# How technostress and self-control of social networking sites affect academic achievement and wellbeing

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## Abstract

**Purpose** – Social networking sites (SNS) are heavily used by university students for personal and academic purposes. Despite their benefits, using SNS can generate stress for many people. SNS stressors have been associated with numerous maladaptive outcomes. The objective in this study is to investigate when and how SNS use damages student achievement and psychological wellbeing.

**Design/methodology/approach** – Combining the theoretical perspectives from technostress and the strength model of self-control, this study theoretically develops and empirically tests the pathways which explain how and when SNS stressors harm student achievement and psychological wellbeing. The authors test the research model through a two-wave survey of 220 SNS using university students.

**Findings** – The study extends existing research by showing that it is through the process of diminishing self-control over SNS use that SNS stressors inhibit achievement and wellbeing outcomes. The study also finds that the high use of SNS for academic purposes enhances the effect of SNS stressors on deficient SNS self-control.

**Originality/value** – This study further opens up the black box of the social media technostress phenomenon by documenting and validating novel processes (i.e. deficient self-control) and conditions (i.e. enhanced academic use) on which the negative impacts of SNS stressors depend.

**Keywords** Technostress, Social networking sites, Self-control, Academic achievement, Wellbeing, Social media

**Paper type** Research paper

## 1. Introduction

Using social networking sites (SNS) such as Snapchat, Instagram, WhatsApp and Twitter is one of the most popular online activities. In 2021, it is estimated that 57% of the total global population use SNS (DataReportal, 2021). While benefits do emerge when people engage with SNS, a considerable body of empirical research also documents the negative consequences associated with SNS use (Cao *et al.*, 2018, 2020; Luqman *et al.*, 2017; Turel, 2015; Turel and Serenko, 2012). One such negative consequence is technostress, which refers to the stress individuals experience from their inability to cope with the demands of information technology (IT) use (Ayyagari *et al.*, 2011).

A consensus exists in the literature that technostress often arises when users engage with SNS (Maier *et al.*, 2015; Tandon *et al.*, 2021; Whelan *et al.*, 2020). SNS stressors can manifest

through multiple mechanisms. For example, users can feel stressed by the perceived invasion of SNS into their personal lives (Zhang and Fu, 2020), the perceived pressure to respond to too many friend requests for social support (Maier *et al.*, 2014) or platform features that are complicated and difficult to navigate (Tarafdar *et al.*, 2020). Yet, as highlighted in a recent systematic literature review, it remains unclear how, why and when (i.e. under what conditions) SNS stressors adversely affect important life outcomes (Laumer and Maier, 2021), particularly among the student population. Without an understanding of the mechanisms connecting SNS stressors to outcomes, research can offer only limited practical guidance to individuals and educators on how to develop intervention strategies. Such understanding is crucial now as students rely on SNS more for social interaction during COVID-19 lockdown measures. Focusing on university students, our motivation is to reveal the process through which SNS stressors influence important academic outcomes.

University students are particularly susceptible to developing problematic SNS use given their intense use of and limited control over the internet, socialization pressures, flexible schedules and extensive free time (Turel and Qahri-Saremi, 2016; Whelan *et al.*, 2020). In student populations, the general use of SNS has largely been associated with lower grades (Datu *et al.*, 2018; Junco, 2012; Kirschner and Karpinski, 2010; Masood *et al.*, 2020; Turel and Qahri-Saremi, 2016) and diminished wellbeing (Kingsbury *et al.*, 2021), both of which can have long-lasting negative life consequences.

Our objective in this study is to determine ***how*** and ***when*** SNS use damages student academic achievement and psychological wellbeing. In terms of the ***how,*** we draw from the theoretical frameworks of technostress (Ayyagari *et al.*, 2011; Tarafdar *et al.*, 2007) and the strength model of self-control (Baumeister *et al.*, 2007) to argue that SNS stressors deplete the energy resources needed to control SNS use, and it is this deficient self-control which ultimately leads to reduced student vitality, satisfaction with academic life and academic achievement. In addressing the ***when*** component of our objective, our study determines if the strength of the relationship between SNS stressors and deficient SNS self-control is modified when students also use SNS intensely for academic purposes. To the best of our knowledge, our study is the first to consider how the use of SNS for academic and nonacademic purposes interact to influence important student outcomes.

To gain a deeper understanding of how SNS stressors emerge, and to offer evidence-based solutions, research must generate more detailed and specific explanations of the intervening and contextual factors (Tams *et al.*, 2018). Our study contributes to this goal in a number of ways. First, we theoretically develop and validate a causal pathway involved in the process by which the impacts of SNS stressors unfold (i.e. through mediation by specific factors). Specifically, we find that it is through the process of diminishing self-control over SNS use that SNS stressors exert their effect on achievement and wellbeing outcomes. Second, we establish the conditions under which the stress-related effects of SNS use materialize (i.e. moderation). While SNS can be a valuable tool to assist student learning, there is a cognitive cost. We find that high SNS usage for academic purposes amplifies the effect of SNS stressors on deficient SNS self-control. Overall, this study contributes to further opening up the black box of the technostress phenomenon (Ayyagari *et al.*, 2011) by documenting and validating novel processes (i.e. deficient self-control) and conditions (i.e. enhanced academic use) on which the negative impacts of SNS stressors depend.

## 2. Theoretical support

### 2.1 SNS technostress
Interacting with IT can be stressful. This phenomenon has given rise to a significant volume of research into the concept of technostress, which has been defined as stress that individuals experience due to their use of IT (Tarafdar *et al.*, 2019).

Technostressors are the creators of stress (Ragu-Nathan *et al.*, 2008). The design and features of SNS applications, such as real-time notifications and emotion displays, strongly influence the potency of technostressors. While research into the stressors associated with SNS use is relatively recent, six SNS stressors have been identified and validated in prior literature (Maier *et al.*, 2012, 2015). These are *social overload* which emerges when users feel that they are experiencing excessive social demands through the SNS (Maier *et al.*, 2014, 2015); *disclosure* which refers to the stress-creating condition of individuals feeling that they get too much information on SNS, which prevents them from effectively using the application (Maier *et al.*, 2015; Tarafdar *et al.*, 2020); *pattern* which describes the stressor the individual experiences when they adapt their use of SNS to conform to his or her friends' use, for example, keeping up with friends' postings and informing friends of their activities (Maier *et al.*, 2015; Tarafdar *et al.*, 2020); *complexity* which reflects the extent to which users perceive SNS as technically difficult to use because they do not understand enough about it – this difficulty could arise from, for instance, features that may be complicated to navigate through, such as privacy and data sharing features (Maier *et al.*, 2015; Tarafdar *et al.*, 2020); *uncertainty* which describes the constant changes and updates to the SNS applications that are stressful (Maier *et al.*, 2015; Tarafdar *et al.*, 2020) and *invasion*, which reflects the stress-creating condition wherein individuals feel that their personal life is being invaded by SNS because they use SNS in inopportune situations such as during vacations (Maier *et al.*, 2012, 2015; Zhang and Fu, 2020).

The outcomes linked to technostress are called strain responses and can be psychological, behavioral or physiological (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008). Studies conclude that people reporting elevated levels of technostress are more likely to suffer the psychological strains of diminished commitment (Tarafdar *et al.*, 2010, 2015), poor self-esteem (Korzynski *et al.*, 2020), dissatisfaction with the IT system (Tams *et al.*, 2020), harmful psychological responses (Riedl *et al.*, 2012), burnout (Afifi *et al.*, 2018) and lower job satisfaction (Califf and Sarker, 2020; Suh and Lee, 2017). While studies of technostress generally rely on self-reported data, physiological studies have also demonstrated that stress hormones cortisol and alpha amylase increase with IT-mediated interruptions (Tams *et al.*, 2018), IT system breakdown (Riedl *et al.*, 2012) and extensive exposure to IT applications (Afifi *et al.*, 2018). For these reasons, technostress has been firmly housed within research pertaining to the dark side of IT use (Salo *et al.*, 2018).

As engagement with digital technology has rippled beyond the workplace to influence our personal lives, so too has the technostress literature evolved to evaluate voluntary interactions with hedonic technologies, specifically SNS. This body of work also confirms the significant stress associated with the use of SNS. Through the distractions inherent within SNS, technostress has been likened with the emerging problem of technology addiction (Brooks *et al.*, 2017; Tarafdar *et al.*, 2020) which is exacerbated by habitual SNS use (Tarafdar *et al.*, 2020; Vaghefi *et al.*, 2020). Problems with concentration, sleep, identity and social relationships have been linked with SNS features which trigger technostress (Kaur *et al.*, 2021; Salo *et al.*, 2019). Emerging research also reveals that the formation of stress associated with using personal IT systems such as SNS occurs at different rates. For instance, the *invasion* technostressor builds up gradually, while a technostressor such as *complexity* emerges in a more punctuated manner (Salo *et al.*, 2021). Technostress also has implications on intentions to continue using SNS. In response to SNS stressors and exhaustion, users develop discontinuous usage intentions to avoid such stress (Luqman *et al.*, 2017; Maier *et al.*, 2015).

Despite the recent advancements in SNS technostress research, the findings from prior studies are limited (in at least one way) as they tend to focus on one specific SNS platform, i.e. Facebook. There are different categories of SNS and users engage with these platforms for different purposes. While Facebook can be considered a general SNS, other categories of SNS

are more heavily used today, including media sharing networks (e.g. Instagram, Snapchat), discussion forums (e.g. Reddit, Digg), consumer review networks (e.g. Yelp, TripAdvisor), content curation networks (e.g. Pinterest, Flipboard) and blogging networks (e.g. Tumblr, Medium). Indeed, the insights from Facebook stressor studies may have limited applicability to university students today as a recent Pew Research Center study reports that 18- to 24-year-olds are more likely to use the media sharing networks Instagram and Snapchat, ahead of Facebook (Pew Research Center, 2021). Therefore, in our study we requested student participants to consider the SNS platform they most frequently use when providing responses.

Underpinning the majority of technostress studies is the transactional theory of stress (Lazarus and Folkman, 1984), which purports that people respond to a stressor through a process of evaluating and implementing available coping resources. Coping mechanisms such as distractions (Tarafdar *et al.*, 2020), distancing from IT (Pirkkalainen *et al.*, 2019), mindfulness (Pflügner *et al.*, 2021) and instrumental and emotional support (Weinert *et al.*, 2020) have been examined in the technostress literature to date. Yet, recent interpretivist research demonstrates how difficult it is for users to mitigate technostress as considerable self-control is required (Salo *et al.*, 2021). Indeed, a proactive personality is important for successful coping (Tiwari, 2020). Therefore, to provide a deeper understanding of how SNS technostress impacts self-control resources, this study views SNS through the strength model of self-control lens.

*2.2 The strength model of self-control*
Self-control refers to the capacity for altering one's own behavior, especially to bring them into line with standards such as ideals, values, morals and social expectations, and to support the pursuit of long-term goals (Baumeister and Tierney, 2012). In everyday life, self-control is required to overcome "dominant responses" (i.e. impulses, habits, urges, cravings and drives) that tempt us to procrastinate, overeat, drink too much alcohol, spend beyond our means or say hurtful things. Self-control is particularly important in managing activities that generate hedonic gratifications and are socially favored (Baumeister and Heatherton, 1994). Engaging in SNS would be consistent with such activities. Many social and behavioral problems can be traced back to a deficiency in self-control (Hagger *et al.*, 2010). Analogously, effective self-control has been shown to contribute to many adaptive outcomes in society, such as success in education, better physical and mental health, career advancement, flourishing interpersonal relationships and the ability to deal with problems (see Nielsen *et al.*, 2020 for a review). The notion of self-control is particularly important in this study as the behavioral outcomes arising from SNS technostress depend on the habitual use of SNS (Tarafdar *et al.*, 2020).

The human capacity to exhibit self-control in the face of temptations is not infinite and depletes over time. In the strength model of self-control, Baumeister and colleagues compare self-control to a muscle (Baumeister *et al.*, 2007). When muscles become stressed from continued use, such as lifting weights repetitiously, they fatigue and eventually fail. Like muscles, self-control requires energy to perform but depletes when exerted. Stressing self-control resources incapacitates the ability to override subsequent acts requiring self-control, a phenomenon called ego depletion (Baumeister *et al.*, 2007). For example, a student may have a goal of performing well in forthcoming exams and so wants to avoid spending time consuming entertainment videos on SNS. An impulse to engage with SNS is triggered every time they see another person using such platforms (Tandon *et al.*, 2021; Whelan *et al.*, 2020). Extinguishing these impulses continuously draws strength from their self-control reserves. When these reserves become exhausted and weak, the person is less likely to maintain the self-control needed to avoid wasting time on SNS (Bright and Logan, 2018).

While we may believe certain people possess tremendous self-control, research suggests that everyone's self-control diminishes when called upon; some people are just better at shaping their environments in a way that limits exposure to temptation, thus preserving their reserves of self-control (Hofmann *et al.*, 2012). A number of lab experiments have confirmed that the ability to regulate oneself becomes impaired following initial efforts to instigate self-control. For example, participants who completed a stressful task designed to deplete self-control (following a set of confusing instructions) committed more errors during a subsequent color-word Stroop task than the nonstressed control group (Hagger *et al.*, 2010). In an important extension to the muscle metaphor, self-control can be improved with dedicated practice (Baumeister and Tierney, 2012). Targeted efforts to control behavior in one area, such as healthy eating, lead to improvements in unrelated areas, such as studying or household chores. While the published literature on ego depletion has been found to be influenced by publication bias (Carter and McCullough, 2014) (i.e. the outcome of an experiment or research study influences the decision whether to publish or otherwise distribute it), overall, a considerable amount of research supports the primary tenet of the strength model of self-control (Englert, 2019; Ginis and Bray, 2009; Hagger *et al.*, 2010).

Students, in particular, are exposed to lots of external distracting stimuli which can impact their ability to develop a successful academic career. In educational settings, the strength of self-control as a means of preventing ego depletion has received some support as a mechanism enabling students to neutralize the impulses and desires not conducive to academic success (Duckworth and Yeager, 2015; Englert *et al.*, 2017; Panek, 2014). Yet, the question of whether the depletion of self-control explains the association between stressors and life outcomes has yet to be examined. We address this question by specifically examining how a deficiency in self-control mediates the relationship between a prominent stressor in today's world (SNS stressors) and student outcomes (achievement and wellbeing). Thus, the strength model of self-control can provide new insights into why SNS stressors are associated with psychological responses, which in turn can inform the design of targeted interventions.

### 2.3 Academic outcomes

Studying at university brings not only a wealth of opportunities but also significant challenges. The factors that influence the success and wellbeing of university students have received much scholarly attention. In the majority of studies on students' use of SNS and its impact on academic achievement, student performance has been measured on the basis of GPA (Cao *et al.*, 2018; Giunchiglia *et al.*, 2018; Junco, 2012; Kirschner and Karpinski, 2010; Lambic, 2016; Michikyan *et al.*, 2015; Rashid and Asghar, 2016). However, more recent research has sought a more holistic measure of academic achievement by measuring learning performance (Al-Rahmi *et al.*, 2018), academic engagement (Datu *et al.*, 2018) and other important aspects of achievement, such as leadership development and extracurricular activities, which potential employers look for when assessing the suitability of a graduating student (Whelan *et al.*, 2020). In this study, we adopt the broader conceptualization of "academic achievement", a multifaceted construct that comprises the different domains of learning available to students while in university (Steinmayr *et al.*, 2018). As such, we define academic achievement as the extent to which a student has attained their goals in terms of study performance and career development.

The pressure to achieve academically, while also transitioning into the university environment, can contribute to suboptimal wellbeing for young students. In recent times, the uptake of student counseling services within universities has risen in parallel with reported mental health difficulties (Kaparounaki *et al.*, 2020). Wellbeing difficulties have become even more pronounced for students during the COVID-19 pandemic as campuses closed, depriving students of social interaction and other support networks (Burns *et al.*, 2020). Indeed, 34% of

Australian university students reported low wellbeing during COVID-19, with 32% reporting very low wellbeing (Dodd *et al.*, 2021). Stemming from World Health Organization's (WHO) definition that health "is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (World Health Organization [WHO], 1948) it is now widely accepted that wellbeing is a multidimensional construct (Wills-Herrera *et al.*, 2009). Subjective wellbeing consists of three strands – evaluative wellbeing (or life satisfaction), eudemonic wellbeing (or vitality) and hedonic wellbeing (feelings of happiness, sadness, anger, stress and pain) (Steptoe *et al.*, 2015). In this study, we adopt two common measures of subjective wellbeing in student populations: satisfaction with academic life and subjective vitality (Burns *et al.*, 2020). Satisfaction with academic life encompasses mood, satisfaction with relationships, self-concepts and self-perceived ability to cope with one's daily academic life (Diener *et al.*, 1985). A student could be physically healthy, but not leading a full and vibrant life. The concept of subjective vitality accounts for these aspects of life, and differs from life satisfaction in that it refers to the state of feeling alive and alert, and having energy available to the self (Vallerand, 2015).

## 3. Hypotheses development

Drawing from the theoretical perspectives of technostress and the strength model of self-control, we now develop our research model and hypotheses as shown in Figure 1. We do not hypothesize on the direct relationships between SNS stressors and the outcomes of wellbeing and performance, as these have been well established in the existing literature (Laumer and Maier, 2021; Salo *et al.*, 2019). However, in testing the validity of our research model, we do include these direct relationships between SNS stressors and outcomes as these paths may influence the mediation analysis. To advance our understanding of how SNS stressors impact life outcomes, we specifically assess the mediating role of deficient self-control and the moderating effect of using SNS for academic purposes.

Here we argue that a deficiency in SNS self-control explains why SNS stressors are associated with negative academic outcomes. To establish our three mediation hypotheses, we argue: (1) the link between SNS stressors and poor self-control; (2) the link between SNS stressors and academic wellbeing and achievement outcomes and (3) how deficient SNS self-control precipitates each of the three dependent variables.
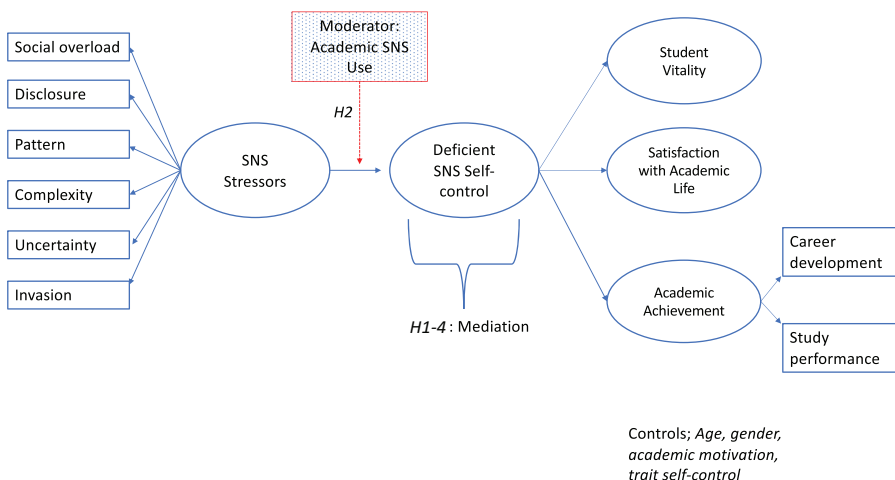


Controls; *Age, gender, academic motivation, trait self-control*

**Figure 1.**
The research model

The uncontrolled use of SNS and other Internet technologies has been consistently linked to deleterious outcomes in students of all ages (Troll *et al.*, 2020). There are many online and offline temptations available to students and self-control is required to avoid these and stay focused on academic goals. Drawing from the strength model of self-control (Baumeister *et al.*, 2007; Baumeister and Tierney, 2012), stress depletes the self-control resources needed to achieve life goals. Studies of student populations support this assertion. Higher levels of perceived stress were found to be associated with higher rates of impulsive control disorders in university students (Leppink *et al.*, 2016). Similarly, the stressors typically encountered by students in real life can generate measurable impairments in self-control observable to parents, teachers and students themselves (Duckworth *et al.*, 2013). The stress-strain-outcome model (SSO; Koeske and Koeske, 2010), which underpins many studies of technology and stress, can be used to support our argument that deficient self-control explains the link between SNS stressors and lower student vitality. The SSO model explains that under this stress, users are likely to experience emotional strain, such as reduced self-control. Furthermore, strain in the form of deficient self-control results in different negative psychological outcomes, such as reduced vitality.

In this study, we argue that a specific type of stressor, SNS stressor, is linked to poor self-control. To the best of our knowledge, no prior study has examined the association between SNS stressors and self-control. However, the related constructs of social connection demands (LaRose *et al.*, 2014) and social media overload (Whelan *et al.*, 2020) have been found to precipitate impulsive online behavior.

In terms of vitality, it is well documented in the stress literature that prolonged exposure to stressors drain the energy required to live, grow and develop (Cooper *et al.*, 2001). A recent systematic literature review highlights that social and technical SNS-stressors can cause psychological strains such as exhaustion and burnout (Laumer and Maier, 2021). Therefore, students who are constantly exposed to the demands of SNS are unlikely to live life to the fullest. Underlying the importance of self-control for students, a study by Oaten and Cheng (2006) reports that student self-control declined during stressful exam periods resulting in poor health choices. Consistent with this perspective, deficient control of various Internet applications, from gaming (Mandryk *et al.*, 2020) to general SNS use (Satici and Uysal, 2015), have been found to directly harm perceptions of vitality. Therefore, we hypothesize:

> *H1.* Deficient SNS self-control mediates the relationship between SNS stressors and student vitality.

The early technostress studies focused on the organizational use of IT (Tarafdar *et al.*, 2007). Within this body of work, a clear consensus exists that technostress reduces job satisfaction (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008). Turning attention to the student population and SNS, qualitative evidence suggests the demands of SNS diminish life satisfaction (Hartnup *et al.*, 2018; Whelan *et al.*, 2020). Moreover, studies of problematic SNS use, where the inability to control SNS is a central issue, report on the negative associations with life satisfaction (Marttila *et al.*, 2021; Satici and Uysal, 2015). Extrapolating from the strength model of self-control and theories of stress, the barrage of notifications a student receives from a media-sharing SNS generates stress which weakens their self-control. Instead of availing of the range of life-enhancing opportunities open to a university student (e.g. participating in sports clubs and societies), the student in a weakened state concedes to impulses and mindlessly skims the videos and images posted on the SNS platform. We argue it is this deficiency in SNS self-control which plays a central role in explaining why the student is not getting the most out of academic life.

Similar to H1 above, the SSO model would add further support to the perspective that deficient self-control explains the link between SNS stressors and reduced life satisfaction.

In this case, reduced life satisfaction is the negative psychological outcome emerging from the strain of deficient self-control. Therefore, we hypothesize:

*H2.* Deficient SNS self-control mediates the relationship between SNS stressors and satisfaction with academic life.

Person–environment fit (French *et al.*, 1982) is an important perspective of stress research. This perspective advocates that stress is a result of the extent of fit or misfit between perceived mental workload and a person's mental resources. The theory further suggests that stress reduces performance (French *et al.*, 1982; Hamilton and Warburton, 1979). Technostress studies have drawn from the person–environment fit perspective to validate the diminishing effects on performance (Cooper *et al.*, 2001). In terms of SNS stressors, the relationship between SNS overload and performance has been extensively studied. Poorer performance is the outcome when both working professionals (Yu *et al.*, 2018) and students (Whelan *et al.*, 2020) are subjected to excessive social media. We argue that self-control is an important variable which explains why SNS stressors are associated with suboptimal academic achievement. Self-control has been found to predict a variety of important outcomes relevant to university students, such as higher performance (Tangney *et al.*, 2004; Troll *et al.*, 2020). Thus, drawing from the strength model of self-control, we argue that SNS stressors deplete the ability to control SNS use, which in turn manifests as poorer academic achievement:

*H3.* Deficient SNS self-control mediates the relationship between SNS stressors and academic achievement.

Drawing from the strength model of self-control, SNS stressors lead to deficient self-control. Here we argue that the increased use of SNS specifically for academic purposes will moderate this relationship. Academic SNS use is defined here as the use of SNS by students to access and share learning content, communicate with instructors and fellow students and customize and build communities related to their program of study.

SNS are feature-rich and research shows that people can perceive them as being useful in many different contexts (Chen and Karahanna, 2018). In addition to satisfying hedonic needs (socialization and entertainment), students also use SNS for utilitarian reasons (to enhance their academic learning). Platforms such as Snapchat, Twitter and YouTube are used to coordinate group assignments, communicate with instructors and classmates, supplement course content and expose students to technologies and skills that may improve their employment success. In contrast to studies of general SNS use among students, studies which investigate the specific use of SNS for academic purposes report a positive relationship between SNS use and academic achievement (Chang *et al.*, 2019; Lambic, 2016). Yet, SNS has become such an important aspect of students' lives that they now automatically switch from using SNS to fulfill an academic task, to also satisfy socialization needs. A recent study reveals the use of SNS for multiple purposes (e.g. keeping in touch with friends, reading news, playing games, arranging events) enhances perceptions of stress (Salo *et al.*, 2019). Following this line of thought, SNS can distract the user from a primary goal and this induces perceptions of stress (Brooks *et al.*, 2017). A student may be distracted by other features when using SNS to learn, which further amplifies frustrations and perceptions of stress. As advocated by the SSO model (Koeske and Koeske, 2010), stress leads to strain, such as deficient self-control. Thus, academic SNS use may generate additional stress, above and beyond those associated with social SNS use, which further weakens self-control. For example, not only does a student feel pressurized to support friends and family through SNS but also to provide additional support to classmates as they are using SNS to collaborate on a group assignment. This additional SNS strain will further weaken self-control.

Focusing specifically on Facebook, Tarafdar *et al.* (2020) confirm that seeking distractions within the same SNS platform explains the pathway from SNS stressors to SNS addiction. Similarly, using SNS more intensely amplifies the effect of information overload on fatigue, but attenuates communication overload (Whelan *et al.*, 2020). To explain why users would continue to engage with the same stress-creating technology, Tarafdar *et al.* (2020) draw from the theory of technological framing (Davidson and Pai, 2004) to suggest that when the use of IT is cognitively represented as uncomfortable, the user will use the IT in a different way in order to change their cognitive frame to a more pleasant representation. This is eminently possible with SNS given the rich feature set afforded by the most popular platforms.

Developing from the above insights, we argue that the more a student uses SNS for academic purposes, the stronger will be the association between SNS stressors and deficient self-control, largely because the student is seldom away from SNS. For example, to alleviate the stress resulting from the complexity of using SNS, a student could resort to, for instance, viewing Instagram videos of content related to their course of study. However, using SNS for such academic purposes is cognitively taxing (Luqman *et al.*, 2017) and would result in depleting SNS self-control resources even further. Therefore, we hypothesize:

*H4.* Academic SNS use positively moderates the relationship between SNS stressors and deficient SNS self-control, such that the effect is stronger for students with higher academic SNS use.

## 4. Methods

### 4.1 Participants

The research model was tested using survey data collected over two points in time from students of a large (450 students) introductory-level course in a university in Ireland. The study began with a pilot study involving 42 SNS users who were university students. Results demonstrated sufficient validity and reliability. Participants for the main study were recruited through an in-class announcement. To be included participants had to be at least 18 years of age, currently using SNS and must consent to participation. Participation was voluntary and was encouraged with entry into a draw for one of five EURO 25 gift vouchers. Study procedures were approved by the research ethics board of the university.

The time-lagged design separated predictor variables from outcomes which reduces common method bias (CMB; Podsakoff *et al.*, 2003) and lends stronger (but imperfect) support for causal arguments (Turel and Qahri-Saremi, 2016). The predictors and control variables were measured at t1. Two weeks later, the outcome variables, mediator and moderator were measured at t2. The two-week time lag was considered sufficient for participants to retain interest in the study, but not too long as they lose interest (Turel and Qahri-Saremi, 2016).

The first survey was completed by 372 participants (83% response rate) with the follow-up survey completed by 356 (79% response rate). When matched, 318 participants had completed both surveys. Of the matched sample, 37 did not fully complete both surveys, resulting in unusable data that was discarded. Another 99 responses were discarded as they incorrectly answered at least one of the four attention check questions included in the surveys. After this data cleaning process, the final sample consisted of 220 participants. We used the G-power sampling size information (Faul *et al.*, 2009) to determine if the sample size of 220 is adequate. Since our model has three predictors, using G-power with an effect size of 0.10, alpha of 0.05 and a power of 0.95, the minimum sample size needed was 132. Thus, we can conclude that the sample size of 220 provides sufficient power to enable the findings to be used with confidence.

In terms of sample characteristics, 60% were female with the remaining 40% classifying themselves as male. The mean age was 19.84 years (SD = 1.36). Snapchat was by far the most

preferred SNS platform (68%), followed by Instagram (23%), Twitter (3%), WhatsApp (2%), Facebook (1%) and others (3%). This aligns with recent data from the USA which confirms that 18–24 years old mostly use the media sharing networks Snapchat and Instagram (Pew Research Center, 2021). Of the participants, 75% had been using SNS for more than five years, 19% for four to five years, with the remaining 6% for three to four years. Participants were asked to answer all questions in relation to their use of their preferred SNS platform.

### 4.2 Measures

All measurement items were taken from prior validated studies. A seven-point Likert scale was used to measure the key constructs of the research model, except for academic achievement which was measured with a five-point scale as per the original construct design. All survey items are provided in Table A1.

Following the approach of Tarafdar *et al.* (2020), **SNS stressor** is specified as a second-order reflective latent construct with six first order dimensions, that are also reflective. The first-order constructs are social overload, disclosure, pattern, complexity, uncertainty and invasion. **Deficient SNS self-control** was measured using the scale developed by LaRose *et al.* (2003). The moderating variable, **academic SNS use**, was measured using a scale taken from (Chang *et al.*, 2019). **Student vitality** was measured using a well-established six-item scale (Bostic *et al.*, 2000; Ryan and Frederick, 1997). **Satisfaction with academic life** was adapted from the commonly used life satisfaction scale (Diener *et al.*, 1985). Finally, **academic achievement** is specified as a second order reflective construct comprising the two first order dimensions of study performance and career development, also reflective (Whelan *et al.*, 2020). When completing this scale, participants were instructed to reflect specifically on their academic life as opposed to their general life satisfaction.

### 4.3 Controls

As a personal trait, self-control may influence the extent of their SNS self-control, we controlled for this effect by using an established four-item scale (Soror *et al.*, 2015). We also controlled for academic motivation, using the same scale as Klobas *et al.* (2018) as previous research suggests academic motivation drives many outcomes relevant to student life (Wentzel and Wigfield, 1998). Gender and age were also included in the model as control variables.

### 4.4 Research model results

The hypotheses were tested using SmartPLS 3.3.3 (Ringle *et al.*, 2015). The Partial least-squares (PLS) approach to structural equation modeling (SEM) enables researchers to estimate complex models with many constructs, indicator variables and structural paths without imposing distributional assumptions on the data (Hair *et al.*, 2011). PLS is an appropriate methodology when the goal of the study is both to evaluate the validity of a research model, and to test new theoretical relationships within that model (Hair *et al.*, 2017). As the purpose of this study is to test a new theoretical explanation (i.e. the strength model of self-control) linking SNS stressors to academic achievement and wellbeing outcomes, PLS-SEM is deemed an appropriate approach. In SEM analyses, a two-stage approach, first examining the measurement model and then the structural model is recommended (Hair *et al.*, 2011). The assessment of the measurement model, provided in the supplementary information, demonstrates sufficient convergent validity, discriminant validity and reliability for all scales.

### 4.5 Assessing the measurement model

As all constructs in the model were reflective, we followed the procedures recommended by Hair *et al.* (2019) to test convergent and discriminant validity. The first step involves the

examination of indicator loadings. Loadings above 0.708 are recommended. Two items on the seven-item deficient SNS self-control scale and one item on the six-item student vitality scale fell below this threshold. However, the item for student vitality was retained as the average variance extracted (AVE) for the construct remained above 0.50 (Hair *et al.*, 2019). The two deficient SNS self-control items were removed from the analysis as their inclusion would have resulted in the AVE falling below 0.50.

The second step tests for construct reliability, which indicates the extent to which items on a scale are related in reality. We evaluated the internal consistency of the scale items by examining composite reliabilities (CR) and the convergent validity with the AVE values. The CRs being above 0.7 suggests satisfactory construct reliability (Fornell and Larcker, 1981). No CR value was above 0.95, which can be an indication of redundant items, thereby reducing construct validity. Convergent validity is the extent to which the construct converges to explain the variance of its items. AVE is the metric used for evaluating a construct's convergent validity. A construct that explains at least 50% of the variance of its items is considered acceptable (Hair *et al.*, 2019). All AVEs in our data exceed 0.5 which further establishes satisfactory construct reliability (Fornell and Larcker, 1981). The descriptive statistics, loadings, CR and AVEs are shown in Table A1.

Discriminant validity, the extent to which a construct is empirically distinct from other constructs in the model, is assessed in the third step. For appropriate discriminant validity, the heterotrait-monotrait (HTMT) ratio, which is an estimate of the true correlation between two constructs if they were perfectly measured, should be below 0.90 for all constructs, or 0.85 for the more conservative 0.85 threshold (Henseler *et al.*, 2015). Based on the HTMT values in Table 1, all the values did not exceed the threshold of 0.85, indicating that the variables in the dataset have sufficient discriminant validity. Henseler *et al.* (2015) also suggest that the traditionally used Fornell and Larcker criterion (Fornell and Larcker, 1981) also be employed as a support to HTMT values. This measure is obtained by comparing the square root of the AVE to the inter-construct correlation of that same construct and all other reflectively measured constructs in the structural model. If the square root of AVE (diagonal values in Table 1) is greater than the corresponding construct correlations, this suggests discriminant validity is present (Fornell and Larcker, 1981). This was the case for all our data.

As we used self-reported surveys to gather data, we tested for the potential influence of CMB. All CMB detection techniques have limitations, so we used a number of methods to assess for CMB. First, the occurrence of a variance inflation factor (VIF) greater than 3.30 for any latent variable is proposed as an indication that a model may be contaminated by CMB (Kock, 2015). Therefore, if all VIFs resulting from a full collinearity test are equal to or lower than 3.30, the model can be considered free of CMB. The VIF matrix confirmed all values were less than 3.30 (see Table A1 for values for each latent variable). Second, we conducted a single factor test (Harman, 1976) to check for CMB. We examined the unrotated factor solution in SPSS for all the items of our first-order constructs. The factor analysis revealed 12 distinct factors with the largest factor accounting for only 25.75% of the variance and found no single construct accounted for a majority of the total variance. These tests, along with the two-wave survey, ensure that CMB is not a major concern in this study.

### 4.6 Assessing the structural model

When the measurement model assessment is satisfactory, the next step in evaluating PLS-SEM results is to assess the structural model. Statistical significance and relevance of the path coefficients, coefficient of determination ($R^2$), the blindfolding-based cross validated redundancy measure $Q^2$ and the model's out-of-sample predictive power should all be assessed at this stage (Hair *et al.*, 2019).

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Social overload | 0.74 | | | | | | | | | | | |
| 2. Disclosure | 0.08 (0.12) | 0.79 | | | | | | | | | | |
| 3. Pattern | 0.13 (0.23) | −0.04 (0.09) | 0.76 | | | | | | | | | |
| 4. Complexity | −0.05 (0.11) | −0.16 (0.19) | 0.32 (0.57) | 0.74 | | | | | | | | |
| 5. Uncertainty | 0.08 (0.12) | 0.03 (0.06) | 0.09 (0.17) | 0.11 (0.19) | 0.83 | | | | | | | |
| 6. Invasion | 0.03 (0.16) | −0.09 (0.13) | 0.24 (0.31) | 0.37 (0.50) | 0.33 (0.19) | 0.82 | | | | | | |
| 7. Deficient SNS self-control | −0.02 (0.09) | −0.18 (0.22) | 0.14 (0.20) | −0.18 (0.10) | 0.02 (0.16) | 0.07 (0.13) | 0.71 | | | | | |
| 8. Academic SNS use | 0.16 (0.22) | 0.07 (0.13) | −0.01 (0.12) | 0.15 (0.19) | 0.20 (0.18) | 0.24 (0.28) | 0.16 (0.18) | 0.79 | | | | |
| 9. Student vitality | 0.32 (0.41) | 0.32 (0.06) | −0.09 (0.16) | −0.17 (0.22) | 0.03 (0.19) | −0.18 (0.22) | 0.14 (0.20) | 0.03 (0.19) | 0.76 | | | |
| 10. Satisfaction with academic life | 0.29 (0.38) | 0.53 (0.60) | −0.06 (0.14) | −0.18 (0.10) | 0.02 (0.16) | 0.06 (0.09) | 0.10 (0.12) | 0.17 (15) | 0.24 (0.31) | 0.79 | | |
| 11. Study performance | 0.42 (0.59) | 0.57 (0.66) | −0.08 (0.10) | −0.11 (0.15) | −0.04 (0.16) | −0.03 (0.06) | 0.04 (0.08) | −0.01 (0.04) | 0.47 (0.56) | 0.01 (0.03) | 0.85 | |
| 12. Career development | −0.05 (0.07) | −0.09 (0.09) | 0.06 (0.10) | 0.11 (0.19) | −0.08 (0.13) | 0.08 (0.09) | 0.14 (0.16) | 0.10 (0.14) | −0.04 (0.09) | 0.11 (0.13) | −0.10 (0.12) | 0.87 |

**Note(s):** HTMT, heterotrait-monotrait ratio; SNS, social networking sites

Table 1.
Correlations between
latent variables with
square root of AVEs in
the main diagonal
(HTMT values in
brackets)

The significance of path coefficients was determined via a bootstrapping procedure by setting the number of cases equal to the sample size (Tenenhaus *et al.*, 2005) and the number of bootstrap samples to 5,000 (Hair *et al.*, 2017). While the conventional approach for mediation testing begins with establishing the direct relationship between the independent and dependent variables (Baron and Kenny, 1986), contemporary thinking suggests this first step has no bearing on whether mediation is present or not (Hayes, 2017). Indeed, terms such as full or partial mediation are redundant. The indirect effect is either significant or not, regardless of the significance of the total effect (Hayes, 2017). Adopting the contemporary mediation approach, Figure 2 indicates that deficient SNS self-control mediates the relationship between SNS stressors and student vitality (H1 supported), satisfaction with academic life (H2 supported) and academic achievement (H3 supported) [1], [2]. The *t* scores and *p* values for each hypothesis are also provided in Table 2.

As hypothesized, the intensity with which a student used SNS for academic purposes moderated the relationship between SNS stressors and deficient SNS self-control (H4 supported). As depicted in Figure 3, the positive relationship between SNS stressor and deficient SNS self-control is stronger for those students who use SNS more intensely for academic purposes.

With respect to $R^2$, a variance of 16.6% is explained for deficient SNS self-control; 15.2% is explained for student vitality; 18.2% of the variance of satisfaction with academic life and 16.7% for academic achievement is explained in our research model. Of the control variables, academic motivation was positively related to all three outcomes. The demographic controls of age and gender were not significantly related to any construct. Similarly, trait self-control was not significantly related to any construct, including deficient SNS self-control. All four hypotheses remained supported when the control variables were excluded from the analysis, with only modest changes to the path coefficient strengths.

The $f^2$ effect size for the mediated relationships in H1, H2 and H3 are 0.07, 0.09 and 0.05 respectively. These effect sizes indicate that deficient SNS self-control has a substantive mediation impact on all three outcomes, albeit one that is in the low to moderate effect range (Hair *et al.*, 2017). The $f^2$ value for the moderated relationship in H4 is 0.16, which is in the small effect range. These effect sizes are in line with the literature on digital media impacts
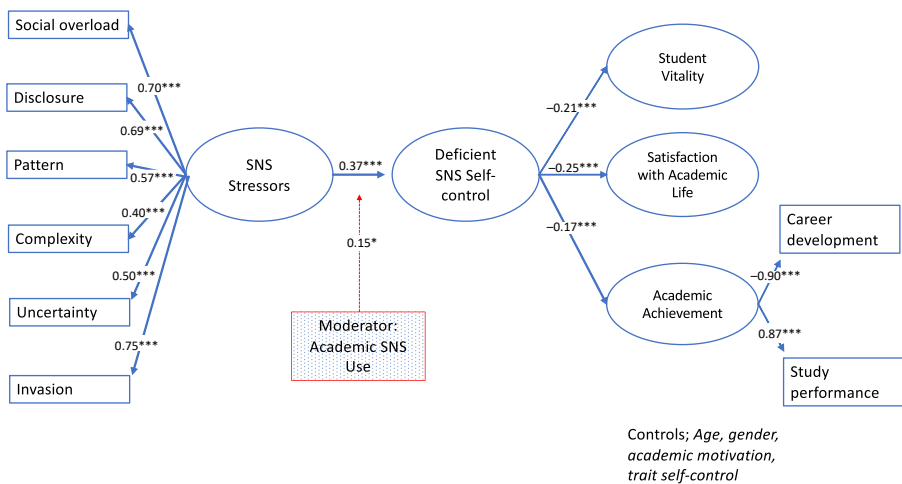


**Figure 2.**
Research results

**Note(s):** *$p < 0.5$, **$p < 0.01$, ***$p < 0.001$

| H# | Path | t-value | p-value | $f^2$ | 95% CI lower | 95% CI upper | Supported |
|---|---|---|---|---|---|---|---|
| H1 | SNS stressor → Deficient SNS self-control → Student vitality | 2.27 | 0.023 | 0.07 | −0.125 | −0.016 | Yes |
| H2 | SNS stressor → Deficient SNS self-control → Satisfaction with academic life | 2.89 | 0.004 | 0.09 | −0.131 | −0.017 | Yes |
| H3 | SNS stressor → Deficient SNS self-control → Academic achievement | 1.99 | 0.047 | 0.05 | −0.100 | −0.019 | Yes |
| H4 | Moderating effect of academic SNS use on the relationship between SNS stressor → Deficient SNS self-control | 2.093 | 0.037 | 0.16 | 0.015 | 0.300 | Yes |

**Note(s):** SNS, social networking sites; CI, Confidence interval
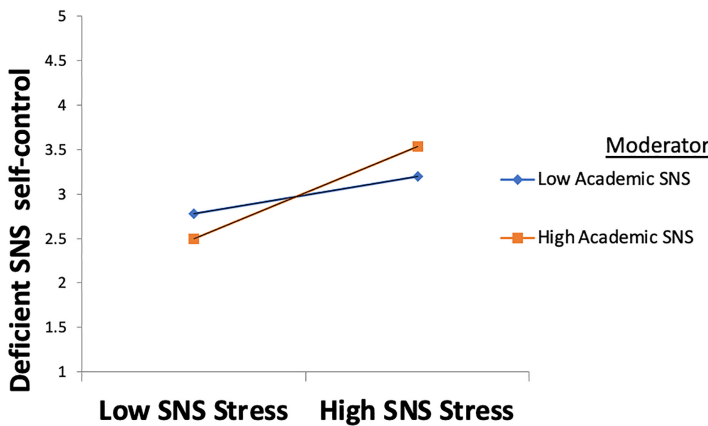
**Table 2.**
Results of hypotheses
testing



**Figure 3.**
Moderation effect

where effect sizes are typically low and close to null (Johannes *et al.*, 2021). Concerning the control variables, trait self-control had a weak effect on deficient SNS self-control ($f^2 = 0.09$). Academic motivation had a moderate effect on academic achievement ($f^2 = 0.17$) and weak to moderate effects on student vitality ($f^2 = 0.12$) and satisfaction with academic life ($f^2 = 0.09$).

Calculating the $Q^2$ is another means to assess the predictive power of the PLS path model (Hair *et al.*, 2019). This measure indicates the model's out-of-sample predictive power and relevance. In a structural model, $Q^2$ values larger than zero for reflective latent constructs indicate predictive relevance for a particular dependent construct (Hair *et al.*, 2017). In our model, all four dependent variables are above zero, with academic achievement the highest $Q^2$ (0.12), followed by student vitality (0.11), satisfaction with academic life (0.10) and deficient SNS self-control (0.07). Thus, these results provide support for predictive relevance of the latent constructs.

In a final assessment of the model's predictive validity, we conducted a PLSpredict analysis which uses a subsample of the data to predict another sample in a random repeated process. Researchers are advised to focus on the prediction errors of the model's key endogenous construct when interpreting PLSpredict results (Hair *et al.*, 2019). If none of the prediction errors for each construct indicator are higher for the PLS-SEM assessment when compared to a linear regression version, then a high predictive power can be assumed (Hair *et al.*, 2019). In our PLSpredict assessment, we selected deficient SNS self-control as the central

construct. The linear regression prediction errors for all indicators were higher than the PLS-SEM version, thus confirming the model exhibits high predictive power.

It is also possible that our theoretical construction of the model, with the strength model of self-control explaining why SNS stressors lead to maladaptive academic outcomes, is inappropriate. To alleviate such concerns, we tested for potential reverse relationships in our model. First, we tested the alternative hypothesis that SNS stressors acted as the mediating variable between deficient SNS self-control and the academic outcomes. This hypothesis was rejected for each of the paths to the three academic outcomes. Second, we considered whether the relationship from deficient SNS self-control to SNS stressors was moderated by academic SNS use. This path too was not significant. Third, although not compatible with the strength model of self-control, we also tested if academic SNS use moderated the relationship between deficient SNS self-control and academic outcomes. Each of these moderated relationships was insignificant, which validates the positioning of academic SNS use in our research model. Together, these tests show that alternative relationships are unlikely to be an issue in our research model.

## 5. Discussion

For university students, the use of SNS for personal and academic purposes is now ubiquitous. Despite its benefits, using SNS can be stressful for many people (Cao *et al.*, 2018; Masood *et al.*, 2020; Salo *et al.*, 2019). Prior research concerning SNS stress has focused on conceptualizing the different types of stressors perceived by users and the consequences of that stress. However, our understanding of the dynamics linking SNS stressors to outcomes is limited (Salo *et al.*, 2019). The manifestations of SNS stress are experienced in varying ways for different users. Relying largely on theories of cognitive distractions, some recent studies have partially revealed the black box linking SNS stressors to consequences (Brooks *et al.*, 2017; Salo *et al.*, 2019). To advance these insights, our study draws from the influential strength model of self-control (Baumeister *et al.*, 2007; Baumeister and Tierney, 2012) to theoretically develop and empirically validate an alternative explanation of when and how SNS stressors lead to adverse life outcomes. We next explain the paper's contributions and its implications for research and practice.

### 5.1 Research contributions

Our first theoretical contribution is to extend recent discussions on the impact of SNS on student outcomes (Muraven, 2010). Unlike previous studies which mostly consider how excessive time spent on SNS impacts academic outcomes (Junco, 2012; Kirschner and Karpinski, 2010), we provide a more nuanced understanding of how SNS use unfolds for students using the technostress and self-control perspectives. Such theory-driven approach in educational Information systems (IS) perspective is rare, and causal pathways developed in prior studies lack a proper theoretical foundation (Masood *et al.*, 2020). Our study contributes by shifting the discussion away from a focus on the amount of time students spend on SNS, to an appreciation of students' perception of SNS (i.e. the stress arising from SNS use) and how that perception can influence important academic outcomes. Extensive use of SNS may only be a problem in that it takes time away from other activities (e.g. studying for exams). In the context of video games for example, increasing evidence supports the view that intense play may involve patterns of gaming that are characterized by high involvement but are not problematic (Billieux *et al.*, 2019; Griffiths, 2010). This study places emphasis on the stressors resulting from SNS use which indirectly affect student wellbeing and success variables through self-control deficiencies. Our findings are consistent with the recent Troll *et al.*'s (2020) study of student attachment to smartphones, in that self-control over personal

technology is central in explaining why some students fare better than others. While time spent on SNS use does play a role, it needs to be considered in conjunction with moderating variables, such as SNS self-control and gratification sought, to better understand how time spent on SNS influences important life outcomes. Furthermore, our study extends prior research which stops at the performance level (Cao *et al.*, 2018; Luqman *et al.*, 2017; Masood *et al.*, 2020) by incorporating student psychological wellbeing into the educational SNS research agenda.

Second, this study extends previous works by yielding a more nuanced understanding of the moderating factors that bound the applicability of SNS stressor effects. We found that the use of SNS for academic purposes enhances the effect of SNS stressors on deficient SNS self-control. In other words, the stress generated from using SNS will weaken a student's self-control, and this weakening of self-control is even more pronounced when the student also uses SNS intensely for academic purposes. This finding sheds light on the boundary conditions, or contextual factors, on which the stress-related effects of SNS depends, a critical contribution to theory development and testing (Hayes, 2017). In explaining the observed association between SNS stressors and SNS addiction, Tarafdar *et al.* (2020) argue that users continue to engage in the SNS platform for alternative tasks in order to take their mind off the stress they experience when using SNS. Following this line of thought, as a coping mechanism, students may switch to using SNS to achieve academic goals when SNS stressors materialize. However, the technostress experienced from using SNS for their personal lives may leave self-control resources in a weakened state. Therefore, as our results suggest, a heavy reliance on SNS for academic purposes only serves to exacerbate the effects of SNS stress. For example, if using Snapchat for social purposes generates stress for a student, a switch to using Snapchat intensely to coordinate university assignments will result in less self-control and ultimately poorer academic outcomes.

Our literature search only returned one previous study (i.e. Chang *et al.*, 2019) which considered how both academic and nonacademic SNS uses affect students' outcomes. In that particular study, the dual uses of SNS were examined in separate research models with compulsive nonacademic SNS use found to be negatively associated with academic achievement, and compulsive academic SNS usage positively associated with academic achievement. When examined in isolation, high academic use of SNS may well be positively correlated with academic achievement. However, people engage with SNS for multiple purposes which often interact. These interaction effects are encapsulated in our research model, the results of which suggest that high use of SNS for academic purposes indirectly leads to diminished student achievement and wellbeing. Therefore, our findings question those existing studies which report a direct positive relationship between academic SNS use and student performance (Chang *et al.*, 2019; Lambic, 2016). Students can use the same SNS for both social and academic activities. Extrapolating from our findings, it is possible that the boundaries between hedonic (i.e. social interactions with friends) and utilitarian (i.e. developing academic knowledge) pursuits become blurred and confused when SNS is used for dual purposes. SNS was traditionally an environment for hedonic experiences. For students, the recent adoption of SNS to satisfy utilitarian needs may conflict with their perceptions of what SNS provides them. Indeed, they may feel they never get a break from SNS as it has become central to their social and academic lives. This conflict could lead to a lack of focus which strengthens the relationship between stressors and academic outcomes.

Our third contribution is to introduce the strength model of self-control into the technostress literature. This model advocates that self-control is analogous to the muscles in our body in that repeated stress (e.g. through lifting weights or avoiding dominant responses) depletes the energy needed to override subsequent acts requiring self-control (Baumeister *et al.*, 2007; Baumeister and Tierney, 2012). For students, self-control seems to be particularly important (Duckworth *et al.*, 2014). In experimental settings, ego-depleted undergraduate

students performed significantly worse on tasks based on cognitive ability and fluency (Schmeichel *et al.*, 2003, 2006). When stressed by exams, students' self-control performance was less efficient leading to a less healthy lifestyle during the exam period (Oaten and Cheng, 2006). Our findings confirm existing studies which suggest university students are particularly susceptible to SNS stressors (Cao *et al.*, 2018; Masood *et al.*, 2020). We go a step further and show that it is through the process of diminishing self-control over SNS use that SNS stressors inhibit performance and wellbeing outcomes. This is a new conceptual development because it validates an important causal pathway in technostress research and adds to our understanding of how the damaging effects of technostress can be mitigated.

### 5.2 Practical contributions

This study has important practical implications. Deficient control over SNS use is central in explaining how SNS stressors lead to problems. Extending the muscle analogy, research has shown that self-control can be strengthened in the long run by regularly performing self-control acts. Such training improves the efficiency or availability of self-control resources (Hagger and Chatzisarantis, 2013), and should be considered by individuals and their caregivers as a focal point for effective intervention strategies. For instance, research has shown that engaging in short-term acts (e.g. controlling speech, using the nondominant hand) lead to improved performance on self-control tasks under depletion (Muraven, 2010). Similarly, SNS users may believe that switching their use to different SNS features or purposes will enable them to cope with SNS stressors. However, even a low use of SNS for academic purposes will only partially offset the effects of SNS stressors on self-control. Users are thus advised to take a complete break from using SNS on the onset of stress. Insights from the boundary management literature (Bulger *et al.*, 2007) are pertinent here too. To alleviate SNS technostress, students should separate the personal life use of SNS from the academic use, rather than continuously switching between the two.

Providers of SNS applications can also benefit from this study. Problematic users of SNS are more likely to quit using the app, which would adversely affect the providers' revenue model. While numerous digital self-control tools exist to temper SNS use, such as feature minimization, app blocking and gamification awards, to the best of our knowledge none directly addresses the stress generated by SNS use. Numerous stress-sensing technologies can now be embedded in devices accessing SNS (Whelan *et al.*, 2018). These technologies can be exploited by SNS providers to alert users to rising stress levels and "nudge" them to less stressful activities.

Finally, because the COVID-19 mandated remote teaching, SNS applications are increasingly being used in universities to disseminate learning content and facilitate interactions between students and instructors. While SNS provides efficiencies and is often the preferred mode of interaction by students, educators also have a duty of care to students. Educators need to be aware that using SNS for academic purposes is cognitively taxing on students. Mandating that students use these technologies may only serve to diminish self-control even further (Englert *et al.*, 2017). Students should be offered the opportunity to choose to some degree when and how to use SNS to support specific learning content.

### 5.3 Limitations and future research

This study is subject to a number of limitations. First, our sample had an overwhelming preference for using media sharing SNS, which is only one category of SNS. A fruitful area of future enquiry would be to compare the association between SNS stressors and self-control across different categories of SNS, for example, professional SNS like LinkedIn compared to discussion SNS like Digg. Second, our study relied on self-reported data which can be subject to some biases, ranging from a misunderstanding of what a proper measurement is, to social-desirability bias. Prior technostress research suggests that the combination of physiological

measures of stress along with psychological measures yields a more valid representation of the stress construct (Tams *et al.*, 2014). To advance our understanding of SNS stressors, future studies should aim to incorporate physiological measures of stress into their investigations. This need not be an expensive proposition. Wearable technologies such as the Fitbit now capture heart rate variability, which is a reliable indicator of stress. Third, the wellbeing outcomes measured in this study were customized specifically to student academic life. It is possible that a student could thrive in their academic life, but struggle in other aspects such as family life. Future studies could examine if and how SNS stressors contribute to conflict between the academic and family life domains. Finally, our study only considered between-person effects. Cross-sectional self-reported psychological measures can fluctuate from day to day and even over the course of a day. Future studies should adopt an experience sampling study which would also assess within-person effects over time. Such an approach would allow researchers to assess how the perception of SNS stressors in an individual, at a point in time, influence other variables at a later point in time.

## Notes

1. The direct relationships between SNS Stressors and the three dependent variables only become insignificant when the mediating variable is introduced. Under the conventional Baron and Kenny approach, H1–H3 can thus be considered to be fully mediated.

2. We also tested each mediated relationship using the PROCESS macro in SPSS. Each hypothesized relationship was also supported using this approach.

## References

Afifi, T.D., Zamanzadeh, N., Harrison, K. and Acevedo Callejas, M. (2018), "WIRED: the impact of media and technology use on stress (cortisol) and inflammation (interleukin IL-6) in fast paced families", *Computers in Human Behavior*, Vol. 81, pp. 265-273.

Al-Rahmi, W.M., Alias, N., Othman, M.S., Marin, V.I. and Tur, G. (2018), "A model of factors affecting learning performance through the use of social media in Malaysian higher education", *Computers and Education*, Vol. 121, pp. 59-72.

Ayyagari, R., Grover, V. and Purvis, R. (2011), "Technostress: technological antecedents and implications", *MIS Quarterly*, Vol. 35, pp. 831-858.

Baron, R.M. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psychological research. Conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology*, Vol. 51 No. 6, pp. 1173-1182.

Baumeister, R.F. and Heatherton, T.F. (1994), *Losing Control: How and Why People Fail at Self-Regulation*, Academic Press, New York.

Baumeister, R.F. and Tierney, J. (2012), *Willpower: Rediscovering the Greatest Human Strength*, Penguin, New York.

Baumeister, R.F., Vohs, K.D. and Tice, D.M. (2007), "The strength model of self-control", *Current Directions in Psychological Science*, Vol. 16 No. 6, pp. 351-355.

Billieux, J., Flayelle, M., Rumpf, H.J. and Stein, D.J. (2019), "High involvement versus pathological involvement in video games: a crucial distinction for ensuring the validity and utility of gaming disorder", *Current Addiction Reports*, Vol. 6, pp. 323-330.

Bostic, T.J., Rubio, M.D. and Hood, M. (2000), "A validation of the subjective vitality scale using structural equation modelling", *Social Indicators Research*, Vol. 52 No. 3, pp. 313-324.

Bright, L.F. and Logan, K. (2018), "Is my fear of missing out (FOMO) causing fatigue? Advertising, social media fatigue, and the implications for consumers and brands", *Internet Research*, Vol. 28 No. 5, pp. 1213-1227.

Brooks, S., Longstreet, P. and Califf, C. (2017), "Social media induced technostress and its impact on internet addiction: a distraction-conflict theory perspective", *AIS Transactions on Human-Computer Interaction*, Vol. 9 No. 2, pp. 99-122.

Bulger, C.A., Matthews, R.A. and Hoffman, M.E. (2007), "Work and personal life boundary management: boundary strength, work/personal life balance, and the segmentation-integration continuum", *Journal of Occupational Health Psychology*, Vol. 12 No. 4, pp. 365-375.

Burns, D., Dagnall, N. and Holt, M. (2020), "Assessing the impact of the COVID-19 pandemic on student wellbeing at universities in the United Kingdom: a conceptual analysis", *Frontiers in Education*, Vol. 5, 582882.

Califf, C.B. and Sarker, S. (2020), "The bright and dark sides of technostress: a mixed-methods study involving healthcare it", *MIS Quarterly*, Vol. 44 No. 2, pp. 809-856.

Cao, X., Gong, M., Yu, L. and Dai, B. (2020), "Exploring the mechanism of social media addiction: an empirical study from WeChat users", *Internet Research*, Vol. 30 No. 4, pp. 1305-1328.

Cao, X., Masood, A., Luqman, A. and Ali, A. (2018), "Excessive use of mobile social networking sites and poor academic performance: antecedents and consequences from stressor-strain-outcome perspective", *Computers in Human Behavior*, Vol. 85, pp. 163-174.

Carter, E.C. and McCullough, M.E. (2014), "Publication bias and the limited strength model of self-control: has the evidence for ego depletion been overestimated?", *Frontiers in Psychology*, Vol. 5, 823.

Chang, C.T., Tu, C.S. and Hajiyev, J. (2019), "Integrating academic type of social media activity with perceived academic performance: a role of task-related and non-task-related compulsive Internet use", *Computers and Education*, Vol. 139, pp. 157-172.

Chen, A. and Karahanna, E. (2018), "Life interrupted: the effects of technology-mediated work interruptions on work and nonwork outcomes", *MIS Quarterly*, Vol. 42 No. 4, pp. 1023-1042.

Cooper, C.L., Dewe, P. and O'Driscoll, M.P. (2001), *Organizational Stress: A Review and Critique of Theory, Research, and Applications*, Sage, London.

DataReportal (2021), "Global social media stats global digital insights", available at: https://datareportal.com/social-media-users (accessed 29 October 2021).

Datu, J.A.D., Yang, W., Valdez, J.P.M. and Chu, S.K.W. (2018), "Is Facebook involvement associated with academic engagement among Filipino university students? A cross-sectional study", *Computers and Education*, Vol. 125, pp. 246-253.

Davidson, E. and Pai, D. (2004), "Making sense of technological frames: promise, progress, and potential", in Kaplan, B., Truex, D.P., Wastell, D., Wood-Harper, A.T. and DeGross, J.I. (Eds), *IFIP Advances in Information and Communication Technology*, Springer, Boston, Massachusetts, pp. 473-491.

Diener, E., Emmons, R.A, Larsen, R.J. and Griffin, S. (1985), "The satisfaction with life scale", *Journal of Personality Assessment*, Vol. 49 No. 1, pp. 71-75.

Dodd, R.H., Dadaczynski, K., Okan, O., McCaffery, K.J. and Pickles, K. (2021), "Psychological wellbeing and academic experience of university students in Australia during COVID-19", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 3, p. 866.

Duckworth, A.L., Gendler, T.S. and Gross, J.J. (2014), "Self-control in school-age children", *Educational Psychologist*, Vol. 49 No. 3, pp. 199-217.

Duckworth, A.L., Kim, B. and Tsukayama, E. (2013), "Life stress impairs self-control in early adolescence", *Frontiers in Psychology*, Vol. 3, 608.

Duckworth, A.L. and Yeager, D.S. (2015), "Measurement matters: assessing personal qualities other than cognitive ability for educational purposes", *Educational Researcher*, Vol. 44 No. 4, pp. 237-251.

Englert, C. (2019), "The self-regulation of human performance: a critical discussion and future directions for self-control research", *Performance Enhancement and Health*, Vol. 6 Nos 3/4, pp. 156-157.

Englert, C., Zavery, A. and Bertrams, A. (2017), "Too exhausted to perform at the highest level? On the importance of self-control strength in educational settings", *Frontiers in Physiology*, Vol. 8, 1290.

Faul, F., Erdfelder, E., Buchner, A. and Lang, A.G. (2009), "Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses", *Behavior Research Methods*, Vol. 41, pp. 1149-1160.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurements error", *Journal of Marketing Research*, Vol. 18 No. 4, pp. 39-50.

French, J.R.P., Caplan, R.D. and Harrison, R.V. (1982), *The Mechanisms of Job Stress and Strain*, Wiley, London.

Ginis, K.A.M. and Bray, S.R. (2009), "Application of the limited strength model of self-regulation to understanding exercise effort, planning and adherence", *Psychology and Health*, Vol. 25 No. 10, pp. 1147-1160.

Giunchiglia, F., Zeni, M., Gobbi, E., Bignotti, E. and Bison, I. (2018), "Mobile social media usage and academic performance", *Computers in Human Behavior*, Vol. 82, pp. 177-185.

Griffiths, M.D. (2010), "The role of context in online gaming excess and addiction: some case study evidence", *International Journal of Mental Health and Addiction*, Vol. 8, pp. 119-125.

Hagger, M.S. and Chatzisarantis, N.L.D. (2013), "The strength model of self-control: recent advances and implications for public health", *Social Neuroscience and Public Health: Foundations for the Science of Chronic Disease Prevention*, pp. 123-139.

Hagger, M.S., Wood, C., Stiff, C. and Chatzisarantis, N.L.D. (2010), "Ego depletion and the strength model of self-control: a meta-analysis", *Psychological Bulletin*, Vol. 136 No. 4, pp. 495-525.

Hair, J.F., Hult, G.T.M., Ringle, C.M. and Sarstedt, M. (2017), *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, 2nd ed., Sage, Thousand Oaks.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011), "PLS-SEM: indeed a silver bullet", *The Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-152.

Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. (2019), "When to use and how to report the results of PLS-SEM", *European Business Review*, Vol. 31 No. 1, pp. 2-24.

Hamilton, V. and Warburton, D.M. (1979), "Physiological aspects of information processing and stress", in *Human Stress and Cognition: An Information Processing Approach*, John Wiley and Sons, London.

Harman, H.H. (1976), *Modern Factor Analysis*, Chicago University Press, Chicago.

Hartnup, B., Dong, L. and Eisingerich, A.B. (2018), "How an environment of stress and social risk shapes student engagement with social media as potential digital learning platforms: qualitative study", *Journal of Medical Internet Research*, Vol. 4 No. 2, E10069.

Hayes, A.F. (2017), *Introduction to Mediation, Moderation, and Conditional Process Analysis*, The Guilford Press, London.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modelling", *Journal of the Academy of Marketing Science*, Vol. 41 No. 3, pp. 115-135.

Hofmann, W., Vohs, K.D. and Baumeister, R.F. (2012), "What people desire, feel conflicted about, and try to resist in everyday life", *Psychological Science*, Vol. 23 No. 6, pp. 582-588.

Johannes, N., Nguyen, T., Weinstein, N. and Przybylski, A.K. (2021), "Objective, subjective, and accurate reporting of social media use: no evidence that daily social media use correlates with personality traits, motivational states, or well-being", *Technology, Mind, and Behavior*, Vol. 2 No. 2.

Junco, R. (2012), "Too much face and not enough books: the relationship between multiple indices of Facebook use and academic performance", *Computers in Human Behavior*, Vol. 28 No. 1, pp. 187-198.

Kaparounaki, C.K., Patsali, M.E., Mousa, D.P.V., Papadopoulou, E.V.K., Papadopoulou, K.K.K. and Fountoulakis, K.N. (2020), "University students' mental health amidst the COVID-19 quarantine in Greece", *Psychiatry Research*, Vol. 290, 113111.

Kaur, P., Dhir, A., Alkhalifa, A.K. and Tandon, A. (2021), "Social media platforms and sleep problems: a systematic literature review, synthesis and framework for future research", *Internet Research*, Vol. 31 No. 4, pp. 1121-1152.

Kingsbury, M., Reme, B.A., Skogen, J.C., Sivertsen, B., Øverland, S., Cantor, N., Hysing, M., Petrie, K. and Colman, I. (2021), "Differential associations between types of social media use and university students' non-suicidal self-injury and suicidal behavior", *Computers in Human Behavior*, Vol. 115, 106614.

Kirschner, P.A. and Karpinski, A.C. (2010), "Facebook and academic performance", *Computers in Human Behavior*, Vol. 26 No. 6, pp. 1237-1245.

Klobas, J.E., McGill, T.J., Moghavvemi, S. and Paramanathan, T. (2018), "Compulsive YouTube usage: a comparison of use motivation and personality effects", *Computers in Human Behavior*, Vol. 87, pp. 129-139.

Kock, N. (2015), "Common method bias in PLS-SEM: a full collinearity assessment approach", *International Journal of E-Collaboration*, Vol. 11 No. 4, pp. 1-10.

Koeske, G.F. and Koeske, R.D. (2010), "A preliminary test of a stress-strain-outcome model for reconceptualizing the burnout phenomenon", *Journal of Social Service Research*, Vol. 17 Nos 3/4, pp. 107-135.

Korzynski, P., Rook, C., Florent Treacy, E. and Kets de Vries, M. (2020), "The impact of self-esteem, conscientiousness and pseudo-personality on technostress", *Internet Research*, Vol. 31 No. 1, pp. 59-79.

Lambic, D. (2016), "Correlation between Facebook use for educational purposes and academic performance of students", *Computers in Human Behavior*, Vol. 61, pp. 313-320.

LaRose, R., Connolly, R., Lee, H., Li, K. and Hales, K.D. (2014), "Connection overload? A cross cultural study of the consequences of social media connection", *Information Systems Management*, Vol. 31 No. 1, pp. 59-73.

LaRose, R., Lin, C.A. and Eastin, M.S. (2003), "Unregulated internet usage: addiction, habit, or deficient self-regulation?", *Media Psychology*, Vol. 5 No. 3, pp. 225-253.

Laumer, S. and Maier, C. (2021), "Social media stress: a literature review and future research directions", in *Information Technology in Organisations and Societies: Multidisciplinary Perspectives from AI to Technostress*, pp. 203-242.

Lazarus, R.S. and Folkman, S. (1984), *Stress, Appraisal, and Coping*, Springer, New York.

Leppink, E.W., Odlaug, B.L., Lust, K., Christenson, G. and Grant, J.E. (2016), "The young and the stressed: stress, impulse control, and health in college students", *The Journal of Nervous and Mental Disease*, Vol. 204 No. 12, pp. 931-938.

Luqman, A., Cao, X., Ali, A., Masood, A. and Yu, L. (2017), "Empirical investigation of Facebook discontinues usage intentions based on SOR paradigm", *Computers in Human Behavior*, Vol. 70, pp. 544-555.

Maier, C., Laumer, S., Eckhardt, A. and Weitzel, T. (2012), "Online social networks as a source and symbol of stress: an empirical analysis", *Proceedings of the 33rd International Conference on Information Systems (ICIS)*, Orlando, Florida.

Maier, C., Laumer, S., Eckhardt, A. and Weitzel, T. (2014), "Giving too much social support: social overload on social networking sites", *European Journal of Information Systems*, Vol. 24 No. 5, pp. 1-18.

Maier, C., Laumer, S., Weinert, C. and Weitzel, T. (2015), "The effects of technostress and switching stress on discontinued use of social networking services: a study of Facebook use", *Information Systems Journal*, Vol. 25 No. 3, pp. 275-308.

Mandryk, R.L., Frommel, J., Armstrong, A. and Johnson, D. (2020), "How passion for playing world of warcraft predicts in-game social capital, loneliness, and wellbeing", *Frontiers in Psychology*, Vol. 11, 2165.

Marttila, E., Koivula, A. and Räsänen, P. (2021), "Does excessive social media use decrease subjective well-being? A longitudinal analysis of the relationship between problematic use, loneliness and life satisfaction", *Telematics and Informatics*, Vol. 59, 101556.

Masood, A., Luqman, A., Feng, Y. and Ali, A. (2020), "Adverse consequences of excessive social networking site use on academic performance: explaining underlying mechanism from stress perspective", *Computers in Human Behavior*, Vol. 113, 106476.

Michikyan, M., Subrahmanyam, K. and Dennis, J. (2015), "Facebook use and academic performance among college students: a mixed-methods study with a multi-ethnic sample", *Computers in Human Behavior*, Vol. 45, pp. 265-272.

Muraven, M. (2010), "Building self-control strength: practicing self-control leads to improved self-control performance", *Journal of Experimental Social Psychology*, Vol. 46 No. 2, pp. 465-468.

Nielsen, K.S., Bauer, J.M. and Hofmann, W. (2020), "Examining the relationship between trait self-control and stress: evidence on generalizability and outcome variability", *Journal of Research in Personality*, Vol. 84, 103901.

Oaten, M. and Cheng, K. (2006), "Improved self-control: the benefits of a regular program of academic study", *Basic and Applied Social Psychology*, Vol. 28 No. 1, pp. 1-16.

Panek, E. (2014), "Left to their own devices: college students' 'guilty pleasure' media use and time management", *Communication Research*, Vol. 41 No. 4, pp. 561-577.

Pew Research Center (2021), "Social media use in 2021", available at: https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/ (accessed 1 November 2021).

Pflügner, K., Maier, C. and Weitzel, T. (2021), "The direct and indirect influence of mindfulness on techno-stressors and job burnout: a quantitative study of white-collar workers", *Computers in Human Behavior*, Vol. 115, 106566.

Pirkkalainen, H., Salo, M., Tarafdar, M. and Makkonen, M. (2019), "Deliberate or instinctive? Proactive and reactive coping for technostress", *Journal of Management Information Systems*, Vol. 36 No. 4, pp. 1179-1212.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.

Ragu-Nathan, T.S., Tarafdar, M., Ragu-Nathan, B.S. and Tu, Q. (2008), "The consequences of technostress for end users in organizations: conceptual development and empirical validation", *Information Systems Research*, Vol. 19 No. 4, pp. 417-433.

Rashid, T. and Asghar, H.M. (2016), "Technology use, self-directed learning, student engagement and academic performance: examining the interrelations", *Computers in Human Behavior*, Vol. 63, pp. 604-612.

Riedl, R., Kindermann, H., Auinger, A. and Javor, A. (2012), "Technostress from a neurobiological perspective: system breakdown increases the stress hormone cortisol in computer users", *Business and Information Systems Engineering*, Vol. 4 No. 2, pp. 61-69.

Ringle, C.M., Wende, S. and Will, A. (2015), *Smart PLS*, Hamburg, available at: http://www.smartpls.de.

Ryan, R.M. and Frederick, C. (1997), "On energy, personality, and health: subjective vitality as a dynamic reflection of well-being", *Journal of Personality*, Vol. 65 No. 3, pp. 529-565.

Salo, J., Mäntymäki, M. and Islam, A.K.M.N. (2018), "The dark side of social media – and fifty shades of grey; introduction to the special issue: the dark side of social media", *Internet Research*, Vol. 28 No. 5, pp. 1166-1168.

Salo, M., Pirkkalainen, H., Chua, C.E.H. and Koskelainen, T. (2021), "Formation and mitigation of technostress in the personal use of IT", *MIS Quarterly*, Forthcoming.

Salo, M., Pirkkalainen, H. and Koskelainen, T. (2019), "Technostress and social networking services: explaining users' concentration, sleep, identity, and social relation problems", *Information Systems Journal*, Vol. 29 No. 2, pp. 408-435.

Satici, S.A. and Uysal, R. (2015), "Well-being and problematic Facebook use", *Computers in Human Behavior*, Vol. 49, pp. 185-190.

Schmeichel, B.J., Demaree, H.A., Robinson, J.L. and Pu, J. (2006), "Ego depletion by response exaggeration", *Journal of Experimental Social Psychology*, Vol. 42 No. 1, pp. 95-102.

Schmeichel, B.J., Vohs, K.D. and Baumeister, R.F. (2003), "Intellectual performance and ego depletion: role of the self in logical reasoning and other information processing", *Journal of Personality and Social Psychology*, Vol. 85 No. 1, pp. 33-46.

Soror, A.A., Hammer, B.I., Steelman, Z.R., Davis, F.D. and Limayem, M.M. (2015), "Good habits gone bad: explaining negative consequences associated with the use of mobile phones from a dual-systems perspective", *Information Systems Journal*, Vol. 25 No. 4, pp. 403-427.

Steinmayr, R., Heyder, A., Naumburg, C., Michels, J. and Wirthwein, L. (2018), "School-related and individual predictors of subjective well-being and academic achievement", *Frontiers in Psychology*, Vol. 9, 2631.

Steptoe, A., Deaton, A. and Stone, A.A. (2015), "Subjective wellbeing, health, and ageing", *The Lancet*, Vol. 385 No. 9968, pp. 640-648.

Suh, A. and Lee, J. (2017), "Understanding teleworkers' technostress and its influence on job satisfaction", *Internet Research*, Vol. 27 No. 1, pp. 140-159.

Tams, S., Hill, K., Ortiz de Guinea, A., Thatcher, J. and Grover, V. (2014), "NeuroIS – alternative or complement to existing methods? Illustrating the holistic effects of neuroscience and self-reported data in the context of technostress research", *Journal of the Association for Information Systems*, Vol. 15 No. 10, pp. 723-753.

Tams, S., Legoux, R. and Leger, P.-M. (2018), "Smartphone withdrawal creates stress: a moderated mediation model of nomophobia, social threat, and phone withdrawal context", *Computers in Human Behavior*, Vol. 81, pp. 1-8.

Tams, S., Ahuja, M., Thatcher, J.B. and Grover, V. (2020), "Worker stress in the age of mobile technology: the combined effects of perceived interruption overload and worker control", *Journal of Strategic Information Systems*, Vol. 29 No. 1, 101595.

Tandon, A., Dhir, A., Almugren, I., AlNemer, G.N. and Mäntymäki, M. (2021), "Fear of missing out (FoMO) among social media users: a systematic literature review, synthesis and framework for future research", *Internet Research*, Vol. 31 No. 3, pp. 782-821.

Tangney, J.P., Baumeister, R.F. and Boone, A.L. (2004), "High self-control predicts good adjustment, less pathology, better grades, and interpersonal success", *Journal of Personality*, Vol. 72 No. 2, pp. 271-324.

Tarafdar, M., Cooper, C.L. and Stich, J.F. (2019), "The technostress trifecta – techno eustress, techno distress and design: theoretical directions and an agenda for research", *Information Systems Journal*, Vol. 29 No. 1, pp. 6-42.

Tarafdar, M., Maier, C., Laumer, S. and Weitzel, T. (2020), "Explaining the link between technostress and technology addiction for social networking sites: a study of distraction as a coping behavior", *Information Systems Journal*, Vol. 30 No. 1, pp. 96-124.

Tarafdar, M., Pullins, E.B. and Ragu-Nathan, T.S. (2015), "Technostress: negative effect on performance and possible mitigations", *Information Systems Journal*, Vol. 25 No. 2, pp. 103-132.

Tarafdar, M., Tu, Q. and Ragu-Nathan, T. (2010), "Impact of technostress on end-user satisfaction and performance", *Journal of Management Information Systems*, Vol. 27 No. 3, pp. 303-334.

Tarafdar, M., Tu, Q., Ragu-Nathan, B. and Ragu-Nathan, T. (2007), "The impact of technostress on role stress and productivity", *Journal of Management Information Systems*, Vol. 24 No. 1, pp. 307-334.

Tenenhaus, M., Vinzi, V.E., Chatelin, Y.M. and Lauro, C. (2005), "PLS path modelling", *Computational Statistics and Data Analysis*, Vol. 48 No. 1, pp. 159-205.

Tiwari, V. (2020), "Countering effects of technostress on productivity: moderating role of proactive personality", *Benchmarking*, Vol. 28 No. 2, pp. 636-651.

Troll, E.S., Friese, M. and Loschelder, D.D. (2020), "How students' self-control and smartphone-use explain their academic performance", *Computers in Human Behavior*, Vol. 117, 106624.

Turel, O. (2015), "Quitting the use of a habituated hedonic information system: a theoretical model and empirical examination of Facebook users", *European Journal of Information Systems*, Vol. 24 No. 4, pp. 431-446.

Turel, O. and Qahri-Saremi, H. (2016), "Problematic use of social networking sites: antecedents and consequence from a dual-system theory perspective", *Journal of Management Information Systems*, Vol. 33 No. 4, pp. 1087-1116.

Turel, O. and Serenko, A. (2012), "The benefits and dangers of enjoyment with social networking websites", *European Journal of Information Systems*, Vol. 21 No. 5, pp. 512-528.

Vaghefi, I., Qahri-Saremi, H. and Turel, O. (2020), "Dealing with social networking site addiction: a cognitive-affective model of discontinuance decisions", *Internet Research*, Vol. 30 No. 5, pp. 1427-1453.

Vallerand, R.J. (2015), *The Psychology of Passion: A Dualistic Model*, Oxford University Press, Oxford.

Weinert, C., Maier, C., Laumer, S. and Weitzel, T. (2020), "Technostress mitigation: an experimental study of social support during a computer freeze", *Journal of Business Economics*, Vol. 90, pp. 1199-1249.

Wentzel, K.R. and Wigfield, A. (1998), "Academic and social motivational influences on students' academic performance", *Educational Psychology Review*, Vol. 10 No. 2, pp. 155-175.

Whelan, E., Islam, A.K.M.N. and Brooks, S. (2020), "Applying the SOBC paradigm to explain how social media overload affects academic performance", *Computers and Education*, Vol. 143, 103692.

Whelan, E., McDuff, D., Gleasure, R. and vom Brocke, J. (2018), "How emotion-sensing technology can reshape the workplace", *MIT Sloan Management Review*, Vol. 59 No. 3, pp. 10-12.

WHO (1948), "Constitution of the world health organization", available at: https://www.who.int/governance/eb/who_constitution_en.pdf (accessed 15 January 2021).

Wills-Herrera, E., Islam, G. and Hamilton, M. (2009), "Subjective well-being in cities: a multidimensional concept of individual, social and cultural variable", *Applied Research in Quality of Life*, Vol. 4 No. 2, pp. 201-221.

Yu, L., Cao, X., Liu, Z. and Wang, J. (2018), "Excessive social media use at work: exploring the effects of social media overload on job performance", *Information Technology and People*, Vol. 31 No. 6, pp. 1091-1112.

Zhang, R. and Fu, J.S. (2020), "Privacy management and self-disclosure on social network sites: the moderating effects of stress and gender", *Journal of Computer-Mediated Communication*, Vol. 25 No. 3, pp. 236-251.

**Appendix**

| Construct | Item | Mean | SD | Loading |
|---|---|---|---|---|
| *Social overload*<br>Adapted from Tarafdar *et al.*<br>(2020) and Maier *et al.* (2015)<br>CR: 0.86<br>AVE: 0.55<br>VIF: 1.63 | I take too much care of my friends' wellbeing on SNS | 3.82 | 1.42 | 0.76 |
| | I deal with my friends' problems too much on SNS | 3.13 | 1.60 | 0.77 |
| | My sense of being responsible for how much fun my friends have on SNS is too strong | 2.96 | 1.56 | 0.73 |
| | I am too often caring for my friends on SNS | 3.27 | 1.47 | 0.81 |
| | I pay too much attention to posts of my friends on SNS | 3.92 | 1.67 | 0.70 |
| | I congratulate SNS friends as a consequence of a birthday reminder, although I would not congratulate them in real life | 2.78 | 1.80 | 0.79 |
| *Disclosure*<br>Adapted from Tarafdar *et al.*<br>(2020) and Maier *et al.* (2015)<br>CR: 0.87<br>AVE: 0.62<br>VIF: 1.69 | There is more information on SNS than I can digest | 5.54 | 1.52 | 0.74 |
| | I receive too much information on SNS | 4.87 | 1.64 | 0.86 |
| | The information on SNS overextends me | 4.09 | 1.61 | 0.79 |
| | It is difficult for me to focus on the essential information on SNS | 4.05 | 1.56 | 0.75 |
| *Pattern*<br>Adapted from Tarafdar *et al.*<br>(2020) and Maier *et al.* (2015)<br>CR: 0.85<br>AVE: 0.73<br>VIF: 1.49 | Through SNS, I am forced to inform friends about news prompts | 3.24 | 1.61 | 0.77 |
| | Through SNS, I am forced to communicate with friends periodically | 4.02 | 1.74 | 0.88 |
| | I am forced to adapt my communication patterns to SNS | 4.46 | 1.62 | 0.83 |
| *Complexity*<br>Adapted from Tarafdar *et al.*<br>(2020) and Maier *et al.* (2015)<br>CR: 0.83<br>AVE: 0.55<br>VIF: 1.74 | I need a long time to understand and use SNS | 2.22 | 1.19 | 0.71 |
| | I do not find enough time to upgrade my technology skills to use SNS | 2.60 | 1.56 | 0.79 |
| | I do not know enough about SNS to use it satisfactorily | 2.26 | 1.38 | 0.78 |
| | I often find SNS too complex to use | 1.85 | 1.03 | 0.73 |
| *Uncertainty*<br>Adapted from Tarafdar *et al.*<br>(2020) and Maier *et al.* (2015)<br>CR: 0.86<br>AVE: 0.68<br>VIF: 1.70 | There are always new terms and conditions on SNS | 5.09 | 1.02 | 0.70 |
| | SNS apps are constantly being changed | 5.71 | 1.19 | 0.90 |
| | Overall, SNS is constantly being changed | 5.97 | 1.10 | 0.87 |
| *Invasion*<br>Adapted from Tarafdar *et al.*<br>(2020) and Maier *et al.* (2015)<br>CR: 0.86<br>AVE: 0.67<br>VIF: 1.56 | I am in touch with my SNS friends too much over SNS, even during my vacation | 5.03 | 1.83 | 0.80 |
| | I sacrifice my vacation and weekend time to use SNS | 4.09 | 1.07 | 0.84 |
| | I feel my personal life is being invaded by SNS | 4.21 | 1.85 | 0.81 |

**Table A1.**
Item means, standard deviations (SD), loadings and significance levels

| Construct | Item | Mean | SD | Loading |
|---|---|---|---|---|
| *Deficient SNS self-control* Adapted from LaRose *et al.* (2003) CR: 0.83 AVE: 0.52 VIF: 1.37 | I have a hard time keeping my SNS use under control | 4.09 | 1.62 | 0.71 |
| | I have to keep using the SNS more and more to get my thrill | 3.34 | 1.45 | 0.73 |
| | *I get tense, moody or irritable if I cannot get on SNS when I want* | *3.25* | *1.61* | *0.57\** |
| | *I have tried unsuccessfully to cut down on the amount of time I spend on SNS* | *3.77* | *1.71* | *0.58\** |
| | I sometimes try to conceal how much time I spend on SNS from my family or friends | 3.30 | 1.86 | 0.71 |
| | I would go out of my way to satisfy my SNS urges | 2.76 | 1.42 | 0.76 |
| | I feel my SNS use is out of control | 2.88 | 1.53 | 0.80 |
| *Academic SNS use* Taken from Chang *et al.* (2019) CR: 0.82 AVE: 0.61 VIF: 2.12 | Using SNS for academic purposes is part of my everyday activity | 4.38 | 1.83 | 0.75 |
| | I feel out of touch when I have not logged onto academic-related content on SNS | 4.23 | 1.84 | 0.83 |
| | I use SNS frequently to access external materials that can support my academic learning | 4.17 | 1.71 | 0.71 |
| | Using SNS for performing academic tasks has become my daily routine | 3.92 | 1.78 | 0.85 |
| | My motivation to achieve better academic performance attracts me to use SNS for academic purpose | 3.57 | 1.69 | 0.74 |
| *Student vitality* Taken from Bostic *et al.* (2000) and Ryan and Frederick (1997) CR: 0.91 AVE: 0.63 VIF: 2.25 | I feel alive and vital | 5.02 | 1.38 | 0.78 |
| | Sometimes I feel so alive I just want to burst | 3.74 | 1.68 | 0.62 |
| | I have energy and spirit | 4.85 | 1.49 | 0.88 |
| | I look forward to each new day | 4.82 | 1.39 | 0.80 |
| | I nearly always feel alert and awake | 3.70 | 1.38 | 0.81 |
| | I feel energized | 4.08 | 1.42 | 0.84 |
| *Satisfaction with academic life* Adapted from Diener *et al.* (1985) CR: 0.89 AVE: 0.62 VIF: 1.64 | In most ways my academic life is close to my ideal | 3.81 | 1.43 | 0.84 |
| | The conditions of my academic life are excellent | 4.12 | 1.49 | 0.83 |
| | I am satisfied with my academic life | 4.32 | 1.40 | 0.92 |
| | So far I have gotten the important things I want in my academic life | 4.30 | 1.48 | 0.73 |
| | If I could live my academic life over, I would change almost nothing | 3.83 | 1.42 | 0.71 |
| *Study performance* Taken from Whelan *et al.* (2020) CR: 0.90 AVE: 0.61 VIF: 1.97 | Quantity of study | 2.27 | 0.99 | 0.78 |
| | Quality of study | 2.49 | 0.98 | 0.90 |
| | Accuracy of study | 2.63 | 1.02 | 0.86 |
| *Career development* Taken from Whelan *et al.* (2020) CR: 0.93 AVE: 0.82 VIF: 2.76 | Obtaining personal career goals | 2.46 | 1.02 | 0.90 |
| | Developing skills needed for your future career | 2.39 | 1.07 | 0.91 |
| | Making progress in your career | 2.43 | 1.06 | 0.91 |

**Note(s):** AVE, average variance extracted; CR, composite reliability; SD, standard deviation; SNS, social networking sites; VIF, variance inflation factor; * Items were removed due to loadings less than 0.70 and where inclusion resulted in AVE falling below 0.50

**Table A1.**

## About the authors

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