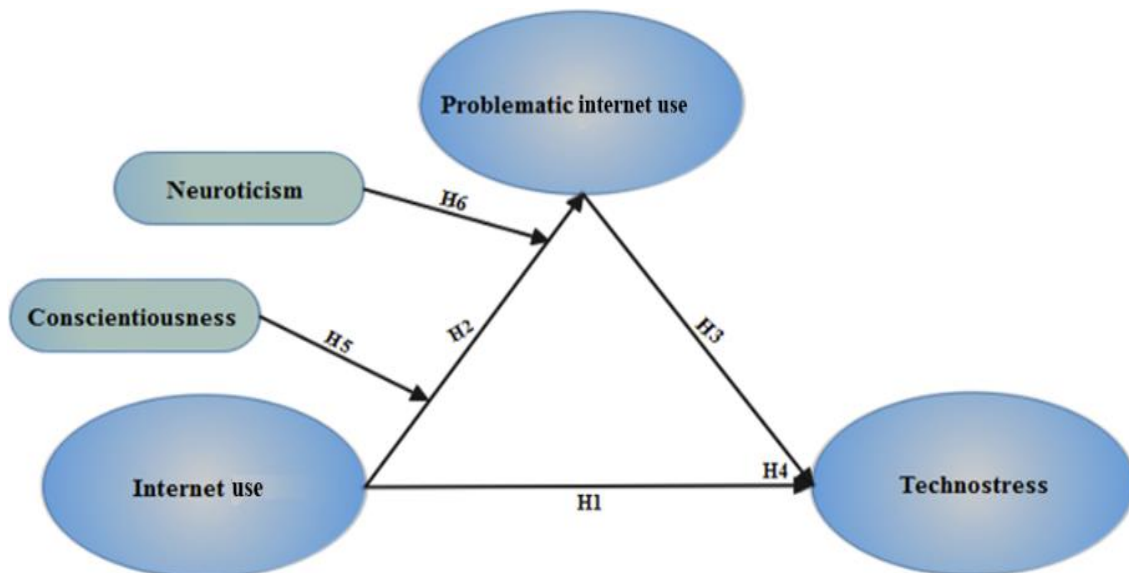

Figure 1. Research model and hypotheses.

2. METHOD

This study explored the relationship between technology use, personality and technostress among university students. The declaration of Helsinki, " ethical principles for medical research involving human subjects," published by the world medical association, served as the guide for this study. Informed consent was acquired and participants were examined after the data collection.

2.1. Participants

Participants for the present study (n=165; 56.5% females and 43.5% males) were bachelor's and master's students from two public universities (the University of Sargodha and the University of Sahiwal) in Pakistan recruited via purposive sampling. G*Power software's power analysis and the "a-priori technique" were used to calculate the sample size (Faul, Erdfelder, Buchner, & Lang, 2009; Uttley, 2019). The sample size follows other a -priori studies (Allom, Mullan, & Hagger, 2016). Data was collected online through google forms. The inclusion criterion was that: 1) students should be 18 years old and above 2) and they should be internet users. Participants in the research varied in age from 18 to 25, with a mean age of 20.9 years. Among participants, 69.6 % were studying in bachelor's programs, and 30.4 % were studying in master's programs. While 21.7% were first-year students, 23.9 % were sophomores and 54.4% were seniors.

2.2. Measures

Reliable and valid instruments from the literature were used in this study. "Internet usage scale" (IUS) was administered to measure internet use (Monetti et al., 2011). It was developed by Monetti et al. (2011) to measure internet use among students. The IUS is comprised of 12 questions which are responded to on a Likert scale. The reliability of IUS was excellent (α= 0.90) for the current sample. Problematic internet use was assessed with the questions of the PRIUSS (the Problematic and Risky Internet Use Screening Scale) developed by Jelenchick et al. (2014). The PRIUSS contains 18 questions with a Likert scale response format. The PRIUSS encompasses a solid theoretical background and detects addictive behavior effectively. Excellent reliability scores (α= 0.96) were achieved in the current sample for the PRIUSS. The stress resulting from technology use was measured with an adapted measure of technostress the "Technostress Questionnaire," containing 12 items (Westermann, 2017). Answers were anchored on a Likert scale and reliability scores were excellent for the current sample (α=0.94). Personality was measured through the "Ten Item Personality Inventory" (TIPI) developed by Gosling, Rentfrow, and Swann Jr (2003). The TIPI generally measures five main personality dimensions, but the questions assessing neuroticism and conscientiousness were used for analysis in the current study. The answers were recorded on a Likert scale. This study's reliability scores for TIPI were excellent (α= 0.95). The respondents' descriptive profiles and detailed scoring of study variables have already been provided in Bajwa, Abdullah, Jaafar, and Samah (2021a).

3. RESULTS

The structural model assessed the data for all the prerequisite assumptions, such as multicollinearity, normality, outliers and sample size and met the assumptions. The sample size was appropriate to run data on smartPLS without any outliers, skewness and kurtosis were within an acceptable range (+1, −1), and item correlations were less than 0.90 presenting no multicollinearity. Smart-PLS 3.3.3 was administered (Ringle, Wende, & Becker, 2015) and a two-step technique was employed to analyze the structural relationships among the variables (Gefen & Straub, 2005). Firstly, the measurement model tested reliability, construct, convergent and discriminant validity. The structural model was established in the second step to assess the relationships (Anderson & Gerbing, 1988; Hair, Hult, Ringle, Sarstedt, & Thiele, 2017).

Table 1. Assessment of the structural model.

R^2	**Endogenous variables**	R^2	R^2 **adjusted**
	Problematic internet use	0.520	0.51
	Technostress	0.371	0.363
Effect size (f^2)	Exogenous variables	TS	
	Internet use	0.069	
	Problematic internet use	0.153	
Collinearity (Inner VIF)	Exogenous variables	TS	
	Internet use	1.758	
	Problematic internet use	2.631	
Predictive relevance (Q-square)	Endogenous variables	Q^2	
	Problematic internet use	0.300	
	Technostress	0.213	

Note: TS= Technostress, f^2=Effect size, R^2 = Coefficient of determination, VIF = Variance inflation factor, Q^2= Predictive relevance.

Reliability of the variables was achieved through "Cronbach's Alpha" (CA) and Composite Reliability (CR), which ranged from (0.896 to 0.959) and (0.915 to 0.963) respectively. It exceeded the cut-offs (0.70) in all the cases (Hair et al., 2017). Convergent validity was calculated with Factor Loadings (FA) and Average Variance Extracted (AVE) and was achieved. Next, Fornell Larcker and the HTMT (Heterotrait-Monotrait Ratio) were calculated to achieve discriminant validity. Results confirmed the discriminant validity of all the constructs and between each pair of variables.

First, it is essential to address the latent collinearity issues to evaluate the structural model. All inner VIF (variance inflation factor) thresholds for the constructs were below 0.3 showing no collinearity, as Hair et al. (2017) proposed. Next, it is important to determine R^2 (variance explained by the outcome variable), f^2 (effect size) and Q^2 (predictive relevance). R^2 was calculated for the current data in Table 1 and following Cohen's (1988) interpretation, the values are substantial (R^2 PIU= 0.520 and R^2 TS= 0.371), representing a strong model. According to Sullivan and Feinn (2012), the p-value indicates the presence of effect. Nonetheless, it does not tell the magnitude of the impact (Sullivan & Feinn, 2012). Thus, f^2 was calculated to measure the actual effect size. Referring to Cohen's (1988) interpretation in Table 1, internet use has a weak effect (0.069) while PIU (0.153) has a medium effect to explain the variance in technostress. Furthermore, Q^2 was examined with the blindfolding technique (resampling). In any model, the Q^2 value should be greater than zero to demonstrate acceptable predictive relevance (Hair, Risher, Sarstedt, & Ringle, 2019). The data exhibited acceptable predictive relevance in the current model because the Q^2 value of exogenous variables was larger than zero (Q^2 PIU = 0.300 and Q^2 TS = 0.213) (Hair et al., 2019; Stone, 1974).

Table 2 presents the findings of the direct association between the exogenous and endogenous variables. Results depicted that Internet use exerted a statistically significant effect on technostress (β = 0.27, p< 0.00). Similarly, PIU significantly affected technostress (β = -0.40, t = 4.46, p< 0.00). The third hypothesis predicted an effect of internet usage on problematic internet usage (β = -0.50, t = 8.22, p< 0.00) and it was highly significant. Further, the mediating role of PIU in the relationship between internet use and technostress was assessed through bootstrapping. The results in Table 3 showed a partial mediation (p<.00) through PIU between the relationships of IU and TS (β=0.2, t=4.26, p= 0.00). Next, the moderating role of personality type was assessed based on the relationship between IU and PIU. The bootstrapping method was performed, and the results were statistically significant. The relationship between IU and PIU was moderated significantly and positively (β=0.24, t=2.42, and p=0.02) by neuroticism, while IU and PIU were moderated negatively by consciousness (β= -0.19, t=2.03, and p=0.04) Table 4. Figure 2 presents all the path model results.
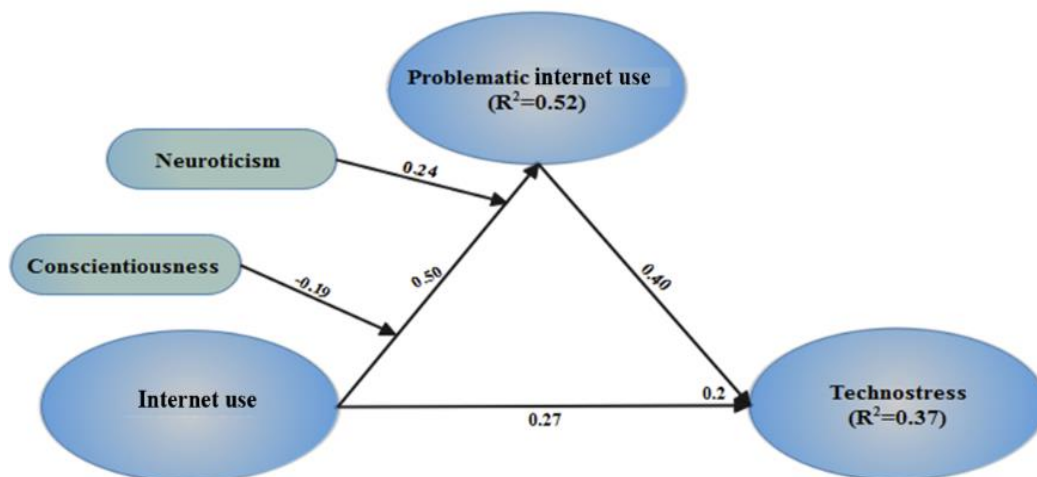

Figure 2. Path model results.

Table 2. Path coefficient (Direct effect) results.

Hypotheses	OS/Beta	LL	UL	SD	t	*p*	Decision
IU ---> TS	0.27	0.09	0.42	0.09	3.04	0.00***	Supported
PIU ---> TS	0.40	0.23	0.58	0.09	4.46	0.00***	Supported
IU ---> PIU	0.50	0.39	0.61	0.06	8.22	0.00***	Supported

Note: ***p < .001; t > 1.96. IU=Internet use, PIU= Problematic internet use, TS= Technostress.

Table 3. Path coefficient (Indirect effect) results.

Hypothesis	OS/Beta	LL	UL	SD	T		p	Decision	Mediation
IU ---> PIU ---> TS	0.20	0.13	0.31	0.05	4.26		0.00***	Significant	Partial mediation

Notes: ***p < .001; t > 1.96. IU=Internet use, PIU= Problematic internet use, TS= Technostress.

Table 4. Moderating effect results.

Hypotheses	OS/Beta	SD	t	P	Decision
IU*NEU*PIU -> PIU	0.24	0.10	2.42	0.02*	Supported
IU*CONS*PIU -> PIU	-0.19	0.09	2.03	0.04*	Supported

Notes: *p < .05; t > 1.96. IU=Internet use, NEU= Neuroticism, CONS= Conscientiousness, PIU= Problematic internet use.

4. DISCUSSION

This study aimed to assess the relationship between internet usage, problematic internet use and technostress alongside the moderating role of personality among university students in the Punjab province. "Structural Equation Modelling" (SEM) tests the hypothesized model. SEM explained the mediating role of PIU concerning internet usage and technostress. Results also elaborated that personality moderates the link between internet use and problematic internet usage.

According to recent literature findings, social media usage (SMU) intensity proved to be the strongest predictor of fatigue related to SMU (Malik, Dhir, Kaur, & Johri, 2020). Few researchers explored that overuse of different social media platforms adversely affected users' fatigue (Dhir, Yossatorn, Kaur, & Chen, 2018; Luqman, Cao, Ali, Masood, & Yu, 2017). Likewise, researchers in the United States and Hong Kong investigated the impact of social media and internet addiction on technostress. Results showed that social media and internet addiction are positively related to technostress. Another study reported a strong positive connection between internet addiction and stress scores. An upsurge in internet use duration was associated with increased addiction and stress (Unsar et al., 2020). All these studies support the current study's findings regarding the positive association of internet usage and PIU with technostress.

Current results also revealed that internet use is strongly linked with problematic internet use. Preceding literature supported this finding and proposed that increased internet usage duration resulted in internet addiction among university students (Unsar et al., 2020). Many other studies align with current findings that increased use results in internet addiction at a young age (Alam et al., 2014; Sahin, 2011; Yang & Tung, 2007). Another scholarly work stated that the magnitude of internet use is related to all aspects of problematic internet use (Andreassen et al., 2013).

The next hypothesis suggested the mediation of PIU in the association between internet usage and technostress. Findings supported the hypotheses that PIU significantly facilitates the relationship between internet use and technostress. These findings coincide with a study conducted among Instagram users' who found that Instagram addiction partially mediated the association between overuse of "instastress" and emotional fatigue among the users (Sanz-Blas, Buzova, & Miquel-Romero, 2019). Another study explored internet addiction's mediating role in the association between daily internet usage and psychological well-being (Van der Aa et al., 2009). These findings seem logical, too, because internet users who use it in a problematic or addictive way will ultimately end up with technostress.

Personality is a well-established factor related to substance addiction in the existing literature. Since new types of addictions are emerging as essential variables and behavioral addictions are established in the literature, it is vital to explore how personality relates to them. Sufficient studies highlight the equivalent role of personality in substance use and different forms of behavioral and technology addictions (Andreassen et al., 2013; Grant, Potenza, Weinstein, & Gorelick, 2010). The next hypothesis was about the moderating role of conscientiousness in the association between IU and PIU. Findings revealed that conscientiousness negatively moderated this association. It shows that conscientiousness weakens the association between internet usage and addiction. These findings are supported by the work of Kraut et al. (2002). They explained that people with different personality types use the internet differently. Van der Aa et al. (2009) also affirmed that the possible negative relation between the daily use of the internet and addiction differs according to different personality types. For introverts, less emotionally stable and less agreeable individuals' internet usage was more powerfully associated with internet addiction. But according to their study findings, conscientiousness did not significantly moderate the association between internet usage and PIU (Van der Aa et al., 2009). A possible reason for these contradictory results may be other dispositional factors in associating internet usage with PIU (McElroy, Hendrickson, Townsend, & DeMarie, 2007).

The concluding hypothesis tested the moderation of neuroticism between IU and PIU. Findings revealed that neuroticism strengthened the link between IU and PIU. Thus, it affirms that people with neurotic tendencies are more inclined to addictive tendencies, and their internet use becomes problematic and addictive. These findings are similar to a study from Pakistan indicating that university students addicted to smoking behavior had high levels of neuroticism (Afridi & Rahim, 2020). Davis (2001) and Caplan (2003) further supported these findings. They concluded that introverted, low-agreeable and neurotic or emotionally unstable adolescents end up in a vicious cycle where individuals who develop internet addiction result in even greater levels of addiction and worsening consequences.

5. Conclusion and Recommendations

This study has contributed new knowledge about the impact of internet usage and problematic internet use on technostress and the role of the personality types' among university students in Pakistan. This study aimed to explore the mediation of problematic internet usage in the relationship between internet usage and technostress and the moderation of personality types in the relationship between internet usage and PIU. The findings support the hypothesized model that increased internet usage leads to addiction leading to technostress among university students. Moreover, personality plays a key role in explaining what types of people can start using the internet problematically. Current findings augment existing understanding of the negative aspects of human digitalization. Since the internet is such a crucial instrument for integrating today's society, it is unavoidable that young people will use it wisely and responsibly. Government institutes responsible for cyber control, educators, university administrations, families and public institutions should raise awareness about the thin line between internet usage and PIU and the negative effects of internet addiction and technostress.

5.1. Limitations and Future Directions

There were certain constraints and limitations in the current study. Firstly, the data was collected from only two universities or regions. To address their generality, these findings may still be restricted. Prospective studies are encouraged to evaluate this model in different cities and universities. Next, the sample size is relatively small to make generalizations.

Furthermore, these findings may not apply to the wider population as all survey respondents were students. Another significant limitation is the self-reported nature of survey questionnaires and sampling techniques. Future researchers must use additional ways to double-check the respondent's information about internet use and probability sampling techniques and a large sample should be used to increase generalization. The widespread negative impacts mentioned in this study are likely increased by students'constant need to utilize the internet for their education and other factors muddle the conclusions. On the other hand, it's conceivable that the study's effects are amplified due to recognized problems with the student subjects.

CONFLICT OF INTEREST
The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS
All authors contributed equally to the conception and design of the study.

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Nurture: Volume 17, Issue 1, 1-9, *2023*
Online ISSN: 1994-1633/ **Print ISSN**: 1994-1625
DOI: 10.55951/nurture.v17i1.137 | **URL**: www.nurture.org.pk