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From Screens to Strain: The Mediating Role of Stress in Digital Fatigue and Teaching Effectiveness Among Female Educators

Lt. Kodukula Venkata Lakshmi Prudhvila
Assistant Professor, Department of Psychology
St. Joseph's college for Women (A)
Visakhapatnam, Andhra Pradesh, India
Prudhvilakodukula99@gmail.com

Abstract

The enormous rate of digitization of education has presented a significant challenge to the educators in the form of technology-related requirements, and it has led to the emergence of the question of digital fatigue and its consequences on the teaching quality. In this paper, the connection between digital fatigue and the teaching effectiveness among female teachers will be studied with references to the mediating process of the psychological stress. The researchers adopted a cross-sectional research design in which 101 female teachers at both undergraduate and post-graduate levels were utilized to gather the information. The respondents completed standardized tools which comprised of digital fatigue, psychological distress, and perceived teaching effectiveness. The findings revealed a positive association between the levels of digital fatigue and the levels of psychological distress, including symptoms of depression, anxiety, and stress. It is worth mentioning that stress was among the primary psychological intermediaries in terms of which digital fatigue influenced the teaching effectiveness. Even though the digital fatigue was not a causative factor directly affecting the teaching effectiveness, it indirectly influenced it, causing the increase in stress levels, which, in its turn, negatively affected the professional performance of the educators. These results show that stress is a significant process that links the effects of technology-related fatigue to the results in teaching. The study reveals that the institutional interventions were required that would improve the digital well-being and stress management among educators. Illuminating the psychological processes of digital burnout, this research will develop its input to the better understanding of the well-being and performance of teachers in the increasingly technology oriented learning environments.

Keywords: *digital fatigue, teaching effectiveness, mediation analysis, female educators, technostress*

Introduction

The digital revolution in the education sector has gained pace more than ever before, and the COVID-19 pandemic has been a decisive factor in causing an unprecedented technological intervention in the teaching processes (Pokhrel and Chhetri, 2021; Trust and Whalen, 2020). Teachers across the world have moved to the use of technology-mediated instruction, with the use of digital platforms to deliver lessons, engage with students, assess them, and perform administrative duties (Sokal et al., 2020). Although digital technologies provide better pedagogical opportunities and flexibility in the learning process, they place significant cognitive,

emotional, and physical strain on educators (Molino et al., 2020; Zhao and Watterston, 2021). This active digital use has created such phenomenon as digital fatigue an exhaustion caused by excessive exposure to digital technology and virtual relationships (Fauville et al., 2021; Nesher Shosha and Wehrt, 2022). The phenomenon of digital fatigue is implemented in the reality of many different aspects, including cognitive fatigue because of the overload of information on a mass scale, emotional fatigue because of the virtual interaction, and physical discomfort because of spending too much time on the screen (Ragu-Nathan et al., 2008; Schmuck et al., 2022). A mental depletion, a lack of concentration, a pressure related to technologies, and a desire to use technology are the symptoms of digital fatigue in teachers (Califf et al., 2020; Virtanen et al., 2021). Such issue as digital fatigue is now rather widespread among the teaching fraternity, and more than 60 percent of educators have been moderately and severely technology-midst burned out (Sokal et al., 2020; Pressley, 2021). Together with the increasing digital demands, teachers are vulnerable to the increasing threats of obtaining psychological stress, e.g. depression, stress, and anxiety (Ozamiz-Etxebarria et al., 2021; Pressley et al., 2021). The job of a teacher is a field that is closely linked with emotional labour, interpersonal concerns, and performance pressure, which are compounded by technological needs (Harmsen et al., 2018; Yin et al., 2021). The research reported that technostress otherwise known as stress in using technology has been associated with burnout, job dissatisfaction, and low wellbeing in teachers (Joo et al., 2020; Wang et al., 2020). The stressors can be of special concern to female educators because gendered expectations in workplaces with caregiving, emotional labour, and work-family balance challenges are especially notable in online workplaces (Gabster et al., 2020; Nash and Churchill, 2020). The quality of instructions offered by teachers, their ability to keep students engaged throughout the learning process, support learning, and deliver quality instructions are considered among the most significant outcome variables in the educational research (Stronge et al., 2011; Kunter et al., 2013). Some of the aspects that may affect the effectiveness of teaching include the pedagogical knowledge, instructional strategies, classroom management and most importantly, the psychological wellbeing and stress levels of the teachers (Klusmann et al., 2022; Zee and Koomen, 2016). Recent evidence suggests that some stressors associated with technology may compromise the efficiency of the teaching process, requiring the depletion of psychological resources, compromising the quality of instruction, and reducing the capacity of the teacher to employ responsive pedagogy (Joo et al., 2021; Panisoara et al., 2020). Despite the fact that the notion of digital fatigue has become the focus of more attention as a significant problem in the educational context, the lack of research focused on the impact of the latter in the efficacy of teaching exists. The useful theoretical framework is the Conservation of Resources (COR) theory that can be used to explain this relationship (Hobfoll, 1989; Hobfoll et al., 2018). According to the COR theory, individuals strive to obtain, preserve and protect valuable resources including psychological, emotional and cognitive skills. Stress occurs when there is a threat of resources, loss or failure to get resources after exerting much effort on them. Digital fatigue may also be a pointer of resource wear due to a sustained technological strain, which subsequently cause psychological strain. This stress, in its turn, can affect the performance of teaching by reducing the psychological resources of the educators to teach effectively. It is under this theoretical framework that the alternative hypothesis is the hypothesis of the hypotheses that there is a relationship existing between digital fatigue and teaching effectiveness in female teachers and the psychological stress that mediates this relationship. The knowledge of this mediating

mechanism is vital in the formulation of specific interventions that can deal with the psychological pathways between technology demands and professional outcomes. In the event that stress is the major mechanism, stress management interventions can alleviate the adverse effects of digital fatigue on the quality of teaching even in a situation where digital demands are high.

The current study addresses three specific research questions:

(1) Is digital fatigue associated with psychological distress (depression, anxiety, stress) among female educators?

(2) Does digital fatigue directly predict teaching effectiveness?

(3) Does stress mediate the relationship between digital fatigue and teaching effectiveness?

Hypotheses:

H1: Digital fatigue is positively associated with depression, anxiety, and stress

H2: Digital fatigue is negatively associated with teaching effectiveness

H3: Stress would mediate the relationship between digital fatigue and teaching effectiveness.

Literature Review

Digital fatigue or virtual fatigue in the context of video conferencing services is a multidimensional concept describing the exhaustion caused by the use of digital technologies (Fauville et al., 2021; Nesher Shosha and Wehrt, 2022). Bailenson (2021) has listed four main reasons that lead to video conferencing fatigue, such as close-up eye contact, cognitive load of seeing oneself constantly, diminished mobility, and cognitive load of communication. In addition to video conferencing, digital fatigue refers to more general technology-related fatigue such as information overload, communication overload, the stress of being constantly connected, and technostress (Ragu-Nathan et al., 2008; Tarafdar et al., 2020). Digital fatigue among teachers in the learning context is caused by various factors such as long hours of online teaching, constant online interaction with students and parents, administration-related work with technology, and the psychological pressure of keeping students engaged in the virtual learning process (Sokal et al., 2020; Pressley, 2021). Researchers find that teachers have high levels of digital exhaustion, and several educators have more than 8-10 hours of screen time every day (MacIntyre et al., 2020; Trust and Whalen, 2020). Such a long-term digital interaction is related to physical symptoms (strain on the eyes, headaches, musculoskeletal pain), cognitive symptoms (inability to concentrate, mental fatigue), and emotional symptoms (irritability, lack of motivation) (Schmuck et al., 2022; Virtanen et al., 2021).

Psychological Distress Among Educators

The problem of stress, anxiety, and depression is greater in teachers than in most other occupations because of reasons such as high workload, emotional load, role ambiguity, and little autonomy (Harmsen et al., 2018; Yin et al., 2021). These problems have been worsened by the shift to digital teaching, and meta-analytic studies have shown that teachers experience high levels of psychological distress during the pandemic (Ozamiz-Etxebarria et al., 2021; Li et al., 2021). Stressors associated with technology, such as poor digital infrastructure, lack of technical training, and stress to quickly develop new technological skills, are among the factors that increase the stress levels of teachers (Joo et al., 2020; Wang et al., 2020). Other factors that put female educators at a disadvantage are gendered demands of emotional work, more domestic work, and the lack of institutional support of work-life balance (Gabster et al., 2020; Nash and Churchill, 2020). The studies indicate that female educators indicate greater stress and burnout

rates than their male counterparts, especially those who have to cope with the demands of their jobs and the needs of their families at the same time in home-based settings (Alves et al., 2021; Benavides et al., 2020). Digital needs and gender expectations intersect, and this specific profile of stressor will generate a significant stressor among female teachers, which should be addressed specifically.

Teaching Effectiveness and Its Determinants

Teaching effectiveness is the ability of educators to promote learning, classroom control, use evidence-based teaching methods, and educational outcomes (Stronge et al., 2011; Kunter et al., 2013). The concept of effective teaching demands not just the pedagogical background and subject mastery but also such psychological resources as emotional regulation, cognitive flexibility, and sustained attention (Klusmann et al., 2022; Zee and Koomen, 2016). The psychological health of teachers is also an important factor affecting the quality of instruction, and the studies have shown that stress, burnout, and a sense of emotional fatigue adversely affect the quality of teaching behaviors, teacher-student relationships, and student performance (Arens and Morin, 2016; Oberle and Schonert-Reichl, 2016). The connection between the use of technology and effectiveness of teaching is a complicated image. On the one hand, the relevant use of technology can support the quality of pedagogical practices; however, on the other hand, a high level of technology demands and related technostress can deteriorate the quality of teaching (Joo et al., 2021; Panisoara et al., 2020). Educators who are highly technostressed-indicated a lower level of instructional efficiency, less creativity in lessons planning, and the inability to respond to teaching (Dong et al., 2020; Sokal et al., 2020). Nevertheless, the pathways between technology stressors and teaching effectiveness have not been investigated fully and, therefore, we have limited knowledge regarding the points of intervention.

Theoretical Framework: Conservation of Resources Theory

The Conservation of Resources (COR) theory is a strong approach to the stress process and its effects on performance outcomes (Hobfoll, 1989; Hobfoll et al., 2018). COR theory assumes that people are motivated to obtain, retain and defend treasured resources such as object resources (e.g., technology), condition resources (e.g., employment), personal resources (e.g., self-efficacy), and energy resources (e.g., time, attention). Stress is caused when resources are put at risk of loss, are lost, or when they are invested in without sufficient returns. The loss of resources is salient more than the gain of resources and the loss of resources initially can lead to loss spiral whereby the resources that follow are more and more hard to maintain. Considered in the context of the present situation, digital fatigue can be a condition of energy resource exhaustion due to the constant technological pressure that is exceeded by the psychological capacities. This resource degradation occurs as stress- an indicator of a resource loss or a possible loss of a resource. Stress also consumes cognitive and emotional resources needed to teach effectively, and this leads to the loss of resources in a spiral that leads to decreased teaching effectiveness. Notably, COR theory implies that managing stress response (avoiding additional loss of resources) can be more effective than managing the original stressor (digital demands), especially when the stressor is a factor of an environment and hard to control.

Methodology:

The sample was made up of 101 female educators, who were teaching at education levels of graduation and post-graduation in institutions of education. The participants were aged between 25 and 45 years. The teaching duties of all the participants included a significant amount of digital

technology use such as online teaching tools, online communication tools, learning management systems, and technology-mediated administrative duties. Convenience sampling was used to recruit the participants through professional networks and learning institutions who agreed to take part in the study. The inclusion criteria were that the participants had to be female teachers who currently work as teachers in the higher education level at least one year of experience in teaching that involved the use of digital technology. Teachers who were on extended leave or those who were not actively teaching were not included in the participation.

Digital Fatigue Scale (DFS)- it is a broad scale that is utilized to assess exhaustion and strain in relation to the use of digital technology in the workplace. The scale measures several dimensions such as cognitive fatigue (mental exhaustion caused by digital activities), physical fatigue (physical strain caused by using technology), emotional fatigue (being exhausted by digital interactions), and motivational fatigue (lower willingness to use technology). Depression Anxiety Stress Scales-21 (DASS-21) was used as a measure of psychological distress, which is a well-validated and commonly used instrument (Lovibond and Lovibond, 1995; Zanon et al., 2020). DASS-21 consists of three subscales characterized by 7 items, such as depression (symptoms of dysphoria, hopelessness, devaluation of life), anxiety (autonomic arousal, situational anxiety, subjective experience of anxious affect), and stress (difficulty relaxing, nervous arousal, agitation) in the assessment. The respondents were asked to rate the degree to which they experienced the respective symptoms during the previous week using a 4-point scale, Subscale scores are multiplied by 2 to be compared with the full DASS, and this gave a scale of 0 to 42 to classify the respondents. Nevertheless, in order to analyse them, raw scores (0-21) were taken. Teaching effectiveness is determined by Perceived Teaching Effectiveness Scale (PES) which is a self-report measure of 8-item that assesses the perception of quality of teaching, student engagement, pedagogical competence and overall teaching performance by educators. The scale covers questions that measure the capability to explain the concepts in a clear way, keeping the students interested, the ability to modify instruction on account of the student, offering constructive feedback and the attainment of learning outcomes. Data collection was done via online survey platform after obtaining institutional ethical approval. The members of the potential sample were recruited via educational institutions and professional contacts and informed about the purpose of the study, procedures, and voluntary participation. Participants were given the battery of measures in one session which took about 20-25 minutes after giving informed consent. Demographic data such as age, education level, teaching experience, and the type of the teaching modality (online, hybrid, face-to-face) was gathered.

Data Analysis

The SPSS software was used to perform data analysis. Early analyses were done to investigate data distribution, data values that lacked, and outliers. All variables of the study were calculated using descriptive statistics (means, standard deviations, ranges, percentiles). The correlation coefficients between digital fatigue and depression, anxiety, stress, and teaching effectiveness were determined to assess the bivariate relationships. All analyses were determined to be statistically significant at $p < .05$.

An indirect effect of digital fatigue on teaching effectiveness through stress was tested with the help of Hayes macro of mediation (Model 4) (Hayes, 2018). The model of mediation analysed: (a) the influence of digital fatigue on stress (path a), (b) the influence of stress on teaching effectiveness that remains unaffected by digital fatigue (path b), (c') the direct influence of digital

fatigue on teaching effectiveness, and (c) the overall influence of digital fatigue on teaching effectiveness. Full mediation represents the case when the indirect effect (a × b) is significant, but the direct effect (c') is not significant, whereas partial mediation represents the case when both indirect and direct effects are significant.

Results

Preliminary Analyses

The preliminary data screening showed no major outliers or assumption violations to use parametric tests. The percentage of missing data was low (<2%), and it was treated by the use of listwise deletion. Analysis of distributions revealed that all the variables were a close approximation to normal distribution with skewness and kurtosis values falling within the acceptable range (±2.0).

Descriptive Statistics

Table 1 shows the descriptive statistics of all the variables in the study. The respondents also expressed moderate degrees of digital fatigue (M = 74.43, SD = 30.75, range = 0-132) which means high but unstable technology-based exhaustion. The scores on digital fatigue were spread throughout the entire range, 25 percent of the participants scored below 50, 50 percent below 74 (median) and 25 percent above 98, which indicates that there is a significant individual variation in digital fatigue experiences. On the psychological distress, the participants said they were at mild to moderate levels of depression (M = 14.12, SD = 9.28, range = 0-34), anxiety (M = 14.77, SD = 9.48, range = 0-34), and stress (M = 11.92, SD = 8.48, range = 0-30). These means scores are classified as mild severity based on the DASS-21 classification guidelines, although there was a lot of variance with some of them displaying severe symptoms. The effectiveness scores were neutral (M = 27.04, SD = 6.01, range = 0-40), and it is possible to conclude that, regardless of the impact of digital fatigue and psychological distress on them, educators retained rather positive attitudes towards their teaching performance. The median of the teaching effectiveness score of 26, and the interquartile range of 24-31, show that the participants considered themselves as quite effective teachers.

Table 1

Descriptive Statistics of Study Variables (N = 101)

Variable	Mean	SD	Minimum	Maximum	25th Percentile	Median	75th Percentile
Digital Fatigue	74.43	30.75	0	132	50	74	98
Depression	14.12	9.28	0	34	6	14	20
Anxiety	14.77	9.48	0	34	6	16	22
Stress	11.92	8.48	0	30	4	12	18
Teaching Effectiveness	27.04	6.01	0	40	24	26	31

Correlation Analysis

The Pearson correlation table of study variables is presented in Table 2. In line with the Hypothesis 1, digital fatigue showed significant positive relationships with depression (r =.32, p <.05), anxiety (r =.20, p <.05) and stress (r =.21, p <.05). These results suggest that greater amounts of digital fatigue had positive correlations with greater psychological distress in all three dimensions, but the correlations were relatively weak, especially those between digital fatigue and anxiety and stress. As opposed to Hypothesis 2, there was no significant correlation between digital fatigue and teaching effectiveness (r = -.03, p >.05), which means that there was no linear relationship between technology-related exhaustion and perceived instructional quality. This surprising result has led to the investigation of indirect routes in which digital fatigue could affect the effectiveness of teaching. Teaching effectiveness showed significant negative relationships with all three psychological distress variables, depression (r = -.38, p < .01), anxiety (r = -.39, p < .01) and stress (r = -.43, p <.01). These intermediate relationships suggest that teachers with greater psychological distress said they had worse teaching effectiveness. The most significant correlation was found between teaching effectiveness and stress, which means that stress can be especially conspicuous to decide the quality of teaching. All three psychological distress variables (depression, anxiety, stress) were intercorrelated in a very strong manner (r = .82 to.90, all p <.01) as the conceptualization of these constructs aligns them as related aspects of general psychological distress. Considering such high intercorrelations and theoretical emphasis on stress as the closest response to environmental demands, further mediation studies were conducted with stress as the mediator variable.

Table 2

Pearson Correlation Matrix Among Study Variables

Variable	**1**	**2**	**3**	**4**	**5**
1. Digital Fatigue	1.00				
2. Depression	.32*	1.00			
3. Anxiety	.20*	.83**	1.00		
4. Stress	.21*	.82**	.90**	1.00	
5. Teaching Effectiveness	−.03	−.38**	−.39**	−.43**	1.00

** p < .05 ** p < .01*

Mediation Analysis: Stress as Mediator

In order to test Hypothesis 3, a mediation analysis was carried out to examine the relationship between stress and teaching effectiveness and whether stress mediates the relationship between digital fatigue and teaching effectiveness. Table 3 shows the findings of the prediction of stress (the mediator) by digital fatigue (path a). Digital fatigue predicted stress significantly (B = 0.06, SE = 0.03, t = 2.17, p =.032, 95% CI [0.01, 0.11]) such that a one-unit increase in digital fatigue was correlated with a 0.06-unit increase in stress. The model accounted 4.6% of the variance in the stress (R 2 =.046, F(1,99) =4.73, p =.032). Although statistically significant, this is a relatively

small effect size that indicates that digital fatigue explains a relatively small portion of stress variance, and other factors play a significant role in the stress levels of educators.

Table 3

Regression Analysis: Digital Fatigue Predicting Stress (Path a)

Predictor	**B**	**SE**	**t**	**p**	**95% CI**
Constant	7.54	2.18	3.46	.001	[3.22, 11.86]
Digital Fatigue	0.06	0.03	2.17	.032	[0.01, 0.11]

Model Statistics: $R^2 = .046$ $F(1,99) = 4.73$ $p = .032$

Table 4 shows the outcomes of the prediction of teaching effectiveness by simultaneously considering the digital fatigue and stress (pathways b and c'). The model accounted 19.0 percent of the variance in teaching effectiveness (R 2 =.190, F(2,98) =11.50, p <.001), which is a moderate effect size. In this model, stress was a strong negative predictor of teaching effectiveness (B = -0.32, SE = 0.07, t = -4.79, p < .001, 95% CI [-0.45, -0.19]) with each unit of stress being associated with a 0.32 unit lowering of teaching effectiveness (path b). This correlation was strong after adjusting to digital fatigue. Importantly, the direct effect of digital fatigue on teaching performance was no longer significant when stress was added to the model (B = 0.01, SE = 0.02, t = 0.75, p = .455, 95% CI = -0.02, 0.05; path c). This three pattern of results significant path a, significant path b, non-significant path c' shows evidence of complete mediation. Digital fatigue affects the effectiveness of teaching by impacting stress and not having a direct impact.

Table 4

Regression Analysis: Digital Fatigue and Stress Predicting Teaching Effectiveness (Paths b & c')

Predictor	**B**	**SE**	**t**	**p**	**95% CI**
Constant	29.79	1.52	19.67	< .001	[26.79, 32.80]
Digital Fatigue	0.01	0.02	0.75	.455	[−0.02, 0.05]
Stress	−0.32	0.07	−4.79	< .001	[−0.45, −0.19]

Model Statistics: $R^2 = .190$ $F(2,98) = 11.50$ $p < .001$

Summary of Mediation Findings

The mediation analysis proved Hypothesis 3 showing that the relationship between digital fatigue and teaching effectiveness is completely mediated by stress. The mechanism works in the following manner: digital fatigue causes more stress which further decreases the teaching effectiveness whereas the digital fatigue does not have a significant direct effect on the teaching effectiveness in case stress is moderated. This observation suggests that the negative effect of digital fatigue on teaching performance is realized entirely because of the stress response that it produces and not because of the direct effects of technology-related fatigue on teaching capacity.

Discussion

The current research analysed the correlations between the concepts of digital fatigue, psychological stress, and teaching effectiveness in a group of female teachers, and more specifically, the concept of stress as a mediating factor. The results showed three major findings, namely, Digital fatigue had a strong relationship with depression, anxiety, and stress, which validates the idea that technology-related fatigue leads to psychological distress. Digital fatigue was not significantly related to teaching effectiveness, as using a negative relationship was proposed; and stress completely mediated the association between digital fatigue and teaching effectiveness, which means that digital fatigue affects teaching performance solely through its impact on stress. The findings add to the knowledge of the psychological processes between the demands of technology and the professional performance in education. The strong positive correlations that exist between digital fatigue and the three dimensions of psychological distress are in line with prior studies that have established that a high level of technology use leads to poor mental health among teachers (Joo et al., 2020; Wang et al., 2020; Virtanen et al., 2021). The fact that the relationship between digital fatigue and teaching effectiveness was not significant was surprising, and it indicates that exhaustion associated with technology, on its own, does not always result in negative teaching performance. Some of the possible reasons that can be mentioned include compensatory mechanisms of educators, professional resilience, and the fact that digital fatigue may affect teaching performance solely via indirect channels. The key result of the given research is the complete mediation of the relationship between digital fatigue and teaching effectiveness by stress. This finding has a theoretical and practical implication. In theory, it is in line with the COR theory that posits that performance impairment is not caused by environmental demands but caused by stress response indicating resource threat or loss (Hobfoll et al., 2018). The mediation pattern suggests that the stress response could be better treated than trying to lessen the digital fatigue as such, where technology integration is a requirement and digital demands are hard to amend.

Conclusion

This study provides a reason to assume that psychological stress is a conclusive mediating variable between digital fatigue and teaching efficacy among women teachers. Even though the correlation of digital fatigue with psychological distress is significant, the effect on teaching performance is completely mediated by the stress response and does not have direct mechanisms. The findings of this paper suggest that stress coping and resilience development interventions may succeed in cushioning the quality of instruction in the condition in which the digital demands remain elevated. The paper draws attention to the importance of institutional cognition of educator wellbeing in digitally intensive learning environments. As the further expansion in the amalgamation of the technologies occurs, the psychological appeal of the digital requests and mitigations thereof are becoming even more crucial to the maintenance of the high-quality instruction and the sustainability of the educator workforce. The learning institutions must consider healthy wellness programs with aim of seeking post-stress measures that seek to curb the work load, social support and growth of careers and stress management programs which are evidence-based. The main research is an indication of a hypothetical open question since it describes that the course under which digital fatigue led to teaching effectiveness is not direct but the effects occur through psychological stresses. The result provides a recommendation that some interventions that are process sensitive in response to the stress might be implemented with the view of disrupting the relationship between the technology needs and the interference with the

professional performance even though the demands of the digital gadgets cannot be diminished significantly. Psychological mechanisms must be informed and needs evidenced based intervention must be committed to make the educator wellbeing and quality of education in our rapidly digitalized educational environment.

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